Draft

Remedial Investigation Report for MRP Site UXO1

Naval Weapons Station Seal Beach Detachment Fallbrook Fallbrook, California

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Prepared for:
Department of the Navy
NAVFAC Southwest
San Diego, California 92132

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REVIEW AND APPROVAL

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ACRONYMS AND ABBREVIATIONS

95 UCL	95 percent upper confidence limit
AGW	Area Groundwater Well
AOPC	Area of potential concern
APE	Area of Potential Effect
ARTO	Arroyo toad
BERA	Baseline ecological risk assessment
bgs	Below ground surface
BLU	Bomb Live Unit
BTAG	Biological Technical Advisory Group
BTV	Background threshold values
BW	Body weight
CAGC	Coastal California gnatcatcher
Cal/EPA	California Environmental Protection Agency
ChaduxTt	St. George Chadux Corp and Tetra Tech EM Inc. Joint Venture
COEC	Chemical of ecological concern
COPC	Chemical of potential concern
COPEC	Chemical of potential ecological concern
C_{prey}	Concentration (prey)
CS	2-Chlorobenzalmalononitrile
CSM	Conceptual site model
C^{soil}	Concentration (soil)
Det	Detachment
DGM	Digital Geophysical Mapping
DMM	Discarded Military Munitions
DoD	Department of Defense
$Dose_{Total}$	Estimated dose from ingestion
DTSC	Department of Toxic Substances Control
Eco-SSL	Ecological Soil Screening Level
ECORP	ECORP Consulting, Inc.
EM	Electromagnetic
EOD	Explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
ESS	Explosives Safety Submission

EU	Exposure unit
EZ	Exclusion zone
FCM	Food chain model
FS	Feasibility study
GPS	Global positioning system
GSV	Geophysical system verification
HA	Hazard Assessment
HERO	Office of Human and Ecological Risk
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
HSA	Hollow stem auger
IAS	Initial assessment study
IC	Institutional control
IRP	Installation Restoration Program
IR_{prey}	Ingestion rate (prey)
IR_{soil}	Ingestion rate (soil)
ISO	Industry standard object
IUR	Inhalation unit risk
IVS	Instrument verification strip
kg	Kilogram
kg/day	Kilogram per day
LAW	Light anti-tank weapon
lbs.	Pounds
LBVI	Least Bell's vireo
LUC	Land Use Control
µg/L	Micrograms per liter
Marrs	Marrs Services Inc.
MC	Munitions constituents
MCB	Marine Corps Base
MDAS	Material documented as safe
MEC	Munitions and explosives of concern
MEC HA	MEC Hazard Assessment
mg	Milligram
mg/kg	Milligram per kilogram

mg^3/kg	Cubic milligrams per kilogram
mg/kg/day	Milligram per kilogram per day
mm	Millimeter
MRP	Munitions Response Program
MPPEH	Material potentially presenting an explosive hazard
MRS	Munitions Response Site
msl	Mean sea level
NAD	Naval Ammunition Depot
NAVFAC SW	Naval Facilities Engineering Command, Southwest Division
NAVWPNSTA	Naval Weapons Station
NEESA	Naval Energy and Environmental Support Activity
ng/kg	Nanogram per kilogram
NHPA	National Historic Preservation Act
NOSSA	Naval Ordnance Safety and Security Activity
NRHP	National Register of Historic Places
OB/OD	Open burn/open detonation
OEHHA	Office of Environmental Health Hazard Assessment
OERR	Office of Emergency and Remedial Response
ORNL	Oak Ridge National Laboratory
PA	Preliminary assessment
PCP	Pentachlorophenol
PEF	Particulate emission factor
PQO	Project Quality Objective
QA	Quality assurance
QC	Quality control
QE	Quality evaluation
RAGS	Risk Assessment Guidance for Superfund
RfC	Reference concentration
RfD	Reference dose
RI	Remedial investigation
RME	Reasonable maximum exposure
RPM	Remedial project manager
RSL	Regional Screening Level
RTK	Real time kinetic
SAP	Sampling and analysis plan
SCDMTSC	Site Characterization and Monitoring Technical Support Center

SDZ	Surface danger zone
SF	Slope factor
SI	Site inspection
SKR	Stephens' kangaroo rat
SLERA	Screening level ecological risk assessment
SUF	Site use factor
SUXOS	Senior unexploded ordnance supervisor
SVOC	Semivolatile organic compound
SWFL	Southwestern willow flycatcher
Tetra Tech	Tetra Tech EM Inc.
TEQ	Toxic equivalent quotient
TNT	Trinitrotoluene
TPH	Total petroleum hydrocarbons
TPH-d	Total petroleum hydrocarbons as diesel
TriEco-Tt JV	TriEco LLC and Tetra Tech EM Inc. joint venture
TRV	Toxicity Reference Value
UCL	Upper confidence limit
USCS	Unified soil classification system
UTM	Universal Transverse Mercator
UXO	Unexploded ordnance
UXO1	Site UXO1
UXOQCSS	Unexploded ordnance quality control specialist
UXOSO	Unexploded ordnance safety officer
VOC	Volatile organic compound

EXECUTIVE SUMMARY

A remedial investigation (RI) was conducted at Munitions Response Program (MRP) Site UXO1 (UXO1), the Quality Evaluation (QE) Test Area. The RI was designed to evaluate the past use of Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) within and adjacent to MRP Site UXO1 (UXO1). UXO1 is located in the southeastern portion of Naval Weapons Station (NAVWPNSTA) Seal Beach Detachment (Det) Fallbrook in Fallbrook, California (Figure ES-1).

Results from a preliminary assessment (PA) in 2007 and a site inspection (SI) in 2010 indicated material potentially presenting an explosive hazard (MPPEH) was present, requiring further evaluation to assess potential explosive hazards, human health and ecological risks at UXO1. The data obtained from the RI were intended to determine the nature and extent of contamination and to support development and evaluation of remedial alternatives in a site feasibility study (FS). The RI work plan defined project quality objectives (PQO), decision making criteria, and associated data needs to fulfill the specified purpose of the RI (TriEco-Tt 2014b).

UXO1 occupies approximately 76 acres within a Level 1 secured area and contains several subareas of concern. The site was originally used as a burn and disposal area, then as a testing area for the Quality Evaluation Laboratory, and finally as a test firing range between 1942 and 1985 (Malcolm Pirnie 2006). An overview of the site is provided on Figure 1-2. Specific activities identified included rocket fuel and black powder burning, munitions testing at ranges, and munitions disposal activities (including burning and detonation). Due to the variety of past uses within the site, the SI approach for MRP Site UXO1 focused on four primary areas: (1) Munitions, fuel and black powder burn and disposal trenches, and burn barrels; (2) Weapons test firing range including target and impact areas; (3) Drop Test Tower; and (4) Building Debris and former trailer. To facilitate evaluation of the site related to those activities, features at the site were grouped into seven exposure units (see Table ES-1 and Figure ES-2). The central portion of the former range Surface Danger Zone (SDZ) that extends south of the boundary of UXO1 was considered an area of potential interest and was also evaluated during the RI.

The primary portion of the site is secured by field fencing and posted the limit access by base personnel, natural resource staff, contractors and cattle that have been used as a fire control measure. Exposure Units 2 through 7 are located within this fenced area. Exposure Unit 1 and the southern portion of the former target range are located outside the fenced area. Future use of the site is planned to remain as secured open space with existing land use controls in place if required. Cattle grazing may occur again in the future, but would likely be limited to the area outside the existing fence.

Remedial Investigation

The RI was designed to evaluate possible impacts related to past operations at specific areas or features within the site. Work included the completion of 34 test pits, eight shallow soil borings, two surface samples and installation of two permanent groundwater wells, drilling of a third well location (where groundwater was not encountered), and the installation of three shallow temporary

wells for the evaluation of perched groundwater within the Pilgrim Creek drainage. The sampling program was, in part, designed to provide results that could be utilized for both human health and ecological risk evaluations (collecting samples at depths of 0 – 0.5, 5, and 10 feet bgs). The sampling program was also designed to develop meaningful geologic information that could be used to update the site conceptual model and analytical data to support human health and ecological risk assessments. Based on these considerations, samples were not only collected in disposal trenches to characterize the debris fill, but to also evaluate the potential for vertical migration of the contaminants into the underlying bedrock. Discrete samples were collected and homogenized in the lab to support the risk assessments. The test pits were located to not only characterize the debris, but combined with geophysical information, the field measurements (depth and width) will assist in quantifying the material for the feasibility study phase of the project.

TriEco-Tt conducted management and removal of all MPPEH and scrap metal encountered as part of the investigation activities. The UXO team conducted a detector aided surface sweep of all areas to be accessed by the investigation team, including the Central Down Range SDZ. Two UXO Technicians III assessed all MPPEH. That which did not pose an explosive hazard was categorized as material documented as safe (MDAS). That which could not be documented as "safe" were disposed of on site during the RI. The scope of the RI also included preparation of a MEC Hazard Assessment (MEC HA), which are included as Appendix C and summarized below.

A digital geophysical mapping (DGM) survey was conducted on a 14-acre hillside area immediately behind the target berm (Appendix E). Features investigated included 77 detected target anomalies from the DGM survey, 14 buried Open Burn/Open Detonation (OB/OD) trenches or areas where trenches may have existed, three Burn Slit/Trenches, soil within the Pilgrim Creek drainage, along with shallow perched groundwater and deeper groundwater within the bedrock. Sampling of surface water was to be conducted during the RI, however there surface water was not present during the field investigation, as such surface water samples were not collected.

The DGM survey also detected heavy anomaly areas that indicated the apparent footprint of Disposal Trench 12. A total of 1,201 of the 2,757 target anomalies identified were located outside of the apparent limits of Disposal Trench 12. Intrusive investigation of the targets outside Disposal Trench 12 within the Range Impact Area resulted in the following:

Item Description	Number of Items	Percent of Total Items Investigated
MPPEH	4	5.2
MDAS	10	13
Scrap Metal	61	79.2
No Finds (terrain noise)	2	2.6

Note: All 14 blind seeds were detected.

Human Health Risk Assessment (HHRA)

A baseline HHRA was selected as the appropriate level after a review of the data indicated that maximum detected chemical concentrations were high enough to exceed risk-based screening levels for multiple chemical constituents (Appendix F). Risk evaluations were completed using both federal and State of California toxicity criteria. The following is a brief summary of the human health risks for MRP Site UXO1. As such, comparisons conducted during the SI are no longer valid. The following provides an updated summary of the general HHRA findings:

- Based on the projected future site use (Secured Open Space), there is no elevated site-related risk to likely human receptors (i.e., natural resources workers).
- Any site-related cancer risks in soil are within EPA's risk management range. Although there are non-cancer hazards from metals in subsurface soil at Exposure Units (EU) 2, 4, 5, 6 and 7, these hazards are all low (less than HI=2.5), except for lead in subsurface soil at EUs 2 and 6. Exposure to contaminants in subsurface soil could only occur if the site is developed.
- The risk from groundwater is due to arsenic, and then only if used as a drinking water source, which is not a likely scenario.

Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) was conducted and then refined using the EPA's Step 3a risk refinement (Appendix G). The SLERA uses conservative assumptions and available scientific literature to evaluate potential risk to ecological receptors; the Step 3a risk refinement considers less conservative and more realistic site-specific exposure assumptions in the risk calculations (EPA 1997b). The SLERA and Step 3a risk refinement evaluated whether chemicals in soil (metals, dioxins, volatile organic compounds [VOC], and explosives) pose unacceptable risk to plants, terrestrial invertebrates, birds, and mammals. The Step 3a risk refinement included a screen against background to eliminate from further consideration those chemicals with exposure unit concentrations less than background.

In summary:

- Chemicals in soil at EUs 2, 3, and 7 may pose an unacceptable risk to ecological receptors and warrant further evaluation.
  - For EU 2, lead (in Disposal Trench 7), and zinc (in Disposal Trenches 4 and 7) were identified as posing risk to plants (0 to 6 ft bgs), and cadmium (0 to 0.5 ft bgs) was identified as posing a risk to birds.
  - In EU 3, cadmium (0 to 0.5 ft bgs) was identified as posing a risk to birds.
  - In EU 7, barium and zinc were identified as posing a risk to plants (0 to 6 ft bgs) and invertebrates (0 to 0.5 ft bgs), and zinc (0 to 0.5 ft bgs) was also identified as posing a risk to non-burrowing omnivorous mammals.

- No chemicals of ecological concern (COEC) were identified and no unacceptable risk is posed to ecological receptors from chemicals at soil at EUs 1, 4, 5, and 6.

MEC Hazard Assessment

MEC HA were prepared to evaluate the site risk posed by munitions-related items within and adjacent to the site (Appendix C). The MEC HA uses a relative numerical scoring system to evaluate explosive hazards at a site that relates to a risk category as follows:

Category 1: 860 to 1,000 (sites with the highest hazard under current use conditions)

Category 2: 720 to 855 (sites with a hazard potential under current use conditions)

Category 3: 475 to 715 (sites compatible with current land uses but not more intrusive uses)

Category 4: 115 to 470 (sites compatible with current or future land uses)

The MEC HA can provide an evaluation of current site conditions as well as future conditions assuming that a proposed remedial/removal action has been performed. The following tables summarize the MEC HA Hazard Level results for Exposure Units Located within the fenced boundary of UXO1 and the area outside the boundary:

MEC HAZARD ANALYSIS SUMMARY – FENCED AREA (EUS 2 THROUGH 7)

	Current Use as Open Space with Natural Resources Management/Weed Control	Future Use for Cattle Grazing Outside the Fenced Former QE Test Area and SKR Habitat		
		Land Use Controls (LUC)	Surface MEC/MPPEH Removal and Land Use	MEC/MPPEH Removal Action and Land Use Control
MRP Site UXO1 Total Score	800	800	535	405
MRP Site UXO1 Hazard Level Category	2	2	3	4

MEC HAZARD ANALYSIS SUMMARY – UNFENCED AREAS (EU 1 AND DOWN RANGE SDZ)

	Current Use for Natural Resources Management and Cattle Grazing	Future Use for Cattle Grazing Outside the Fenced Former QE Test Area and SKR Habitat		
		Land Use Controls (LUC)	Surface MEC/MPPEH Removal and Land Use	MEC/MPPEH Removal Action and Land Use Control
MRP Site UXO1 Total Score	690	690	425	295
MRP Site UXO1 Hazard Level Category	3	3	4	4

REMEDIAL INVESTIGATION CONCLUSIONS

The activities during the RI successfully identified the presence of several suspect subsurface features that were tentatively identified during prior assessments and the Site Inspection (ChaduxTt 2010). Geologic logging and sampling of the former buried disposal and Burn Slit/Trenches provided comprehensive data regarding the characteristics of the material disposed of during past operations at UXO1. During the investigation, the UXO team removed all detected MPPEH and MDAS from the access and work areas. A total of 225 MPPEH items were disposed of during on-site demolition operations and approximately 7,800 pounds (lbs.) of MDAS were shipped from the site for demilitarization and recycling. In addition, approximately 18,200 lbs. of scrap metal was removed from the site and also shipped for recycling.

Based on analytical data and the resultant risk assessments, elevated concentrations of some metals and dioxins indicate that site-related cancer risks (within the risk management range) or non-cancer hazards exist for human health and ecological receptors from both surface and subsurface soils. These contaminants are primarily associated with former burning and disposal operations and, as such, are directly tied to the OB/OD and Burn Slit/Trench locations within EUs 2, 4, 5, 6, and 7. The OB/OD trenches contain a significant amount of debris, however they are covered by fill or topsoil that has evidently played a role in preventing vertical migration of contaminants as evidenced by the analytical results. There were either no detections or no exceedances of human health and ecological based screening criteria for explosives, VOCs, semivolatile organic compounds (SVOC), pentachlorophenol, perchlorate, white phosphorous, and hydrazine for soil or groundwater samples. Where COC or COECs were identified at the surface or in the debris fill, analytical results for samples collected in bedrock soils below the debris fill indicate that the contaminants are not migrating vertically. Similarly, for the Burn Slit/Trenches, even though the soils containing debris or burn ash are located within a depression and are not covered with clean soil, there is no evidence that vertical migration of COCs (dioxins, arsenic and barium) is occurring into the underlying dense granitic bedrock. This is likely in part due to the dry regional climate and relatively low solubility of the COCs (primarily metals). Burn Slit/Trenches 1 and 2 are located within the secured (fenced) portion of MRP Site UXO1; however, Burn Slit/Trench 3 in EU 1 is not fenced.

In Summary:

- MRP Site UXO1 is located within a level one secured area with access to the primary portion of the former munitions testing and OB/OD area (EUs 2 through 7) limited by range fencing. Future use of the area is anticipated to remain secured open space with existing land use controls in place.

- The RI was successful in accomplishing the project quality objectives of delineating COCs or COECs related to known or suspected operations at the site.

- Detector aided surface sweeps were conducted at all suspected or known operational areas or features during the RI by the UXO team. The sweeps were successful in removing MPPEH, MC or MDAS along with scrap metal from the areas investigated. Areas outside the known or suspect disposal areas or operational areas investigated within UXO1 during the RI are considered to have a low potential for the presence of MPPEH.

- There were no UXO, MPPEH or range related items recovered during the detector aided surface sweep of the Central Down Range SDZ. Per the Project Quality Objectives and results of the clearance operations, no further investigation of this AOPC is recommended.

- Table ES-1 provides a summary of the risks identified for each of the EUs and Central Down Range SDZ under the current and likely future use scenarios. The risk summary does not consider residential as a likely future use scenario. Also provided are recommendations regarding possible further response actions for each of the areas. As indicated in the table, further evaluation of EU's 2, 4, 5, 6 and 7 area recommended. No further response action is recommended for EU 1, surface water and groundwater, and the Central Down Range SDZ.

TABLE ES-1 SUMMARY OF RISKS AND RECOMMENDATIONS*

Exposure Unit	MEC Hazard Level[1]	Human Health Risk[2]		Ecological Risk Step 3a Risk Refinement	Comments / Recommendation	
		Exposure Scenario (depth bgs) / Risk Drivers	**Cancer Risk (EPA/Cal)**	**Receptor Group (depth bgs) / Risk Driver**	**Comments**	**Recommendation**
1	3	--		--	• Existing Burn Slit/Trench 1 is located outside the fenced portion of the MRP site	No further response action is recommended for this EU
2	2	• **Future Ind (0 – 10 ft)** / arsenic[3], lead; • **Future Const (0 – 10 ft)** / lead	• **2E-06 / 2E-06 (See comments column) (See comments column)**	• **Plants (0 – 6 ft)** / lead (Disposal Trench 7); zinc (Disposal Trenches 4 and 7); • **Birds (0 – 0.5 ft)** / Cadmium, Zinc	• The human health cancer risk for arsenic fall within the risk management range for the site • The mean lead concentration in subsurface soil at EU2 is 1,695 mg/kg. This value exceed the noncancer RBSLs for lead of 320 for an industrial worker and 39 for a construction worker. Based on the mean concentration, lead is identified as a COC in subsurface soil at EU2. Two of 46 lead soil samples at EU2 exceed the industrial worker RBSL and 9 of 46 samples exceed the construction worker RBSL.18 of 46 samples exceeded the eco screening criteria of 11 mg/kg for **lead** with a high concentration of 14,300 mg/kg detected at a depth of 2-3 ft bgs. • 22 of 46 samples exceeded the ecological screening criteria of 46 mg/kg for **zinc** with a high concentration of 2,690 mg/kg at a depth of 405 ft bgs • 20 of 46 samples exceeded the ecological screening criteria of 0.46 mg/kg for **cadmium** with the high concentration of 19.2 at a depth of 405 ft bgs. • This EU contains six buried disposal trenches with MDAS/MPPEH/Scrap metal and other debris	Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH, lead and ecological risks associated with the buried disposal trenches.
3	2	--		• **Birds (0 – 0.5 ft)** / Cadmium	• Drop Test Tower - four of 18 surface soil samples (0-0.5 ft bgs) exceeded the eco screening level of 0.36 mg/kg with a high concentration of 15.6 mg/kg	Further response action should be considered in the FS based upon ecological risk
4	2	--		--	• Pilgrim Creek Drainage and Burn Slit / Trench 1. Potential for **MEC/MPPEH** exists in Burn Slit/Trench (slough/fill)	Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH in Burn Slit/Trench 1.
5	2	• **Future Ind (0 – 10 ft)** / dioxins	• **1E-05 / 1E-05**	--	• The human health cancer risk for dioxins fall within the risk management range for the site • Buried debris containing **MPPEH** identified in three disposal trenches	Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH in the three buried disposal trenches.

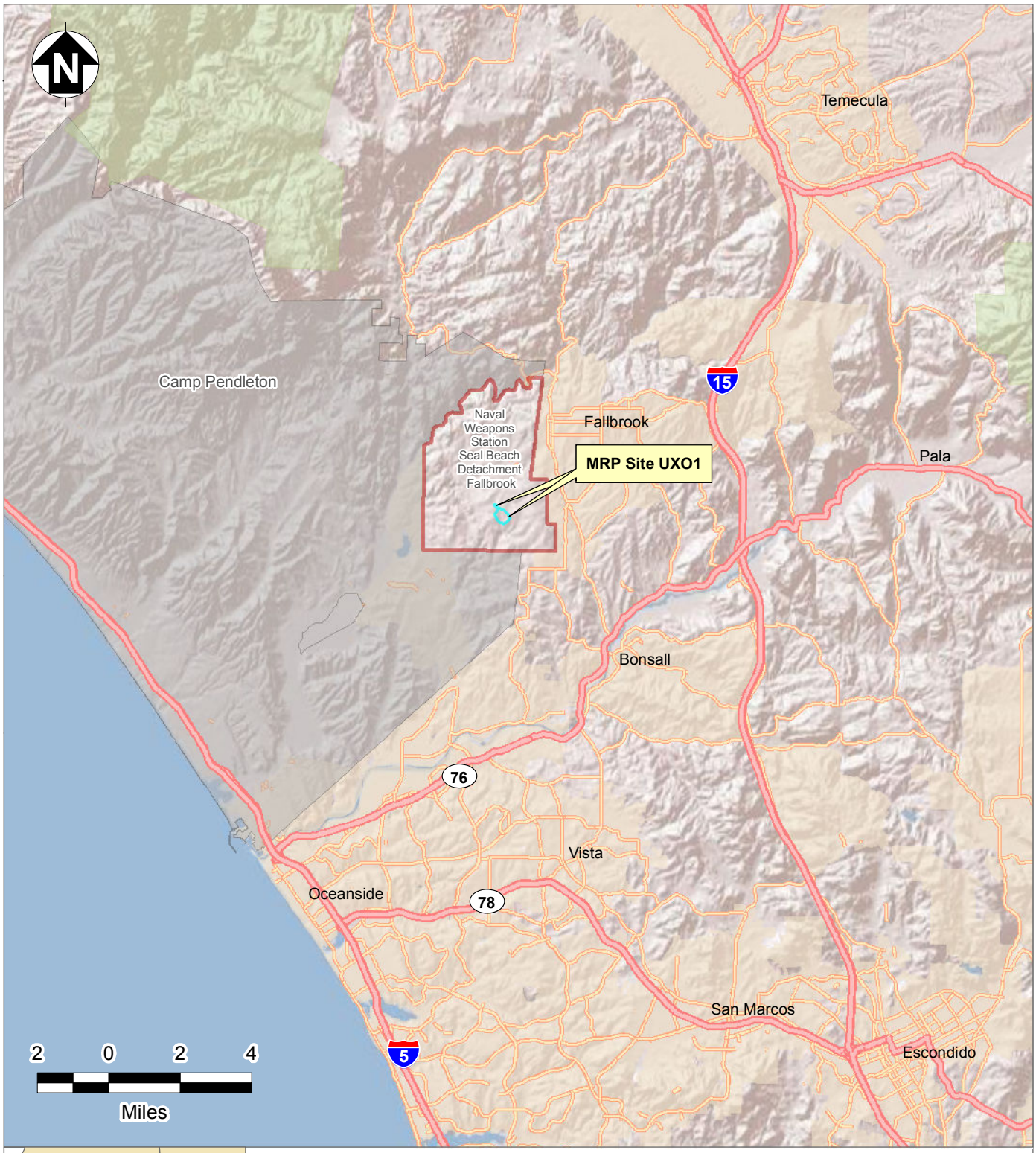
TABLE ES-1 SUMMARY OF RISKS AND RECOMMENDATIONS*

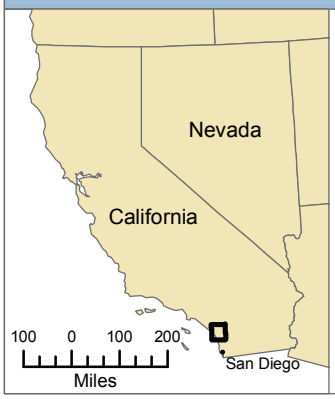
Exposure Unit	MEC Hazard Level[1]	Human Health Risk[2]		Ecological Risk Step 3a Risk Refinement	Comments / Recommendation	
		Exposure Scenario (depth bgs) / Risk Drivers	Cancer Risk (EPA/Cal)	Receptor Group (depth bgs) / Risk Driver	Comments	Recommendation
6	2	• **Future Ind (0 – 0.5 ft and 0 – 10 ft)** / dioxins • **Future Const (0 – 10 ft)** / Lead	• **1E-06 / 1E-06** **(See comments column)**	--	• The human health cancer risks for dioxins fall within the risk management range for the site • The mean lead concentration in subsurface soil at EU6 is 107 mg/kg. This value exceed the noncancer RBSL for lead of 39 for a construction worker. Based on the mean concentration, lead is identified as a COC in subsurface soil at EU6 for the future construction worker only. Two of 12 lead soil samples at EU6 exceed the construction worker RBSL. Buried construction debris in disposal trenches, some **MPPEH** recovered during surface sweep of geophysical survey area	Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH and lead in the subsurface.
7	2	• **Future Ind (0 – 0.5 ft)** / dioxins; • **Future Ind (0 – 10 ft)** / arsenic[3], dioxins; • **Future Const** (**0 – 10 ft)** / barium	• **4E-06 / 4E-06** • **4E-05 / 6E-06** • 6E-07 / 9E-07[4]	• **Plants (0 – 6 ft)** / barium, zinc; • **Invertebrates (0 – 0.5 ft)** / barium, zinc; • **Non-burrowing Mammals(0 – 0.5 ft)** / zinc	• The human health cancer risks for dioxin, arsenic fall within the risk management range for the site • Barium shows a non-cancer Hazard Index of 2 • One of 4 samples exceeded the ecological screening criteria of 330 mg/kg for **barium** with a high concentration of 3,170 at a depth of 0-2 ft bgs. • Three of four samples exceeded the eco screening criteria of 46 mg/kg for **zinc** with a high concentration of 702 mg.kg at a depth of 0-2 ft bgs • CoCs identified are contained within Burn Slit / Trench 7 (slough/fill)	Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH, barium and ecological risks
Surface Water / Groundwater	2	• **Future Ind – Domestic Use** / arsenic	• **5E-05 / 5E-05**	--	• One sample exceeded the residential screening value for **arsenic** in domestic water of 0.0071 ug/L with a high concentration of 5.42 ug/L • **Arsenic** in groundwater is considered to be naturally occurring • The human health cancer risk for arsenic in domestic water falls within the risk management range for the site • Sampling conducted of area groundwater and perched groundwater in Pilgrim Creek	No further action is recommended for this EU
Down Range SDZ	3	--		--	• No range related items identified in surface sweep of the Central SDZ by UXO technicians	No further action is recommended for this area of potential interest

Notes:

All depths are below ground surface (bgs)
Only cancer risks > 10-6 and Hazard Indices >1 are listed in the table; No Hazard Indices >1 were calculated
*Only current (natural resource worker) and likely future land use (industrial and construction) is considered. Residential use is unlikely and is excluded.
[1]Data from MEC HAs (Appendix C) for Potential Explosive Hazard Conditions: Hazard Level 1 = Highest potential; Hazard Level 2 = High potential; Hazard Level 3 = Moderate potential; Hazard level 4 = Low potential
[2]Industrial/Commercial/Natural Resource Worker Scenarios (Appendix F)
[3]Based on State of California toxicity values only
[4]Non cancer Hazard Value of 2
Eco - Ecological
Const - Construction worker
Ind - Industrial worker
MDAS – Material designated as safe
MPPEH – Material potentially presenting an explosive hazard
SDZ - Surface danger zone
-- - Cancer risk less than 10-6 and HI<1

SECTION ES1 FIGURES





NAVWPNSTA Seal Beach Detachment Fallbrook

MRP Site UXO1

Marine Corps Base Camp Pendleton

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook

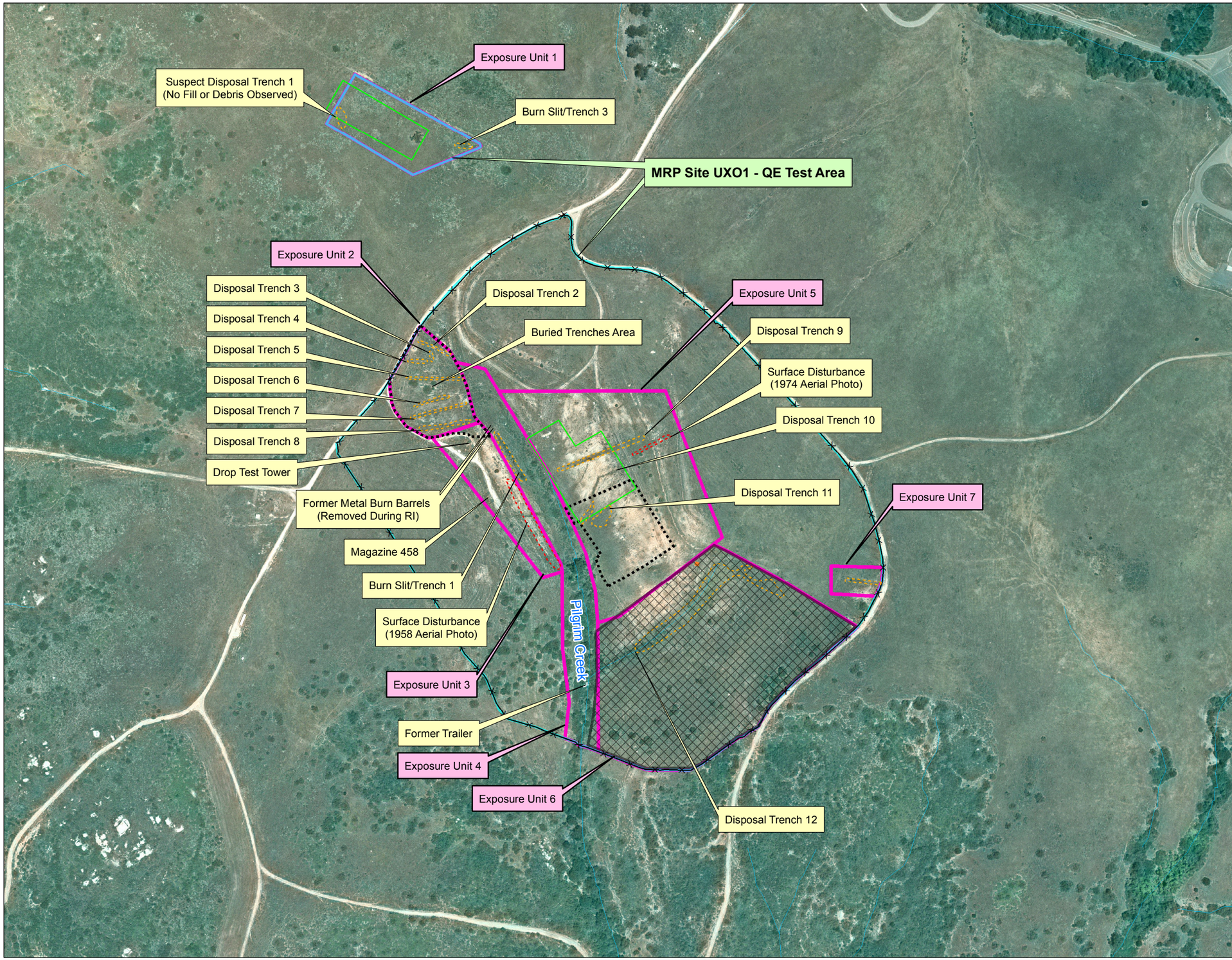
Fallbrook, California

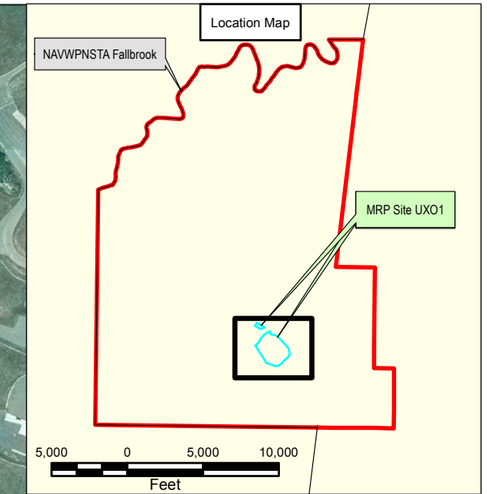
Figure ES-1

Installation Location Map

MRP Site UXO1 RI

2015-09-01 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_ES_1_Installation_Location.mxd TriEco-Tt Mario





- MRP Site Boundary
- Road
- Stream
- Fencing Installed
- Risk Assessment Exposure Unit
- 2010 SI Geophysical Survey Area (ChaduxTt)
- 2015 Geophysical Survey Area (TriEco-Tt)
- Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
- Surface Disturbance (From Historical Photo)
- Disposal Trench Limits (Approximate)

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

N

200 0 200 400
Feet

TriEco Tt
A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure ES-2
Exposure Unit Boundaries Map
MRP Site UXO1 RI

11/20/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_ES_2_Exposure_UnitBoundaries.mxd Tt-SD Mario

1.0 INTRODUCTION

A remedial investigation (RI) was conducted at Munitions Response Program (MRP) Site UXO1 (UXO1), the Quality Evaluation (QE) Test Area. The RI was designed to evaluate the past use of Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) within and adjacent to MRP Site UXO1. The Site is located on the southern portion of Naval Weapons Station (NAVWPNSTA) Seal Beach Detachment (Det) Fallbrook in Fallbrook, California (Figure 1-1).

The data obtained from the RI were intended to determine the nature and extent of contamination and to support development and evaluation of remedial alternatives in a site feasibility study (FS). The RI work plan defined project quality objectives (PQO), decision making criteria, and associated data needs to fulfill the specified purpose of the RI (TriEco-Tt 2014b).

Because of sensitive natural resources within NAVWPNSTA Seal Beach Det Fallbrook, a biological avoidance and minimization plan was developed and implemented during the RI. The plan identified specific procedures to which field teams adhered as they executed the work elements described in the work plan.

Since cultural resources are known to exist in the area, a Phase I Cultural Survey was completed at the site (ECORP 2013). Based on the survey findings, cultural avoidance and minimization measures were implemented where cultural resources were identified near planned work areas.

The RI activities included intrusive investigation and handling of MEC and materials potentially presenting an explosive hazard (MPPEH). Work involving MEC, MPPEH or material documented as safe (MDAS) was conducted in accordance with the Explosive Safety Submission (ESS) prepared for the project (TriEco-Tt 2013).

1.1 PURPOSE AND OBJECTIVES

The purpose of the RI is to evaluate the nature and extent of MEC and MC, use the data to prepare an updated MEC hazard assessment, and perform human health and ecological risk assessments. Specifically, the work included assessment of soil and water conditions at the site and efforts to delineate chemicals of potential concern (COPC) to human health and chemicals of potential ecological concern (COPEC). The risk to human and ecological receptors is defined herein through the completion of both human health and ecological risk assessments.

Detector-aided surface sweeps of all work areas were conducted by the unexploded ordnance (UXO) team and all detected MEC, MPPEH, and MDAS items were removed to clear the areas. After clearance, intrusive investigations were conducted at the features previously identified during the 2010 SI (ChaduxTt 2010). Intrusive investigations were also conducted on a representative subset of the target anomalies detected during the digital geophysical mapping (DGM) survey of the Range Impact Area. An additional surface sweep by the UXO team was conducted beyond the current boundary of MRP Site UXO1 to evaluate the possible presence of MEC or MPPEH in the portion of the former target range surface danger zone (SDZ). Soil

sampling was also conducted throughout the site at locations where MEC/MPPEH or indications of a release were discovered.

The specific objectives of this RI include:

- To determine the nature and extent of MEC/MPPEH within the boundaries of the UXO1 investigation area.
- To determine the nature and extent of MC, if present in surface or subsurface soil, and if it is at concentrations that present a risk to human health or the environment.
- To determine whether MEC, MPPEH, MC or other COPCs are present within the study area in quantities or concentrations that require an immediate response.

1.2 REPORT ORGANIZATION

This RI report is organized as follows:

- Section 1.0 provides an introduction, the overall purpose and objectives for the RI, the report organization, and the site background, including the facility history and the specific history and descriptions of the sub areas of concern within MRP Site UXO1 as well as a summary of previous investigations at the site.
- Section 2.0 presents the environmental setting, including the physical setting, climate, geology, hydrogeology, and ecology.
- Section 3.0 includes the objectives and methodology for the MPPEH and MC investigation, the geophysical survey, sampling associated with the MC investigation and the Human Health and Ecological Risk Assessment.
- Section 4.0 provides the RI results for each of the Exposure Units (EU), including the nature and extent of MPPEH and MC, and a discussion of Human Health and Ecological Risk Assessments Findings for each area of concern. Figures, Analytical Screening Tables, Boring and/or Test Pit Logs, and Photographic Logs are included within each EU subsection of Section 4.0.
- Section 5.0 briefly summarizes the MEC HA, which is included as Appendix C.
- Section 6.0 provides a summary of the conclusions and recommendations of the RI for MRP Site UXO1.
- Section 7.0 provides the references used in this RI.
- Appendix A includes Biological, Stephens' Kangaroo Rat (SKR) Trap and Hold, and Cultural Monitoring Reports.

- Appendix B provides the photographic logs of the site and sampling program.
- Appendix C provides the MEC HA.
- Appendix D presents the investigation field forms (Provided on CD only).
- Appendix E provides the Range Impact Area Geophysical Investigation Report.
- Appendix F provides the HHRA.
- Appendix G provides the Ecological Risk Assessment.
- Appendix H provides the Methods for Calculating Exposure Point Concentrations and Conducting Background Comparisons of Chemicals in Soil.
- Appendix I provides analytical data for all the investigation data presented in this RI (Provided on CD only).
- Appendix J provides the quality control summary report and laboratory and data validation reports (Provided on CD only).
- Appendix K provides the IDW Documentation (Insert when received).

Report figures and tables are included within their respective sections and appendices follow the text of this report.

1.3 BACKGROUND

The following is a brief summary of the history for the NAVWPNSTA Det Fallbrook as well as details on the specific history of MRP Site UXO1.

1.3.1 Facility History

Naval Ammunition Depot (NAD) Fallbrook was commissioned in February 1942. The depot's mission was to receive, store, and guard large quantities of explosives and ammunition and to distribute and deliver them as needed to other installations. NAD Fallbrook was put on caretaker status in 1947 but was reactivated in 1950 with the onset of the Korean War. In 1958, NAD Fallbrook was designated an annex of the Naval Ammunition and Net Depot, Seal Beach. In the 1960s, NAD Fallbrook's primary duty was to support the Pacific Marine Forces. It also stored, tested, and maintained several types of missiles. As of October 1, 1997, the installation's name changed to NAVWPNSTA Seal Beach Det Fallbrook, and the installation reported to the present NAVWPNSTA Seal Beach. It currently inspects, maintains, and recertifies air-launched missiles such as the Phoenix, Sidewinder, Maverick, and a high-speed anti-radiation missile. The installation has 190 magazines that store pyrotechnics, high explosives, fuzes, and detonators, and small arms (Malcolm Pirnie 2006). There are no active ranges within the installation.

1.3.2 MRP Site UXO1 History and Description

MRP Site UXO1 is located in the southeastern portion of the installation (Figure 1-1). The site was originally used as a burn and disposal area, then as a testing area for the Fallbrook QE Laboratory, and finally as a test firing range for larger munitions. According to information provided in the Preliminary Assessment (PA) (Malcolm Pirnie 2006), a majority of the ordnance was picked up or destroyed by U.S. Marine Corps Explosive Ordnance Disposal (EOD) teams during or immediately after testing. The site primarily occupies a broad basin that is part of the Pilgrim Creek drainage, which flows into the San Luis Rey River. Most of MRP Site UXO1 is normally covered with sparse native vegetation, with the exception of the drainage itself that is typically host to dense vegetation. However, due to wildfires that occurred in May 2014, vegetation throughout a majority of the site was impacted. At the time of the investigation, vegetation was just beginning to re-establish itself within the area.

The site occupies approximately 76 acres and contains several subareas where various range-related, munitions testing, and munitions disposal activities including burning and detonation occurred (Figure 1-2). In an effort to better characterize the facility, features of MRP Site UXO1 (Fallbrook QE Test Area) were isolated based on historical use. These include:

- Munitions burn and disposal areas which include up to 12 suspect (buried) Open Burn/Open Detonation (OB/OD) trenches, two historical surface disturbances, and two burn barrels;
- Rocket fuel Burn Slit/Trenches;
- Former Target Range and Drop Test Tower;
- Surface facilities (trailer, former magazines, observation booths), and
- Pilgrim Creek sediment, surface water, and MRP Site UXO1 area groundwater.

Aligning various fractions of the site into subareas based on the historical activity assisted in developing a sampling program intended to validate that past uses are reflected in current conditions. In developing the sampling program for this site, TriEco-Tt used these subdivided areas as a predictive tool for the types of MEC, MPPEH, and MC to be encountered.

The intent of the test firing range and OB/OD operations is to consume the explosive or incendiary devices and related constituents during the test firing or burning process. Typically for QE test operations such as at the Drop Test Tower and Central Firing Range, after detonation of the munitions, the remaining fragments do not contain MC. However, in some cases items are detonated or ejected from the OB/OD location that do not undergo complete combustion. If complete combustion of explosive materials cannot be verified and the debris is categorized as MPPEH, then the item remains MPPEH. Because MPPEH items may contain MC after they are ejected and they may be cracked or fragmented, the area directly under the item is the most likely location where MC could be released into the soil. With this in mind, the following provides a

summary of historical activities for each subarea and describes how that drove the RI MC sampling program design for MRP Site UXO1.

1.3.2.1 Suspect Munitions Burn and Disposal Trenches / Metal Burn Barrels

Portions of the QE Test Area were used for burning and disposing of MEC, MPPEH, and MC. The disposal practices started in 1942 and continued through 1985, according to personnel interviews and historical records (Malcolm Pirnie 2006). Burn and disposal operations occurred at several areas around the site (Figure 1-2) and have been grouped based on past uses as follows:

- A northern outlying suspect buried trench (referred to as Disposal Trench 1), located north of the fenced primary UXO1 area;
- The northwestern buried trenches (Disposal Trenches 2 through 8) that appear to have been used for OB/OD of munitions;
- The central range floor disposal trenches (9 through 11) that appear to have been used for OB/OD of munitions and possibly black powder;
- Two below-grade burn barrels that were used for small arms munitions, and
- The southern target area disposal trench (Number 12) that was identified in the SI. It was initially believed that the trench may have been used as the primary EOD demolition area and the disposal trench for the firing range targets and other debris.

The basis of understanding for each of the munitions burn and disposal areas is provided below;

Northwest outlying buried trench — Based on anecdotal evidence and aerial photographs, a single OB/OD disposal trench may have been present to the north of the main QE Test Area and Burn Slit/Trench 3 (Malcolm Pirnie 2006). Subsequent to the PA, a geophysical survey was conducted in the area that identified possible subsurface anomalies (Marrs 2007). What were previously considered potential anomalies were not reacquired by the geophysical team during the SI (ChaduxTt 2010). There was no surface debris, MEC or evidence of disturbance observed in the area during the SI.

Northwestern buried disposal trenches — A March 1953 aerial photograph indicated the possible presence of four trenches in the northwestern portion of MRP Site UXO1. Based on the geophysical survey of this area during the SI, at least seven disposal trenches (2 through 8) are present (ChaduxTt 2010). Observations made by UXO technicians during surface clearance observations for the geophysical survey conducted by ChaduxTt indicated that a significant amount of MEC and/or MPPEH was scattered at the surface through this area. As such, it was anticipated that OB/OD operations were conducted in this area, resulting in “kick out” of items during operations.

Central range floor buried trenches — Reports indicated that the central disposal and firing range floor area was used for disposing of or burning black powder and other ordnance. Aerial photographs from the late 1950s through at least 1974 show the entire area was disturbed. In 2004, a magnetometer survey tentatively identified two trenches (9 and 10) in the range floor (Marrs 2007). The geophysical survey was conducted as part of the investigation for the nearby IRP Site 27. The location of the southern disposal trench was reacquired and confirmed by an additional geophysical survey conducted in this area during the SI (ChaduxTt 2010). The survey also tentatively identified a smaller trench (Suspect Disposal Trench 11) a short distance south of Disposal Trench 10.

A review of the 1958 aerial photograph identified an area of disturbance west of the Pilgrim Creek drainage. This north-south trending linear feature is approximately 420 feet long and 20 feet wide (Surface Disturbance 1). A second linear feature east of the firing range was identified in the 1974 aerial photograph. The east-west trending feature is approximately 180 feet long and 15 feet wide (Surface Disturbance 2). These features were considered possible disposal trenches based on the historical photographs. Their approximate locations are indicated by dashed red lines on Figure 1-2.

Southern target area disposal trench — The detector-aided survey and reconnaissance mapping during the SI tentatively identified a large disposal trench (Disposal Trench 12) located about 200 feet south of the firing range target and berm. This target area disposal trench was estimated to be 600 feet long and approximately 50 feet wide. An area of disturbance was indicated on a 1974 aerial photograph. A variety of MPPEH and scrap metal was observed on the surface during the detector aided visual survey. No sampling or other intrusive work was completed in this area during the SI.

Below grade munitions burn barrels — Two small munitions disposal burn barrels were present east of the Drop Test Tower. The metal barrels were constructed of 30-inch-diameter corrugated metal pipe (culvert material) placed in a vertical orientation below existing grade. The barrels were reportedly used for burning small arms rounds and other small munitions constituents.

1.3.2.2 Rocket Fuel Burn / Slit Trenches

The three rocket fuel disposal trenches are located in separate areas (Figure 1-2).

Burn Slit/Trench 1 was described in the PA (Malcolm Pirnie 2006) as a deep depression located in the central portion of the site, adjacent to, or contiguous with, the Pilgrim Creek drainage channel. Reports cited in the PA indicate that, in 1969, 423 pounds of liquid rocket fuel and 142 pounds of map-4 amine fuel were burned in the trench. A January 1974 photograph shows signs of disturbance in the same area that is southeast of the primary access road for the Drop Test Tower. The open trench is approximately 16 feet wide, 200 feet long and extends to a depth of approximately 16 feet below ground surface (bgs). The trench was shrouded in heavy brush during the SI; however, it was devoid of vegetation at the time of the RI due to the 2014 Tomahawk wildfire.

Burn Slit/Trench 2 is located near the southeastern boundary of the site, had a corrugated metal cover, and is fenced on the north and south ends to limit access. The trench is approximately 80 feet long, 15 wide, and 12 feet deep in the center. The trench previously contained several wood pallets and other debris at the time of the SI, however due to the fires that affected the area, the wood debris was no longer present.

Burn Slit/Trench 3 is approximately 400 feet north of the main MRP Site UXO1 area and was also covered with corrugated metal. The trench is approximately 12 feet wide, approximately 10 feet deep and 50 feet long. Access into the corrugated metal covered trench was previously limited by four-strand barbed wire fencing. The trench also previously contained several wood pallets and was heavily overgrown with native vegetation. The vegetation and wood pallets were burned during the 2014 wildfire.

1.3.2.3 Former Target Range / Drop Test Tower

The central portion of MRP Site UXO1, the QE Test Area, was used for practice firing of various weapons that included rifle grenades and light anti-tank weapon (LAW) rockets (Figure 1-3). Firing lines were evidently located 400 to 600 feet north of the target, with the area between the firing line and the target berm (range floor) also used as a central burn and disposal area. The target consisted of a 40-foot-long, 15-foot-tall vertical steel plate backed by an earthen berm. A low natural hillside is located south of the berm and is considered to have been a possible impact area for fired munitions. As such, this area may contain unexploded ordnance (UXO) at the surface or that has penetrated the surface. The Surface Danger Zone (SDZ) for the firing range extends south of the fenced boundary of MRP site UXO1 (Figure 1-3). Although considered a low probability, this down-range area could also contain UXO.

A drop test tower (Building 348) was used to test bomblets from cluster bombs (such as Rockeye or MK118 bomblets) and other munitions from the 1950s through the early 1980s. Other munitions testing continued through the late 1980s and apparently included Bomb Live Unit (BLU)-56s. Small fragments of these sub-munitions were found in the vicinity of the tower during the SI (ChaduxTt 2010). Based on the history of testing live munitions in this area, the drop test tower and the Firing Range are the two areas at UXO1 that have the potential to contain munitions that were fired or primed (known as UXO).

1.3.2.4 Surface Facilities

Several concrete huts that were used for shelter and viewing, concrete holding magazines (Keyport Lockers) for temporary storage of munitions, a small magazine (Building 458) that has been decommissioned, and former metal targets are present at the site. A trailer was previously located in the Pilgrim Creek drainage in the southern portion of the site; however, the trailer was destroyed during the 2014 wildfires. Markings previously observed on the exterior of the trailer indicated that it may have been used by the U.S. Marine Corps as a gas mask training and test structure where CS gas (2-chlorobenzalmalononitrile) was used.

1.3.2.5 Pilgrim Creek Sediment, Shallow and Deep Groundwater

Based on potential presence of MEC and MC, the surface and subsurface soils, surface water, sediment, and perched groundwater within the Pilgrim Creek drainage site are considered a subarea that required evaluation during the RI. Also, as part of the site investigation, deeper borings (to a maximum depth of 50 feet) were planned to evaluate groundwater within the site.

1.3.3 Previous Investigations

An initial assessment study (IAS) for NAVWPNSTA Seal Beach, including the Fallbrook Annex and Corona Annex, was completed by Naval Energy and Environmental Support Activity (NEESA) in February 1985 (NEESA 1985). In 1989, NAVWPNSTA Seal Beach requested that NEESA update the IAS, which was revised and issued in August 1990 (NEESA 1990). Sites addressed in the IAS include IRP Site 26 Ordnance Burn Pits and Burial Pits by the Drop Test Tower and Building 348 which is now MRP Site UXO1 Fallbrook QE Test Area. The IAS recommended a SI at the QE Test Area.

A PA for the munitions response program was completed in 2006 (Malcolm Pirnie 2006). The PA recommended a SI for both MEC and MC at the Site and suggested that the SI should focus on the nature and extent of MEC and MC.

An SI report for MRP Site UXO1 among other sites was completed by ChaduxTt in May 2010. The SI performed a file review, site inspection with sampling, refined the site boundaries, conducted an initial munitions hazard screening evaluation, updated the conceptual site model (CSM), and recommended future actions. During the course of the SI, several suspect MEC, MPPEH, and non-munitions related items were observed at the ground surface (ChaduxTt 2010). Biased and unbiased soil samples were submitted to the laboratory for analysis of volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals, dioxins, perchlorate, and explosive compounds. The analytical suite varied by subarea. Although there was no regional, installation or site background data for comparison when the SI was prepared, a comparison of the analytical results to ecological benchmarks and human health screening levels showed the following:

- All 67 samples analyzed for arsenic and three cadmium samples were above residential screening criteria.
- All 67 samples analyzed for arsenic and two cadmium samples exceeded industrial screening criteria.
- The maximum calculated dioxin toxic equivalent quotient (TEQ) of 11.7 nanograms/kg (ng/kg) was below human health screening values (DTSC 2009) of 40 ng/kg for agricultural, 50 ng/kg for residential and 200 ng/kg for industrial scenarios, [Dioxin (2,3,7,8-TCDD)].

- The maximum calculated dioxin TEQ for mammals exceeded the EPA ecological benchmark of 0.2 ng/kg in all ten samples.

- All 67 samples analyzed for aluminum, chromium, iron and vanadium exceeded ecological screening levels.

- Detections of antimony, barium, cadmium, copper, lead, manganese, mercury, and zinc were also noted at concentrations above ecological screening levels in some samples.

- No concentrations of explosives, propellants, VOCs, or SVOCs were detected in any soil samples.

Based on this information, the following was recommended for the RI phase of work at the site:

- Intrusive investigation where MEC or MC was suspected.

- Intrusive MC investigations of the 12 disposal trenches and three burn slits and trenches identified to characterize the nature and extent of buried munitions constituents.

- UXO detector-aided visual surveys as well as additional geophysical surveying in areas of the site not addressed in the SI.

- Further detector-aided visual survey of the firing range impact area south of the target berm.

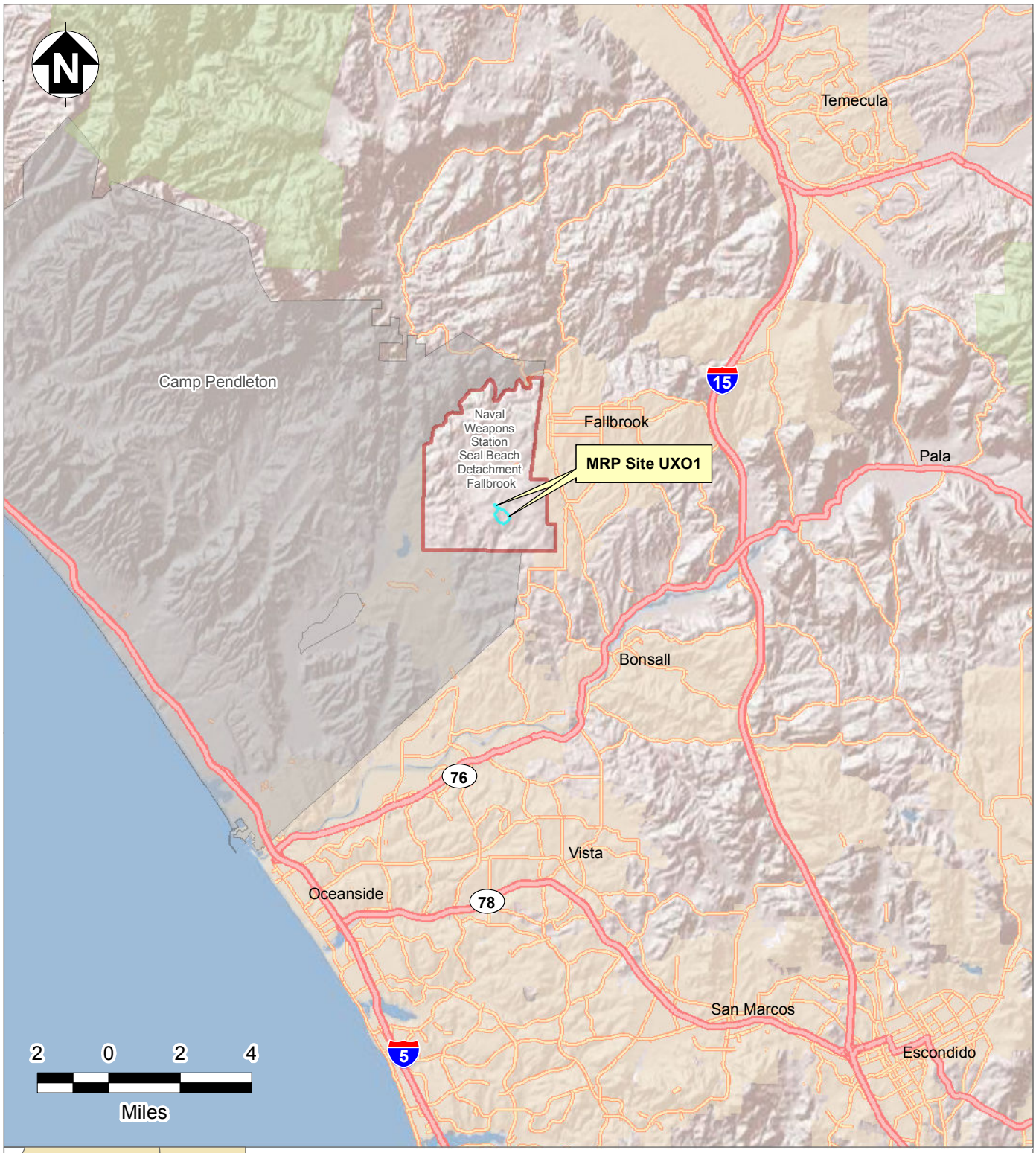
- Detector-aided visual survey of the former target range SDZ (based on the past testing of LAW rockets) that extends south of the site boundary.

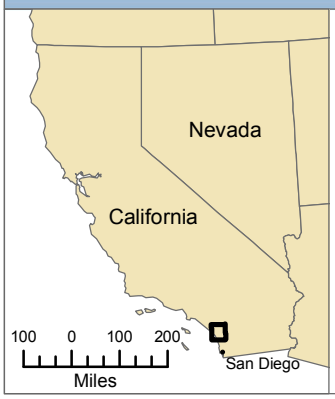
- Further evaluation of areas of historical disturbance identified in photographs, areas previously obscured by vegetation (Pilgrim Creek), and the trailer and adjacent areas.

- The analytical suite should include metals (including strontium), VOCs, SVOCs, explosives, white phosphorus, perchlorate, pentachlorophenol, and dioxins. Where burnt debris is observed, the analysis should include pentachlorophenol, chlorinated dioxins, and furans. For the rocket fuel disposal trenches, the analysis should include perchlorate and total petroleum hydrocarbons as diesel (TPH-d).

- Re-evaluate the metals concentrations based on the results of the recommended background metals study and current screening values.

SECTION 1.0 FIGURES





NAVWPNSTA Seal Beach Detachment Fallbrook

MRP Site UXO1

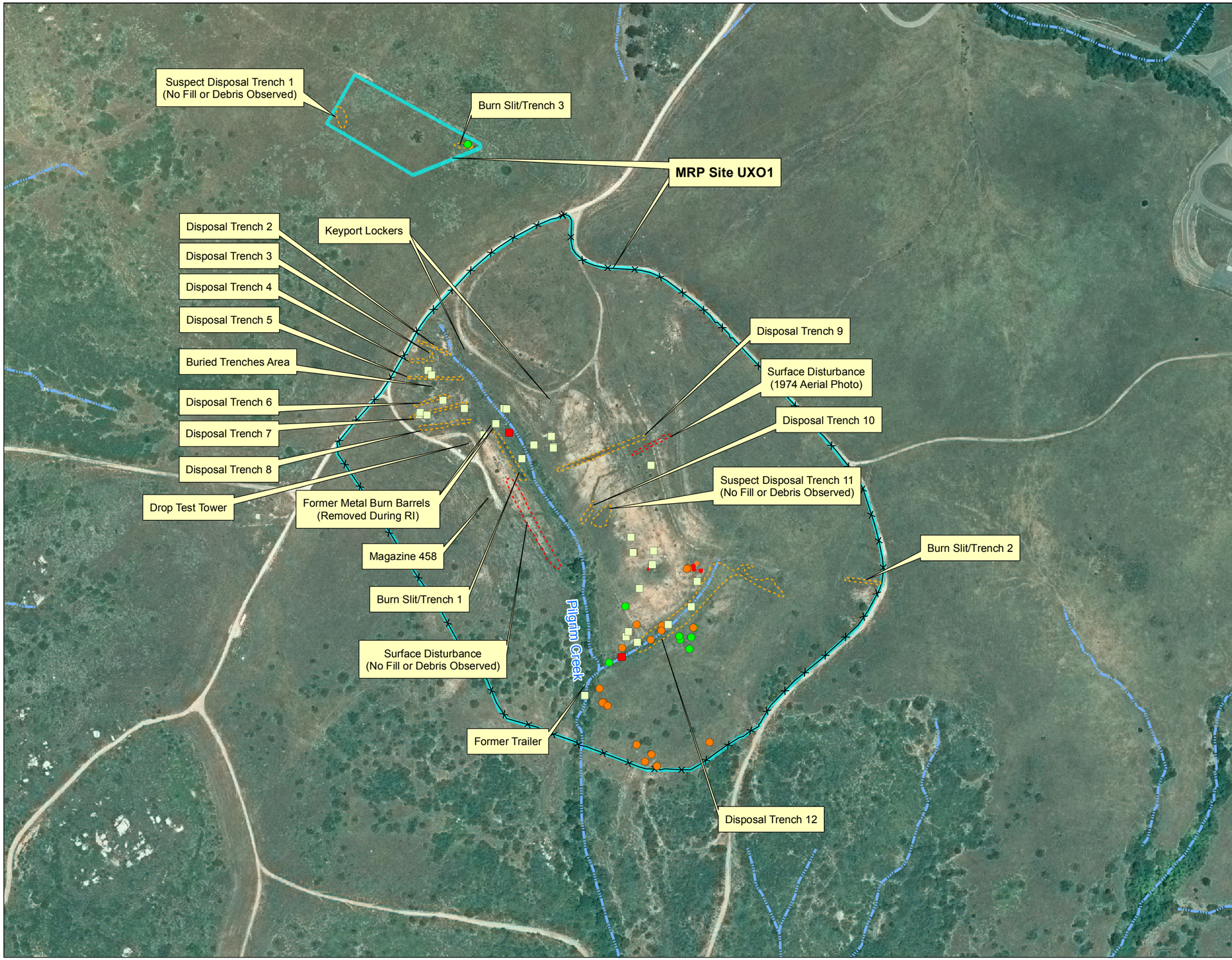
Marine Corps Base Camp Pendleton

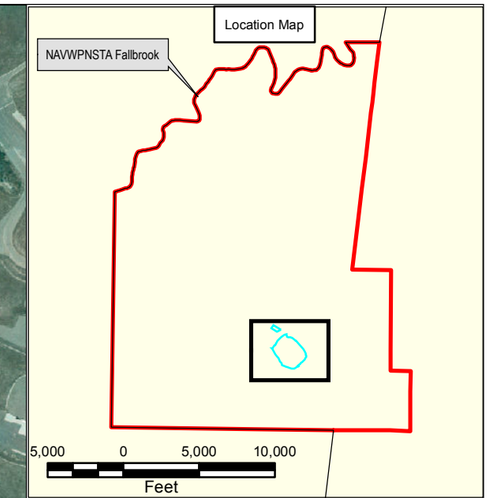
TriEco Tt
A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 1-1
Installation Location Map
MRP Site UXO1 RI

2015-09-03 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_1_1_Installation_Location.mxd TriEco-Tt Mario





MRP Site UXO1 Boundary
Road
Drainage Channel (Approximate)
Range Fencing
Surface Disturbance (From Historical Aerial Photo)
Disposal Trench Limits (Approximate)
MDAS (Removed)
MPPEH (Removed)
Metal Debris (Removed)
Other Debris

Notes:
MEC *Munitions and explosives of concern*
MPPEH *Material potentially presenting an explosive hazard*
MRP *Munitions Response Program*

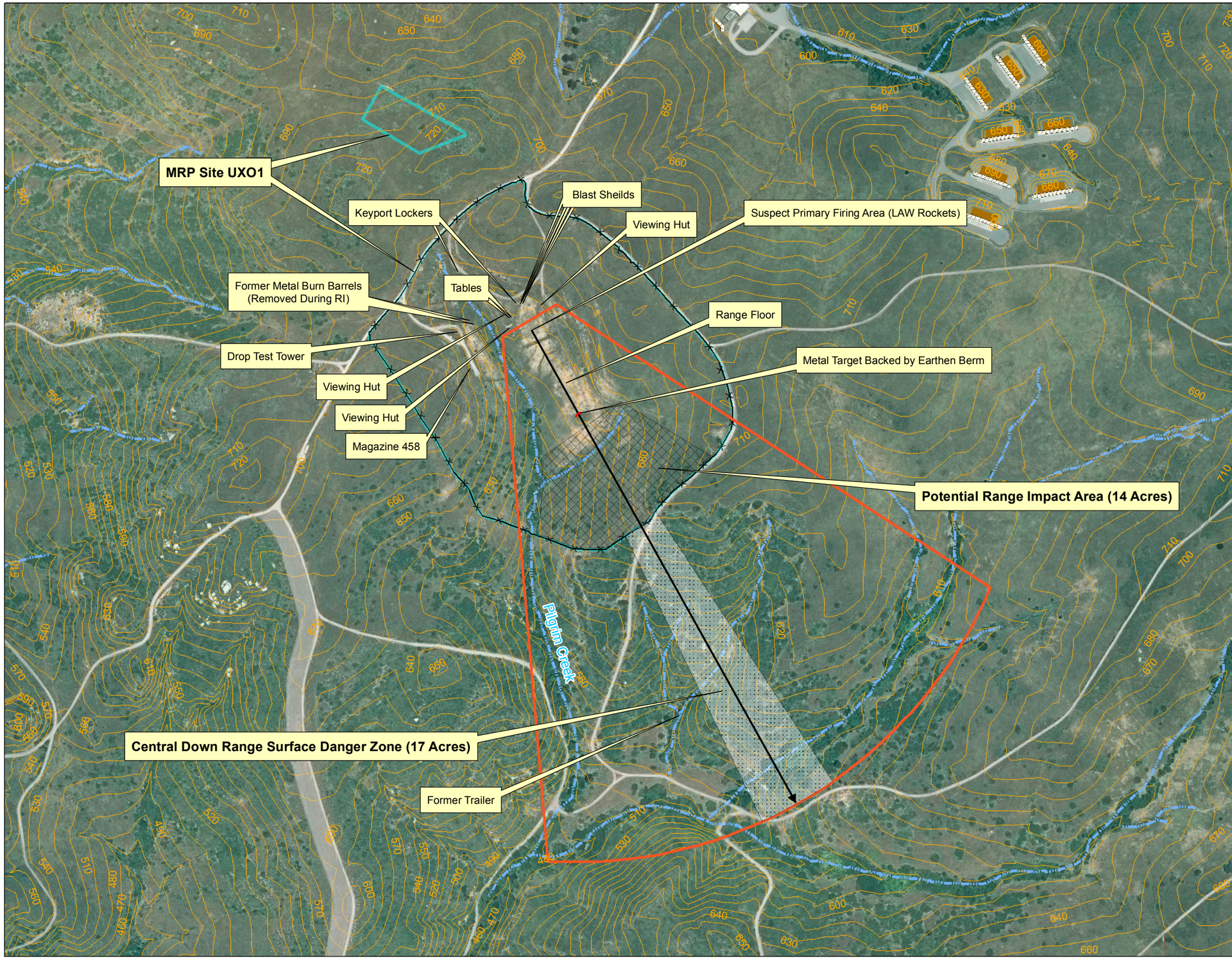
200 100 0 200 400
Feet

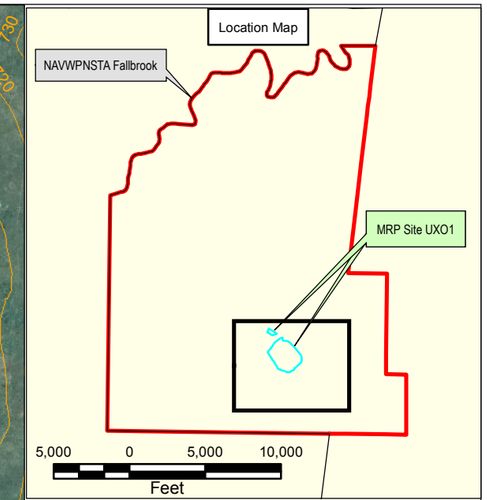
TriEco
A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 1-2
MRP Site UXO1 Munitions Disposal and Other Site Features
MRP Site UXO1 RI

2015-09-01 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_1_2_Site_Features_.mxd TriEco-Tt Mario





MRP Site UXO1 Boundary
Road
Drainage Channel (Approximate)
Elevation Contour (Feet Above Mean Sea Level)
Ammunition Storage
Range Fencing
LAW Rocket Surface Danger Zone (SDZ)
LAW Rocket Trajectory
2015 Geophysical Survey Area (TriEco-Tt)
Detector-Aided Surface Sweep Area (17 Acres)*

Notes:
** Light Anti-Tank Weapon (LAW) rocket surface danger zone was established considering the effective range of the LAW rocket is 33 to 660 feet and the maximum range of the LAW rocket is 3,300 feet.*

N

300 0 300 600
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 1-3

MRP Site UXO1 Range Related Features
MRP Site UXO1 RI

2015-09-14 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_1_3_UXO1_Overview.mxd TriEco-Tt Mario

2.0 ENVIRONMENTAL SETTING

NAVWPNSTA Seal Beach Det Fallbrook is 53 miles north of San Diego, California, in northern San Diego County. It is nine miles inland from the Pacific Ocean and is immediately adjacent to the eastern border of Marine Corps Base (MCB) Camp Pendleton. Elevation at the installation varies from 200 to 840 feet above mean sea level (msl), and the topography is characterized by low hills and alluvial bottomlands. The installation occupies 8,852 acres and is secured by a chain-link fence (Malcolm Pirnie 2006). The location of the installation is shown on Figure 1-1.

2.1 CLIMATE

The climate in the region ranges from warm, dry summers to cool, moist winters. From November to March, the average daily temperature ranges from about 46° to 65°F and for April to September the range is roughly 55° to 90°F. Prevailing winds are from the west, and the mean annual precipitation is approximately 16 inches per year. About 85 percent of the rainfall occurs from November to March.

2.2 GEOLOGY

NAVWPNSTA Seal Beach Det Fallbrook is located in the western portion of the Peninsular Ranges geomorphic province (USGS 2005). The province is dominated by Cenozoic age igneous, volcanic, and metamorphic rocks of the Peninsular Range batholith. Metamorphic rocks now preserved in the central and eastern Peninsular Range region include marbles, slates, schists, quartzites, and gneisses. Nearly flat-lying sedimentary formations unconformably overlie the granitic and metamorphic bedrock in the coastal portions of the province, which include NAVWPNSTA Seal Beach Det Fallbrook. Younger age volcanic rocks are found locally within the central and, to a lesser extent, near the coastal areas of the province, such as the San Onofre Mountains of MCB Camp Pendleton (Walawender 2000; USGS 2005).

Based on area mapping and data obtained from the site investigation, the site is underlain primarily by slightly weathered to unweathered granodiorite that is generally medium to light gray in color (Figure 2-1). When weathered, the granodiorite was observed to have more of a light yellow to tan color with a distinctive pinkish hue. In fresh outcrops or cuttings from the deeper horizons in the borings, the material was a medium grey in color and consisted of a medium crystalline, equigranular granodiorite. In the central range floor area, a relatively thick layer of colluvial soils mantel weathered granodiorite bedrock. This layer ranges in thickness from two to six feet in thickness and is composed of a medium to dark red-brown silty sand with some clay. The colluvium often displays distinctive grey to dark orange brown mottling with root casts, and when dry, is very hard (difficult to excavate) with a blocky texture. This material grades gradually to the weathered granodiorite. It should be noted that the granodiorite observed within MRP Site UXO1 is very similar in composition to the granodiorite sampled in the installation wide background Study prepared in 2012 (SES-Tech 2012).

A relatively thin accumulation of alluvium was observed within the lower elevations of the Pilgrim Creek drainage. This soil consisted of a fine to coarse grained, well graded sand with silt. It was

very loose in consistency and, at the time of the investigation, was generally moist to damp at the surface and dry at a depth of two to three feet. The thickness of this deposit ranged from approximately 11 feet in the northern upper portion of the drainage where the temporary well PC-MW1 was installed and to a depth of approximately six feet near the southern boundary of the site in temporary well PC-MW2.

A majority of the area within the fenced boundary of MRP Site UXO1 displays evidence of surface disturbance. Undocumented fill is present locally as a result of construction of the access roads, excavation of the Burn Slits/trenches, construction of the target berm, as well as general surface disturbance related to fire control operations as a results of historical activities. The Geologic Map (Figure 2-1) indicates areas where significant accumulations of fill were either observed in the test excavations or mapped at the surface; however, additional areas of fill or tailings related to general surface disturbance are likely present throughout the site. The paragraphs below provide a general overview of the materials encountered in the test pits. A detailed summary of the material encountered within each of the exposure units (EU) is provided in Section 4.0 – Remedial Investigation Results.

Undocumented or debris fill was observed in most of the buried disposal trenches in the northwest, central range floor, and to the south of the target berm. No fill or debris was identified in suspected Disposal Trench 1, located north of the main MRP Site UXO1 boundary. In the northwest disposal trenches area (EU 2), which includes buried Disposal Trenches 2 through 8, debris fill was logged to a maximum depth of approximately eight feet and at one location to a width of 18 feet. The trenches ranged in length from 50 to 240 feet. The debris fill consisted of a medium to light brown fine to medium-grained silty sand with varying amounts of metal (scrap, MDAS, and MPPEH), concrete, wood, and, to a lesser extent, plastic and other debris. Evidence of burning was observed in each of the trenches in the form of melted steel, burn ash, partially burned wood, and a baked contact with the underlying or adjacent native soils. A significant amount of metal debris was observed at the surface that is believed to be “kick-out” from the OB/OD operations. The heaviest concentration of this material is to the south of Disposal Trenches 2 and 3.

Buried Disposal Trenches 9, 10, and 11, along with Surface Disturbance 2, are in the located in the central range floor area (EU 5). Disposal Trench 9 contained a significant amount of debris that appeared to have been placed in multiple events. The trench is oriented in an east to west direction and its location is evident by the settlement of the fill creating a linear depression in the middle of the range floor. The trench was approximately 12 feet wide and 380 feet longs with debris fill observed to a maximum depth of eight feet bgs. Disposal Trench 10 was found to be somewhat smaller than suggested by the geophysical data; however, MDAS and MPPEH items were identified in the debris collected from Test Pit 2. The test pit excavated within the suspected Disposal Trench 11 area did not identify fill or debris material. Trenches 9 and 10 also contained varying amounts of metal (scrap, MDAS, and MPPEH), concrete, wood, and plastic with some evidence of burning.

The three test pits completed in Disposal Trench 12 (EU 6) encountered primarily construction debris consisting of wood, rubber, and metal (pipes, wire, nails) and, to a lesser extent, porcelain, plastic, and paper. Scattered munitions related items (MDAS and MPPEH) were observed at the surface within the limits of the disposal trench as well as the rest of the Range Impact Area.

However, there was no evidence of OB/OD operations associated with the debris fill in Disposal Trench 12. The debris fill was observed in our test pits to a maximum depth of approximately 12 feet bgs with a maximum width of approximately 50 feet. Geophysical data suggests the trench, or at least buried metal debris, may be as wide as 100 feet in the eastern portion of the trench. In most trenches where debris was present, there was a one to two-foot cover of relatively clean topsoil horizon overlying the debris material.

2.3 HYDROLOGY

The general hydrologic setting for the northern portion of the installation is dominated by the Santa Margarita River channel that defines the northern boundary of Det Fallbrook. All surface runoff from the northern portion of the installation flows into the Santa Margarita River that is considered part of the Santa Margarita–Upper Ysidora Watershed. The Santa Margarita River and associated groundwater are designated as beneficial use by the State of California Water Resource Control Board. The central portion of the installation may be characterized by first- and second-order ephemeral drainages associated with Fallbrook Creek. Fallbrook Creek traverses the community of Fallbrook and enters the installation near the east gate at Ammunition Road. The creek flows west through the installation and exits Det Fallbrook along the middle of the west boundary, entering MCB Camp Pendleton. The southern portion of the installation drains southward through first- and second-order ephemeral drainages that include Pilgrim Creek. Pilgrim Creek exits the installation along the southern boundary and continues southward, where it eventually joins the San Luis Rey River Channel. First order drainages of Pilgrim Creek begin within the Site and flow southwest where the drainage connects with the main Pilgrim Creek channel.

2.4 HYDROGEOLOGY

Hydrogeological conditions within NAVWPNSTA Seal Beach Det Fallbrook vary significantly because of the physical properties of the underlying igneous bedrock. Although a majority of the sites are underlain by weathered intrusive or extrusive igneous rocks related to placement of the southern California batholith, weathering and fracturing have physically modified these units, in turn locally affecting groundwater conditions. Potable groundwater in this bedrock regime generally occurs at 100 feet or deeper in fractures with laminar to turbulent flow. Flow in the bedrock depends on the fracture patterns and, therefore, may be at any angle to the groundwater gradient (ChaduxTt 2010).

Perched groundwater occurs within the alluvium, colluvium, and/or thin near-surface (weathered) bedrock layers in topographically low areas such as drainages. This seasonal perched water occurs primarily after storms or periods of prolonged precipitation and may be present at relatively shallow depths, less than 10 feet below ground surface (bgs), within the Pilgrim Creek drainage. Although groundwater within the detachment is designated as beneficial use by the Regional Water Quality Control Board, NAVWPNSTA Seal Beach Det Fallbrook receives all of its potable water from the San Diego County Water Authority.

Installation Restoration Program (IRP) Site 27 is located along a shallow drainage swale approximately 600 feet northeast of MRP Site UXO1. In a draft SI report by Marrs Services

Incorporated (Marrs) (2007), groundwater depths ranged between 17 and 29 feet bgs during installation of three monitoring wells in 2006. Based on the well logs, it appears that groundwater occurred at or near the alluvium-to-bedrock contact. It is interpreted to be perched water and likely occurs only seasonally. IRP Site 27 is also within a first-order drainage swale and at approximately the same elevation as MRP Site UXO1. The sites are in separate watersheds; runoff from IR Site 27 is within the Fallbrook Creek drainage basin and the Santa Margarita-Upper Ysidora Watershed, whereas runoff generated from MRP Site UXO1 flows into the Pilgrim Creek drainage basin and the San Luis Rey Watershed.

A total of six borings were completed to evaluate groundwater conditions within MRP Site UXO1 during the investigation (Figure 2-2). Three borings (AGW-MW1 through AGW-MW3) were intended to evaluate deeper groundwater conditions. The borings were completed to depths ranging from 34 to 47 feet bgs. Groundwater was encountered in two of the borings, where monitoring wells MW1 and MW2 were installed. The third boring where MW3 was planned did not encounter groundwater at the maximum explored depth of 47 feet bgs. Groundwater was observed in MW1 and MW2 at depths of approximately 22 and 20 feet bgs, respectively.

Two temporary wells were also installed during the investigation within the Pilgrim Creek drainage to evaluate possible shallow or "perched" groundwater conditions. Wells PC1 and PC2 were completed using hand augers to depths of 17.2 and 10.6 feet bgs, respectively. Topsoil and alluvium were observed to depths of approximately 11 feet in PC1 and 6 feet in PC2. The borings were extended into the weathered bedrock until hand auger refusal was met. Damp soil conditions were noted in the very bottom of the PC1 boring and moist conditions were noted in the PC2 boring at the alluvium to bedrock contact during the drilling process. After allowing the capped wells to sit overnight, groundwater was observed the following day at depths of 16.4 feet bgs in PC1 and 8.6 feet in PC2. A third well was hand augured to a refusal depth of 8 feet, where the main Pilgrim Creek Channel and the channel from the Disposal Trench 12 area (EU 6) join. The soil was dry to damp, with no sign of moist conditions observed during installation of the well, and groundwater was not observed after the well was allowed to stand open for 48 hours. The temporary wells were abandoned on completion of the sampling program.

2.5 ECOLOGY

More than 80 percent of NAVWPNSTA Seal Beach Det Fallbrook lands are natural open space because of the low-intensity land use of the military installation. The Depot Lake and Lower Lake reservoirs are both part of the Santa Margarita-Upper Ysidora watershed. They are used for fire suppression and have been a source of water for livestock (ChaduxTt 2010). The area around Det Fallbrook and MCB Camp Pendleton provides the largest remaining wildlife habitat area in coastal southern California.

A collaborative effort among federal, state, and private agencies called the South Coast Missing Linkages Project aims to identify and prioritize linkages, or corridors of land that maintain natural movement of wildlife between large habitat areas. The goal is to conserve essential biological and ecological processes, and the project has identified 15 linkages for the South Coast Ecoregion. The project is intended to keep populations of plants and wildlife inhabiting the largest remaining

wildland tracts from becoming isolated by creating dispersal corridors between important lands. MCB Camp Pendleton and Det Fallbrook make up the primary parcel of land at the Santa Ana-Palomar Mountains Linkage's western end; the linkage connects the coastal Santa Ana Mountains with the inland Palomar Mountains. In particular, the northern boundary of Det Fallbrook, the Santa Margarita River corridor, is a key component of this linkage. The corridors are considered essential to maintaining ecological processes in an increasingly fragmented landscape.

Several native plant communities at Det Fallbrook provide habitat for wildlife, including perennial grassland, coastal sage scrub, chamise chaparral, coast live oak riparian woodland, and willow riparian woodland. During a 2013 site visit, MRP Site UXO1 was dominated by coastal sage scrub and mixed grassland plant communities, and included areas with southern willow scrub, willow riparian woodland, and coast live oak woodland communities along the drainages. It was observed that the majority of the site appeared to have been brushed or graded for fire control during the years of operation. Since operations ceased at the site, vegetation had reestablished itself throughout most of the site; however, evidence of surface disturbance was still prevalent. A map showing the locations of the vegetative communities from 2013 was provided in the biological avoidance and minimization plan (ECORP 2013) and is included as an attachment to the completed ecological checklist provided in Attachment G1 of Appendix G.

In May 2014, the Tomahawk wildfire swept through Fallbrook and partially into Camp Pendleton and burned a majority of MRP Site UXO1, leaving it devoid of most vegetation. The reduction in shrubs and brush effectively removed almost all the on-site habitat for many of the special status species (such as the California gnatcatcher, the least Bell's vireo [LBVI], and the southwestern willow flycatcher); however, it created new suitable SKR habitat in areas that had previously been too overgrown to support the species (ECORP 2013). A more detailed description of the ecological setting, including a habitat map and site photos is provided in Attachment G1 of Appendix G.

Fauna common to the installation include many mammals (kangaroo rats, voles, deer, mice, bats, ground squirrels, opossum, rabbits, and coyotes), reptiles (rattlesnakes, western fence lizard, and side blotched lizard), and birds (owls, raves, finches, towhees, kites, quails, sparrows, kingbirds, and hawks). Plants observed in January 2015 include California sage brush *(Artemisia californica)*, black sage *(Salvia mellifera)*, laurel sumac *(Malosma laurina)*, white sage *(Salvia apiana)*, deerweed *(Acmispon glaber)*, western sword fern *(Polystichum minutium)*, broad leaf filaree *(Erodium botrys)*, eucalyptus, and annual and perennial grasses.

In addition to the common species noted above, based on the pre-fire condition of the site observed during previous surveys and site visits, as well as post-fire conditions observed during a 2015 site visit (Attachment G1 of Appendix G), a number of special status species could be present at the site. Table G-1 presents the complete list of special status species potentially present at MRP Site UXO1 and their respective state and federal designations. Species that have been documented or have the potential to occur include, but are not limited to, the following federally threatened or endangered species:

- Coastal California gnatcatcher (CAGC) (*Polioptila californica californica*); threatened

- Least Bell's vireo (LBVI) (*Vireo bellii pusillus*); endangered
- Southwestern willow flycatcher (SWFL) (*Empidonax trailli extimus*); endangered
- Stephens' kangaroo rat (SKR) (*Dipodomys stephensi*); endangered
- Arroyo toad (ARTO) (*Bufo californicus*); endangered

CAGN is a non-migratory species that nests in coastal sage scrub and adjacent chaparral, as well as *Baccharis* scrub. The LBVI usually arrives in southern California in mid-March through August or September and nests in riparian as well as coastal sage vegetation with patches of Mexican elderberry (*Sambucus mexicanus*). The SWFL also nests in riparian areas and occurs in southern California from mid-May through September or October. The SKR burrows in areas with low-lying perennial cover and bare ground, including coastal sage scrub, grassland, and chaparral. The ARTO uses wetland and upland areas during different parts of its life cycle; they are known to occur along the Santa Margarita River and may occur in suitable habitat at Det Fallbrook. Since suitable habitat was available for these and other species prior to the 2014 fire, these species could occur at the site once vegetation is re-established.

2.6 ARCHEOLOGICAL RESOURCES

To meet the regulatory requirements of this project, a Phase I Archeological Survey investigation was conducted pursuant to the provisions for the treatment of cultural resources contained within Section 106 of the National Historic Preservation Act (NHPA) (ECORP 2013). Section 106 of the NHPA and its implementing regulations (36 Code of Federal Regulations 800) provide procedures for identifying, evaluating, determining effects, and treating the effects of federal undertakings on historic properties (cultural resources). The first step in the Section 106 process is to define the project Area of Potential Effect (APE). The APE was defined as the area within which ground-disturbing activities will take place that may affect cultural resources. The cultural resources within the APE were identified through a records search and a field survey.

The cultural resources identified within the APE were then evaluated using National Register of Historic Places (NRHP) criteria (36 CFR 60.4). The effects of the project on historic properties (cultural resources determined eligible as a result of the evaluation process) were then identified.

The project area is located in the territory known ethnographically to have been occupied by the Luiseño Native American group, which was converted by friars from Mission San Luis Rey. The Luiseño lived in sedentary and autonomous village groups, each with specific subsistence territories encompassing hunting, collecting, and fishing areas. Villages along the upper San Luis River had acorn-gathering camps on Mount Palomar that were occupied during the fall. Inland populations had access to fishing and gathering sites on the coast, which they used during the winter months.

At the beginning of World War II, the U.S. Navy began proceedings to acquire Rancho Santa Margarita y Las Flores. The east-central portion of the Rancho became NAD Fallbrook in 1941.

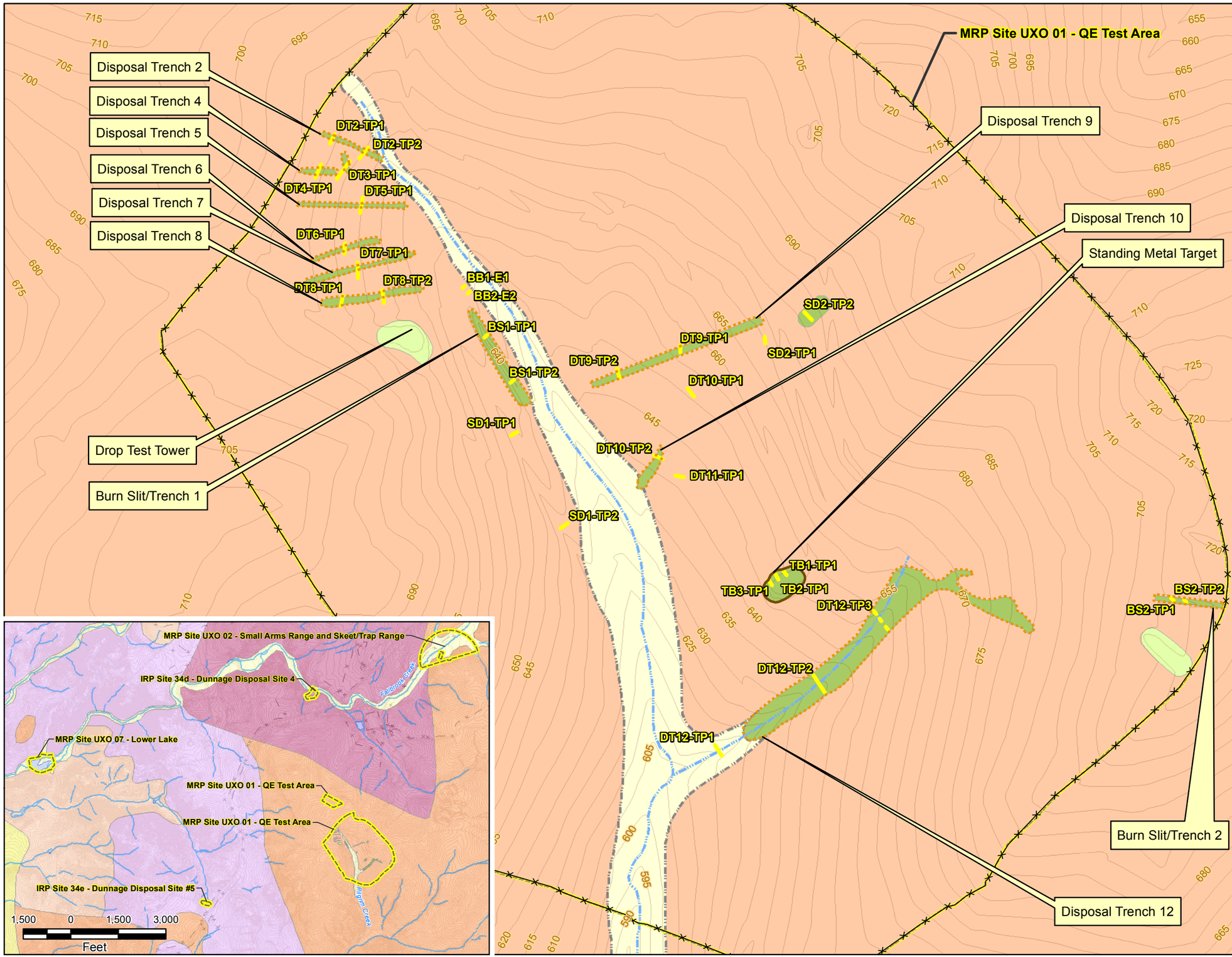
The rest of the Rancho became U.S. Marine Corps Camp Pendleton in 1942. The first buildings and facilities at NAD Fallbrook were completed by the beginning of 1942. By 1945, buildings, structures, and facilities at NAD Fallbrook included 163 magazines, 7 storehouses, 16 miles of railroad spurs, and more than 100 miles of roads. In 1947, Fallbrook was placed in caretaker status and there was a 50 percent reduction in personnel.

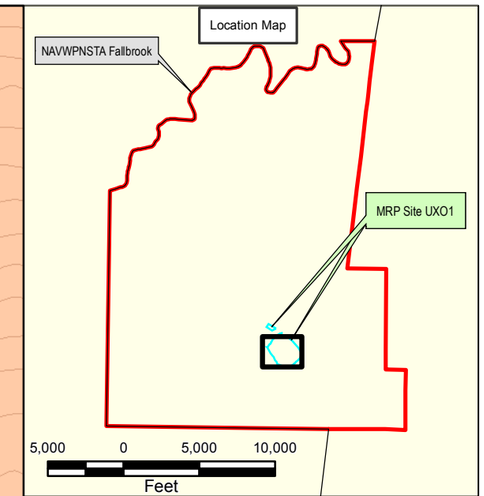
Fallbrook was returned to active status when the Korean War began. During the Korean War, Fallbrook received, stored, segregated, issued, and reworked many tons of ammunition. Ordnance handling at Fallbrook declined during the 1970s, and in 1997 the Naval Weapons Stations were reorganized and Fallbrook became a detachment of Seal Beach. It is officially known as NAVWPNSTA Seal Beach Det Fallbrook.

A total of four historic-period sites, and the historic-period component of one multi-component site (a site consisting of both prehistoric and historic-period artifacts), were recorded within the QE Test Area. Because they were all part of the routine functions of the military and none of them was directly involved in leading-edge military developments, all of the historic sites and the historic component of the multi-component site were evaluated as not eligible for the NRHP. Therefore, there are no historic properties in the MRP Site UXO1 APE.

There was one prehistoric site recorded within the Test Area APE. Monitoring by an archaeologist and Native American monitor was conducted during ground-disturbing activities conducted at Burn Slit/Trench 3 and suspected Disposal Trench 1 that were located adjacent to the recorded prehistoric site. The Field Monitoring Report is provided in Appendix A of this report. Two prehistoric sites were recorded within the Central Down Range Surface Danger Zone. There was no ground disturbance activities conducted in this area.

SECTION 2.0 FIGURES





Geologic Contact (Dashed where inferred)
Disposal Trench Limits (Approximate)
Target Berm
Test Pit

Regional Geology

- Kjm - Volcanics
- Kgb - Diorite/Gabbro
- Kgt - Tonalite
- Kgd - Monzogranite
- Qoal - Older Alluvium
- Qal - Alluvium
- Qaf - Undocumented Artificial Fill
- Qdf - Debris Fill

Elevation Contour (5' interval)
Drainage Channel (Approximate)
Site Boundary

100 0 100 200
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 2-1

MRP Site UXO1 Geology
MRP Site UXO1 RI

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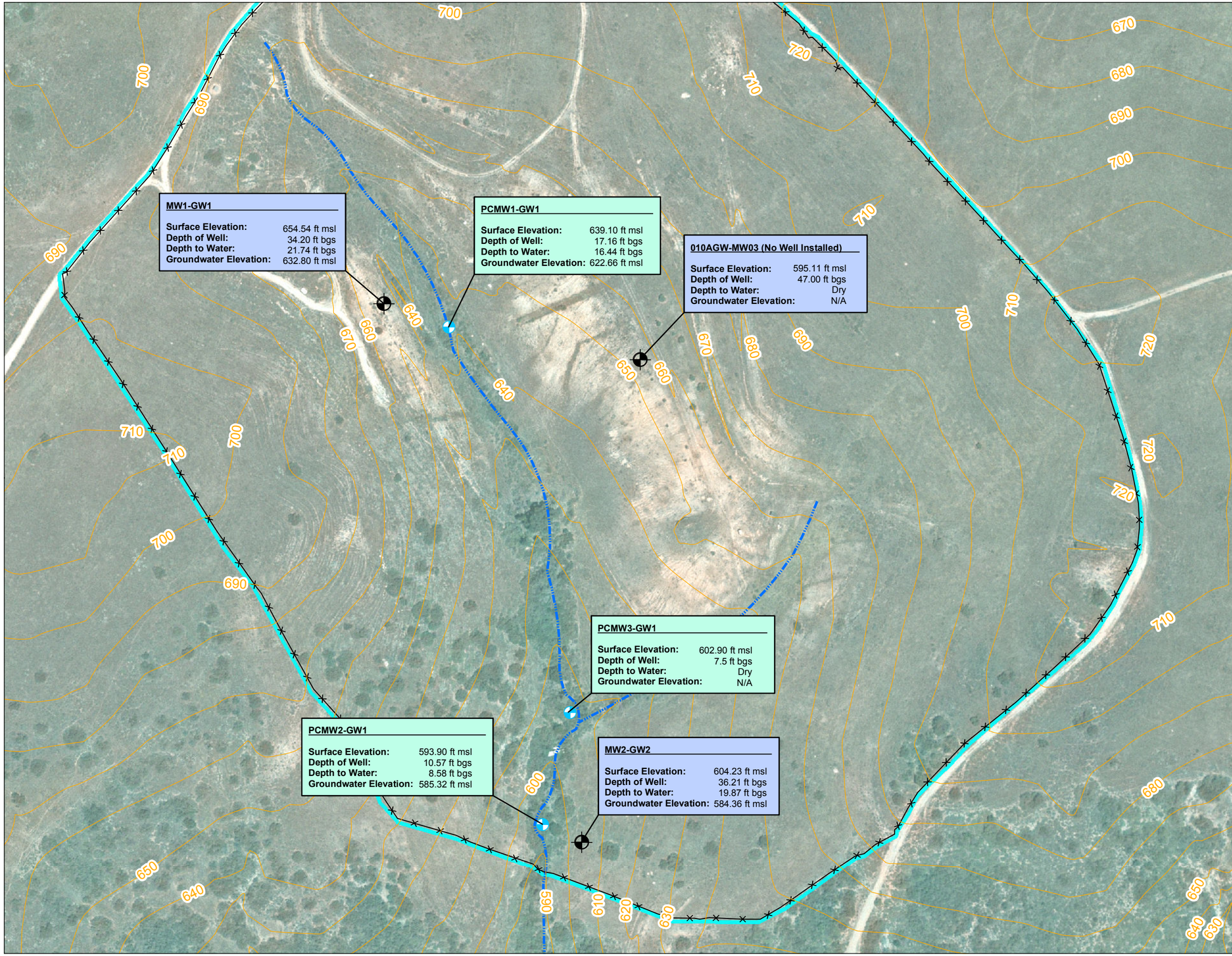

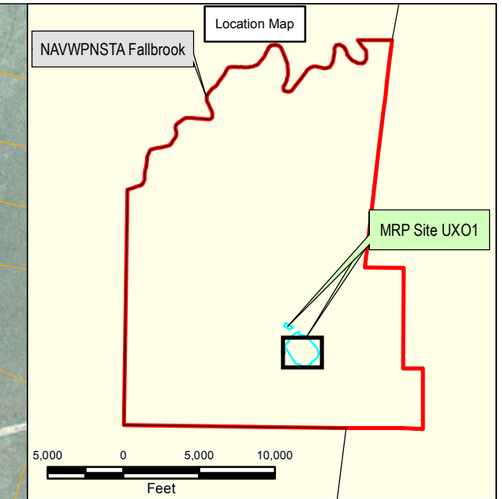

MRP Site UXO1 Boundary
Drainage Channel (Approximate)
Range Fencing
Elevation Contour (Feet Above Mean Sea Level)
Shallow Monitoring Well
Area Monitoring Well

Notes:
bgs Below ground surface
msl Mean sea level

0 100 200 400
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 2-2
Monitoring Well and Groundwater Map
MRP Site UXO1 RI

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3.0 INVESTIGATION METHODS AND FIELD ACTIVITIES

This section provides a summary of the objectives and goals of the remedial investigation documented in the PQOs used to guide the field investigation. The following is a summary of Step 7 of the PQO process, "Develop Plan for Obtaining Data," as detailed in the final work plan (TriEco-Tt 2014b).

The following field activities were performed for the:

<u>Drop Test Tower, Target Berm, Target Range Impact Area, and Central Down Range SDZ</u>

- Mobilization, access route UXO surface sweeps with biological clearance, and vegetation clearing in a portion of the range impact DGM survey area.
- Installation of the instrument verification strip (IVS).
- Reacquisition of surface and subsurface features and possible MPPEH items identified during the 2010 SI investigation.
- Collection of discrete soil samples and analysis for metals and explosives to determine whether MC had been released where MPPEH was observed near the Drop Test Tower.
- Completion of three test pits in the earthen Target Berm.
- Conducting a DGM survey of the range impact area that included:
    - Completion of a geophysical survey with 100 percent coverage over accessible areas.
    - Evaluation of the geophysical survey data to determine if significant anomalies were present. The project geophysicist then evaluated the data in conjunction with the project manager and the UXO team lead.
    - Identification of a select set of target anomalies on the dig sheet, and staking of these in the field by a registered surveyor.
    - Each target anomaly was manually investigated using hand-held metal detectors (Schonstedt, White's, or similar detectors) to identify MPPEH. MPPEH was categorized as MDAS, if possible, or remained as MPPEH and was managed as MEC.
- Conducted a 100 percent detector-aided surface sweep of the Central Down Range SDZ.

For the Munitions Burn and Disposal Areas:

- Intrusive investigation of buried disposal trenches, Burn Slit/Trenches, metal burn barrels and anomalies identified during the RI:
  - MDAS and scrap metal were removed from the investigation areas and recycled.
  - MEC/MPPEH was consolidated and disposed of on-site.
  - Samples were collected from surficial soils, soils within the debris fill, and of native soils below the fill areas.
  - All test pits were backfilled with soil excavated during the investigation. All metal debris, MPPEH, and MDAS were removed by the UXO Technicians prior to use as backfill.

For the Burn Slit/Trenches:

- Intrusive investigation of the soils contained within the Burn Slit/Trenches.
- Removal of the corrugated metal covers at Burn Slit/Trenches 2 and 3.

For the Surface Facilities:

- All facilities were visually inspected by the UXO team. Sampling was not required.
- Soil samples were collected at the location of the former trailer (trailer destroyed during 2014 wildfires).

For Pilgrim Creek Soil, Surface Water and Groundwater:

- Conducted soil sampling of alluvial soils within Pilgrim Creek.
- Surface water could not be collected since there was no water in Pilgrim Creek at the time of the investigation.
- Installed three temporary wells and two permanent wells and collected one set of groundwater samples from two of the temporary wells and both permanent wells (no water in the third temporary well).

Other General:

- Biological monitoring occurred throughout the investigation.
- Cultural and Native American monitoring occurred when work was conducted in the vicinity of Burn Slit/Trench 3.

Activities followed quality control (QC) and quality assurance (QA) procedures outlined in the work plan.

3.1 PRELIMINARY ACTIVITIES

The following preliminary activities were conducted prior to the start of field investigations.

3.1.1 Training

As part of the mobilization process, site-specific training for all on-site personnel was conducted during a project kick-off meeting on January 6, 2015. The training ensured field personnel understood the RI operational procedures and methods including individual duties and responsibilities, and safety and environmental concerns associated with MEC operations. The training included, but was not be limited to, a site history, a review of the ESS (TriEco-Tt 2013), MEC sampling and analysis plan (SAP), Accident Prevention Plan, and site safety and health plan (TriEco-Tt 2014b). Personnel added after the initial session were trained as they arrived. Training was conducted by the UXO safety officer (UXOSO), the field team lead, and the site safety coordinator. In addition, the project biologist trained site personnel on the threatened and endangered species on site and the mitigation measures necessary to minimize impact.

3.1.2 Establishment of Exclusion Zones

The UXOSO established and maintained exclusion zones (EZ) for RI activities because of the potential for encountering live explosively configured or fuzed munitions. The EZs, based on the hazardous fragmentation distance according the types of munitions suspected at the site, were intended to keep non-essential personnel from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation. The specifications of the MRP Site UXO1 EZ are detailed in the ESS (TriEco-Tt 2013). The UXOSO ensured EZs were controlled by barricades at each access point, with red bravo flags and the name and phone number of the senior UXO supervisor (SUXOS) to request access. The barricades ensured non-essential personnel did not access the EZs during MEC investigations and operations.

3.1.3 Vegetation Clearance

In conducting surface sweeps, after clearance of the area by the UXO team and inspection by the biological monitor, personnel brushed a portion of the Range Impact DGM survey area with a skid mounted mower. The vegetation was cut to a height of 6 to 12 inches. Cut material was removed from the site and recycled.

3.1.4 MEC Avoidance Operations

A UXO technician escorted all non-UXO field personnel to conduct MEC avoidance measures. The UXO escort used a metal detector (Schonstedt Magnetic Locator [magnetic gradiometer] and White's all metals detector) to check for possible ordnance or ordnance-related material prior to access by personnel.

The UXO escort was responsible for marking areas with suspected MPPEH or unknown subsurface metal with plastic pin flags so that these areas could be evaluated by the UXO team and avoided by other project personnel. The UXO escort was also responsible for reporting these possible areas to the SUXOS for further evaluation and characterization.

The location of all anomalies identified by the geophysical investigation, survey boundaries, or benchmarks to be marked were investigated by the UXO escort. The UXO escort used a metal detector at the location where any pin flags, stakes, or hubs were to be driven or any ground disturbing activity occurred. A UXO escort also conducted a detector-aided surface sweep ahead of the geophysical investigation team before DGM surveys were conducted over those areas.

3.1.5 Geophysical System Verification

A geophysical system verification (GSV) was performed to evaluate metal detecting techniques and personnel operating the Schonstedt Magnetic Locator, White's all metals detector, and EM61-MK2. The GSV provides rigorous QC/QA of the performance of the personnel and metal detectors and geophysical systems used. The GSV is a tool developed by the Environmental Security Technology Certification Program specifically designed for UXO work. The GSV includes two main processes. The first is an IVS, and the second is placement of blind seeds in the production area. The IVS and blind seed items were placed and buried at locations free of anomalies.

The UXO quality control specialist (UXOQCS) installed an IVS in accordance with the ESS (TriEco-Tt 2013). The IVS was seeded with ISOs to serve as surrogate items that represent MEC used at MRP Site UXO1. The IVS consisted of a 15- by 80-foot area where DGM data were collected at the beginning and end of each day using one survey line to search for the seed items and an adjacent survey line to measure background noise. The IVS location was at the Range Floor of MRP Site UXO1 where no anomalies were detected during the 2010 SI EM61 DGM survey and where MEC was not known or suspected to be present (Figure 3-1).

Four ISOs were seeded in the IVS at varying depths. One small aluminum ISO (1-inch-diameter, 4-inch-long aluminum pipe) was seeded 3 inches bgs, and one small galvanized ISO (1-inch-diameter, 4-inch-long galvanized pipe) was seeded 6 inches bgs to simulate the smallest targets expected under site conditions. One medium ISO (2-inch-diameter, 8-inch-long pipe) was seeded at 10 inches bgs to simulate the medium-sized targets anticipated, and one large ISO (4-inch-diameter, 12-inch-long steel pipe) was seeded 20 inches bgs to simulate the largest targets anticipated. One blind seed per acre was emplaced over the surface sweep areas and 14-acre geophysical survey area (Range Impact Area) for the blind seeding program. Each blind seed was a small galvanized ISO. Blind seeds for the UXO surface sweeps were emplaced at the surface and covered with duff. Blind seeds for the DGM surveys were emplaced at 3 or 6 inches bgs. TriEco-Tt UXO technicians performed detector-aided visual surface sweeps over the IVS to confirm that the area did not contain MEC or MPPEH. The proposed IVS area and blind seed locations were reviewed by a qualified biologist to ensure that holes for the seeds were excavated far enough from burrows to create a sufficient buffer for burrowing animals such as the federally endangered Stephens' kangaroo rat.

The UXOQCS ensured equipment used during the MPPEH investigations was checked to ensure its completeness and operational readiness per the MEC SAP (TriEco-Tt 2015). Any equipment found damaged or defective was returned to the point of origin, and a replacement was secured. All instruments and equipment that required routine maintenance and or calibration were checked initially on arrival and before use each day. This routine procedure ensured equipment was functioning properly. If an equipment check indicated that any piece of equipment was not operating correctly and field repair could not be made, the equipment was tagged and removed from service, and the equipment was replaced.

Activities involving work in areas potentially containing MPPEH hazards were conducted with approval from the Naval Ordnance Safety and Security Activity (NOSSA) and were in accordance with local, state, and federal regulations including Office of the Chief of Naval Operations 8020.15, Naval Sea Systems Command Operations Pamphlet 5, NOSSA Instruction 8020.15D, Department of Defense (DoD) Manual 6055.09, Engineer Pamphlet EP-75-1-2, and all other Navy and DoD requirements regarding personnel, equipment, and procedures.

3.2 GEOPHYSICAL SURVEY METHODS

The Geonics EM61-MK2 (EM61) electromagnetic (EM) time-domain instrument was used for the DGM surveys since it is capable of detecting ferrous metal (containing iron or steel), such as a 20-mm projectile, and nonferrous metal, such as aluminum or brass. A single hand-pushed EM61 (1 meter by 1 meter coil) configuration with real-time kinetic (RTK) global positioning system (GPS) was used to collect DGM data. Details regarding the RI DGM survey methodology are provided in Appendix E.

EM61 DGM surveys were performed over accessible portions of the geophysical survey area (14-acre Range Impact Area) (Figure 1-3). The RI geophysical survey area was located with GPS, flagged, and swept by UXO technicians before conducting the DGM survey. As mentioned previously, vegetation was cut to a height of 6 to 12 inches to facilitate the cart mounted DGM survey.

The EM61 was used in conjunction with a Trimble R10 GNSS RTK GPS. Data were collected at 10 readings per second along parallel lines (or lanes) with a lane spacing of 2.5 feet. Supplemental meandering transects were conducted around the base of steep slopes that could not be safely accessed with the EM61 and around locations where vegetation could not be trimmed. Inaccessible areas were noted and mapped.

3.3 SURVEYING AND ANOMALY REACQUISITION

The UXO and geophysical team flagged the ingress/egress routes, proposed boring and test pit locations, and the initial geophysical survey area for the RI using GPS. A professional licensed land surveyor used an RTK GPS to establish temporary survey monuments for the UXO and geophysical team to use for verifying GPS accuracy during the RI. Acceptable horizontal and vertical accuracy for the survey work by the land surveyor was 0.1 foot. The accuracy of the RTK GPS was established by the land surveyor using one primary control station (CP447) and two

additional survey monuments just outside the MRP Site UXO1 boundaries at the beginning and end of each day. The RTK GPS coordinates were compared with the documented coordinates for the control points to verify horizontal and vertical values. Five temporary survey monuments (control points) were established adjacent to the MRP Site UXO1 boundaries (CP200, CP201, CP202, CP203, and CP204) for use during the RI.

The land surveyor also reacquired 83 target anomalies detected during the RI DGM surveys. During the reacquisition survey, a qualified UXO escort placed pin flags at each of the reacquired target locations using anomaly avoidance.

3.4 INTRUSIVE MPPEH INVESTIGATION METHODS

Test pits were excavated at suspected buried trench locations (suspected Disposal Trenches 1 through 12 and Burn Slit/Trenches 1 through 3) and a subset of target anomalies detected during the RI DGM surveys were intrusively investigated. These intrusive investigations involved five primary steps:

1. **Reacquisition of Test Locations:** Reacquiring and flagging the approximate locations of each proposed test pit location or target anomaly selected for investigation.

2. **Target Anomaly Location:** Locating the target anomaly using a Schonstedt Magnetic Locator and/or White's all-metals detector. This task included scanning a 3-foot radius around the flagged location.

3. **Mechanical Test Pit Excavation:** Excavating test pits at suspected buried disposal trench locations that were identified during the 2010 SI. A long-reach shielded excavator was used to dig test pits to evaluate the horizontal and vertical contacts between debris fill and native soil. Each 1-foot lift was spread on the ground surface adjacent to the trench and screened by the UXO team using hand held metal detectors. Test pits were excavated to at least 2 feet below the debris fill.

4. **Intrusive Investigation of Select Target Anomalies at the Range Impact Area:** Investigating each item detected within the 2-foot radius using hand tools for target anomalies selected for intrusive investigation. UXO personnel hand dug each excavation in 1-foot lifts and continued investigating the target anomaly area until each location was cleared. The maximum excavation depth was set at 4 feet bgs.

5. **Categorization:** Categorizing each recovered metal object as scrap metal, MDAS, or MPPEH and recording the information on a dig sheet (included in Appendix D). This included placing scrap metal in a recycling bin and MDAS in a locked bin for later off-site demilitarization. Unfuzed safe-to-move items were moved to a consolidate point selected by the SUXOS for later detonation. Any MPPEH item considered not safe to move would have been detonated in place. However, no such items were discovered during the RI. All MPPEH identified was consolidated then disposed of onsite in accordance with the ESS (TriEco-Tt 2013)

The categorization of the uncovered items was made by qualified UXO technicians and confirmed by the SUXOS. The SUXOS also recorded the weight and estimated number of metallic objects removed each day. Photographs of the recovered MPPEH items were included in a photo log, presented in Appendix B.

All excavations were inspected for evidence of staining or a possible release of MC before they were backfilled. Soil excavated from the target anomaly location was used to backfill the excavation. Soil samples were collected from debris fill material and underlying native soil for laboratory analysis of MC and other COPCs.

3.5 MPPEH INVESTIGATION QA/QC PROCEDURES

Operational and test procedures for the instrumentation used during the RI field investigations were implemented to conform to the manufacturer's standard instructions. QC of the instruments' data was achieved by performing field testing and checking the sensor and navigation systems against known targets to ensure that they were operating properly. Metal detectors and equipment used to generate field data were calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of the results are consistent with the manufacturer's specifications. Daily field forms were prepared documenting the QC activities and daily field activities, which were reviewed by the UXOQCS. Field forms are provided in Appendix D.

3.5.1 Geophysical System Verification

The GSV was used to test equipment and procedures in support of DGM, anomaly reacquisition, and intrusive investigation operations. The performance standard for the IVS and detection of blind seed items is 100 percent detection of the items. For DGM surveys, IVS and blind seeds were also to be detected with signals comparable with both historical measurements and physics-based model predictions.

3.5.2 UXO Detector-Aided Visual Survey QA/QC Procedures

Blanket Test: Metal detectors used by UXO personnel were checked each day of detector-aided surface survey/scan activities and after any battery change. The blanket test was used to evaluate functionality of the hand-held metal detectors before the IVS was established and used. To conduct the blanket test, an area near the work site and free of anomalies was identified. The SUXOS or UXOQCS placed several inert munitions or surrogate munitions items on the surface and covered the items with a tarpaulin or similar cover so the items would not be visible to the UXO technician. Each UXO technician conducted a detector-aided surface survey of the blanket test area to locate the test items. The SUXOS or UXOQCS compared the results of the tests to actual placements of the items and made corrections as necessary. UXO technicians also conducted random checks during daily operations.

Instrument Verification Strip: Once the IVS was established, it was surveyed by the UXO team each day of detector-aided surface survey/scan and analog mag-and-dig activities. Metal detectors

were checked at the beginning and end of each day at the IVS and after battery changes. The UXO technicians also conducted random metal detector checks during daily operations. The SUXOS or UXOQCS evaluated the real time results of the IVS surveys and made corrections as necessary.

Blind Seeding: ISOs were planted as blind seeds for the UXO detector-aided surface sweeps. The purpose of the blind seeding was to ensure all surface items (including those covered with grass or duff) would be detected, investigated, and addressed (removed). The small ISO blind seeds used were 1-inch–diameter, 4-inch-long steel pipes. Acceptance Criterion: Detection and removal of blind seed by UXO personnel with independent verification by the UXOQCS or a third-party UXO QA technician.

GPS Positioning: Two survey monuments (CP203 and CP204) were occupied with the Trimble ProXRS differential GPS (with OmniStar HP service) used by the UXO team at the beginning and end of each day of use. The GPS coordinates were compared with the initial documented coordinates for the control points. Acceptance Criterion: Maximum ±1 meter offset.

3.5.3 Digital Geophysical Mapping QA/QC Procedures

Geophysical sensors and support equipment, navigation equipment, and operator performance were checked and tested at specific intervals to ensure that the appropriate acceptance criteria were met. These tests are described below.

Geophysical System Verification: A GSV was performed to evaluate geophysical surveying techniques and personnel operating the geophysical instruments for the RI. The GSV consisted of two main elements:

- **IVS:** The objective of the IVS is to verify that the geophysical detection system is operating properly. The IVS targets, consisting of industry standard objects (ISO), are to be observed in the data with signals comparable to historical measurements and physics-based model predictions. Adjacent measurements of site noise were used to determine whether targets of interest can be detected reliably to their depth of interest under the site conditions.

- **Blind Seeding Program:** Blind seeding in the geophysical survey area is an integral part of the GSV. The geophysical survey area (Range Impact Area) was seeded with ISOs at surveyed locations blind to the DGM data processing team. The blind seeding program provided ongoing monitoring of the quality of the DGM data collection and target selection process as it is performed in the production survey throughout the project. The blind seeded ISOs are intended to be numerous enough to be encountered on a daily basis, should be detected as potential targets, and their signals should be comparable to historical measurements and physics-based model predictions.

DGM data were collected at the beginning and end of each day at the IVS using one survey line to search for the seed items and an adjacent survey line to measure background noise. The initial IVS survey was conducted along three transects spaced 2.5 feet apart over the seed items.

For the blind seeding program, the production areas were seeded by the UXO team.

Out-of-Box Tests: The following out-of-box tests were conducted when the geophysical equipment arrived at the site and before the pre-seed DGM survey of the IVS began:

- Inventoried and inspected the equipment to confirm components were present and in good condition.
- Assembled the equipment and powered up.

First-Day Tests: The following tests were conducted at the beginning of the first day of the project. Many of these tests were also conducted more frequently, such as at the beginning of each day of work, as detailed in the following subsections.

- **Equipment and Electronics Warm-Up.** This test was used to minimize sensor drift from thermal stabilization. Most instruments need a few minutes to warm up before data collection begins. Manufacturer instructions were followed and EM61 readings were observed until they stabilized. Acceptance Criterion: Equipment specific (typically 5 to 15 minutes). This test was conducted each time the EM61 was turned on.
- **Record Sensor Positions.** The purpose of this test was to document relative navigation and sensor offsets, detector separation, and detector heights above the ground surface. This information was used to ensure that the detector offset corrections and gradient calculations were performed correctly and that the DGM surveys were repeatable. Acceptance Criterion: ±1 inch senor position offset. This test was conducted at the beginning of each day.

  The EM61 was nulled before the remaining tests were performed. This action was done at the beginning of each day and each time the instrument was powered up.
- **Personnel Test.** This test was used to ensure that survey personnel removed all potential metal interference sources from their bodies. Common interference sources are ballpoint pens; steel-toed boots; or large, metallic belt buckles that can produce data anomalies similar to ordnance targets. Personnel who were to come near the EM61 during survey operations had to approach the sensor and have a second person monitor the EM61 readings. Acceptance Criterion: EM61 ± 2 mV. This test was conducted at the beginning of each day.

- **Vibration Test (Cable Shake).** This test was done to identify and replace any shorting cables and broken pin-outs on connectors. With the instrument held in a static position and collecting data, field personnel shook the cables to test for shorts and broken pin-outs. The cable was to be immediately replaced or repaired if damaged cables or shorts were found. After repair, cables would need to be rigorously tested before use. Acceptance Criterion: Data profile does not exhibit data spike responses. This test was conducted at the beginning of each day.

- **Pull-Away Test**: This test was used to demonstrate the effects of the navigational equipment. During this test, the equipment was powered up and operated as it would be during the survey. The effects of the navigational equipment on the EM61 readings were evaluated in the field. Acceptance Criterion: EM61 ± 2 mV. The operator initially started in the normal operating position. The operator was positioned at the handle of the EM61. The operator walked away from and toward the EM61 while reviewing the changes in the background response on the Allegro hand held computer.

- **GPS Positioning Test.** Two survey monuments (CP203 and CP204) were occupied with the RTK GPS at the beginning of the first day of DGM surveying to verify the accuracy of the GPS positioning was within 1 foot. The survey monuments were established by a California Registered Professional Land Surveyor adjacent to the southern end of the geophysical survey area. The RTK GPS coordinates were compared with the documented coordinates for the control points. Acceptance Criterion: Maximum ±1 foot offset.

Beginning of Each Day Tests: The following tests were conducted at the beginning of each day. (Equipment warm-up and instrument null for the EM61 were conducted each time the equipment was powered up).

- Warm up equipment and electronics
- Record relative sensor positions
- Conduct personnel test
- Null the EM61 before the remaining tests are performed
- Perform cable shake test
- Perform equipment function tests

3.5.4 MPPEH Management and Disposal

Recovered metal objects were categorized as either scrap metal, MDAS or MPPEH, as described above. Scrap metal was placed into an on-site bin and was recycled off site at the end of the investigation. MDAS items were placed into a locked metal bin and taken to Marine Corps Air

Ground Combat Center, Twenty-nine Palms (an authorized recycler) for demilitarization and recycling after all intrusive activities had been completed (disposal records are included in Appendix D-6).

MPPEH items that could not be documented as MDAS and could not be disposed of the same day, due to availability of explosive supplies, were temporarily kept within the secured UXO1 site, in a designated storage magazine (Keyport Locker), until the supplies could be delivered to the site the following work day. If items were stored on-site, notifications were made to the Fallbrook Security Watch Command, Base ESO, and the Naval Facilities Engineering Command, Southwest Division (NAVFAC SW) remedial project manager (RPM). Disposal of MPPEH items by controlled detonations occurred on January 23rd, January 28th, February 4, and February 5, 2015. The MPPEH items and demolitions charges were placed in an excavated hole and covered with soil and barricaded using sand bags before detonation. The area was essentially void of vegetation approximately 200 feet around the demolition location. Explosives for the demolition were supplied on an on-call basis, and all explosives issued were consumed by the end of the day. All demolition operations were performed in accordance with the Department of Defense Explosives Safety Board-approved ESS with no discrepancies (TriEco-Tt 2013). The demolition area was inspected to ensure that all MPPEH had been destroyed after the detonation, and recovered debris was inspected twice and transported to the MDAS container for off-site demilitarization and recycling. Table 3-1 provides a summary of the MPPEH items identified and disposed of onsite during the RI.

Approximately 7,800 pounds of MDAS and 18,200 pounds of scrap metal were removed from the site on February 6, 2015, and demilitarized in accordance with guidelines in DoD 4160.21-M-1 (either smelted or shredded) at an off-site recycling facility. A summary of the specific items are provided in the after Action Report (TriEco-Tt 2015). The certificate of destruction for the MDAS and scrap metal is located in Appendix D-6. Photographs of the MPPEH handling and disposal are included in Appendix B.

3.6 MC Soil Sampling and Analysis

The RI sampling program was developed for the exposure units based on the type of historical activity that was reported to have been conducted. The purpose of the sampling program was to confirm the presence of the disposal trenches, characterize and quantify the material disposed of, and to determine if MC is present in sufficient concentrations to present a human health or ecological risk. A secondary objective was to determine if leaching and/or vertical migration has or is occurring from the MPPEH or MC. It should be noted that there are multiple features (with varied historical activities) within most of the exposure units. For example, Burn Slit/Trench 1 and the former trailer are all located adjacent to Pilgrim Creek and are within exposure unit 4. The sampling program for the Burn Slit/Trenches was designed to collect samples of the soil and or debris contained in the Trenches using the excavator with the analytical program focused on the burning of rocket fuel and black powder. The sampling program at the former trailer was targeted for the possible presence of VOCs, and the Pilgrim Creek sampling program was designed to evaluate a variety of potential contaminant sources including the OB/OD operations. While some composite samples were collected at the surface during the previous SI (ChaduxTt 2010), during the RI all soil samples were collected at discrete intervals and were not sieved. There were no

composite samples collected since the data was intended to be used for risk assessments. The samples were homogenized at the laboratory and were not ground prior to analysis. Laboratory analyses were conducted by EMAX and Eurofins (state certified, DOD-approved laboratories).

Discussion of the results and associated risks found for each of the exposure units are provided in Section 4.0. The following provides a summary of the specific sampling and the analytical program for each of the features evaluated during the RI. These feature-specific sampling programs were applied across the various EUs as described in Section 4.0. Soil boring and test pit logs are provided in Appendix A. The general location of the test pits, soil borings, soil samples and limits of the geophysical survey conducted during this investigation are indicated on Figure 3-1. Detailed sample location data for this RI and the previous SI are included within the Nature and Extent Sections (4.0 – 4.9) of this report.

3.6.1 Buried Disposal Trenches and Burn Barrels

Sampling in the disposal trenches or suspected trenches included the collection of samples at the existing ground surface (0 – 0.5 ft. bgs), collection of a sample from the middle of the debris fill (if observed), collection of a sample at the bedrock to fill contact, and a final sample collected from the native soil (bedrock soil) two feet below the fill material. The location of suspected disposal trenches were tentatively identified using geophysical data from the 2007 Marrs report, the 2010 ChaduxTt SI, and the DGM survey conducted during this RI. The existence of Suspect Disposal Trenches 2 – 10 and a portion of surface disturbance 2 were confirmed during the RI. No fill or debris was observed at the locations of the suspect Disposal Trenches 1, 11, and Surface Disturbance 1, indicating the trenches did not exist. Data obtained from the test pits also provided details regarding the length, width, depth, and contents of the disposal trenches. Using the geophysical data, the footprint has been reasonably defined and the volume of the debris fill estimated. Details of the debris fill volumes are provided where applicable in Sections 4.1 through 4.7 of this report. Analysis of soil samples at these trenches included metals (EPA 6020A/7471A), explosives (EPA 8030A), pentachlorophenol (PCP) (EPA 8270SIM), white phosphorous (EPA 7580), TPH-d (EPA 8015B), perchlorate (EPA 6850), dioxins (EPA 8290A) and hydrazine (EPA 8315A).

The two 30-inch diameter Burn Barrels, used to dispose of small arms munitions, were completely removed during the investigation. The bottom of the barrels were approximately three feet bgs, with the test pits excavated to a depth of approximately six feet bgs. The corrugated metal cylinder and MDAS items identified in the barrels were removed and then retained on site until they were transported to an approved facility for demilitarization and recycling. Soil samples were collected from the native material at the fill to native contact, then at a depth of approximately two feet below the contact. Soil samples were analyzed for metals, explosives, VOCs (EPA 8260B) and TPH-d.

3.6.2 Burn Slit/Trenches

At the three Burn Slit/Trenches, samples were collected from two locations within the central portion of the trenches. Soil samples were collected at the surface of the soil (slough) at

0 - 0.5 ft. bgs and from the underlying bedrock at a depth of approximately 2 feet below the contact of the soil and the bedrock. These trenches were originally excavated to depths ranging from 6 to 14 feet bgs. Two of the Trenches (2 and 3) were covered with corrugated metal covers. Analysis of soil from these trenches included VOCs, SVOCs (EPA 8270C), TPH-d, perchlorate, dioxins, and hydrazine.

3.6.3 Target Berm, Range Impact Area, Central Down Range Area and Drop Test Tower

The Target Berm, the Range Impact Area south of the Target Berm, and Drop Test Tower were considered primary locations where MPPEH could be present. Soil samples were collected from three test pits excavated in the earthen target berm located behind the metal target. Samples were collected at the surface (0 – 0.5 foot bgs) and at a depth of approximately two to four feet bgs. These samples were analyzed for metals, explosives, perchlorate, white phosphorous, and hydrazine.

The Range Impact Area was surveyed using the EM61 DGM Geophysical Survey. Anomalies identified during the survey were intrusively evaluated by the UXO team. The Geophysical Survey report is provided in Appendix E, with a discussion of the results in Section 4.6. Sampling for MC was not included in the sampling program for this area. A total of four MPPEH items were recovered from the Range Impact Area, consolidated, and then disposed of on-site by the UXO team. All MDAS and scrap metal recovered by the team was removed and eventually transported to approved facilities for demilitarization and recycling.

A complete detector-aided visual surface sweep was conducted within the Central Down Range Area by the UXO technicians. The 17-acre area (Figure 1-3) is the central portion of the Firing Range SDZ, where it is considered most likely that overshot from the range might be present. The area extends approximately 2,000 feet south of the fenced portion of MRP Site UXO1, and is characterized by gradually south sloping terrain incised by shallow drainages that feed into the main Pilgrim Creek channel. This area was also burned during the 2014 wildfire, leaving the area essentially devoid of vegetation, facilitating a thorough clearance sweep by the UXO technicians. The UXO technicians removed all metallic items identified during the surface sweep. No MPPEH items were identified during clearance operations. Approximately 200 pounds (lbs.) of MDAS, consisting primarily of ammunition canisters with some scrap metal, was removed from the area.

A complete detector-aided surface sweep was conducted by the UXO Technicians of an area extending approximately 100 feet outward from the Drop Test Tower. All MPPEH, MDAS, and scrap metal identified was removed by the UXO technicians. Four soil samples (DTT1 – DTT4) were collected directly beneath where surficial MPPEH was found at the locations displayed on Figure 3-1. The MPPEH items were disposed of on-site, while the MDAS and scrap metal were transported to an approved facility for demilitarization and recycling. The samples were collected at the surface (0 – 0.5 foot bgs) and at bottom of the borings (three to four feet bgs) to evaluate whether chemicals may have leached into soil from the MPPEH items. These samples were analyzed for metals and explosives.

3.6.4 Surface Facilities and Former Trailer

The work plan specified that wipe samples would be collected for analysis of explosives if evidence of staining was observed at the on-site structures (observation booths or lockers). However, no evidence of discoloration typically associated with explosive compounds was observed by the UXO sampling team. It should be noted that, as a result of the wildfires that affected the area in 2014, any exposed explosive or combustible item at the surface was probably consumed during the event.

The former trailer was located within the lower (southern) portion of the Pilgrim Creek drainage. The trailer had been completely burned during the 2014 wildfire, with only charred metal frame, file cabinets and other metal items remaining. Two surface soil samples (0 – 0.5 foot bgs) were collected from within the trailers footprint and analyzed for VOCs.

3.6.5 Pilgrim Creek Sediment, Shallow Groundwater and Area Groundwater

Four soil borings and three temporary monitoring wells were completed to a maximum depth of 17 feet to evaluate the alluvial soil and to determine if perched groundwater was present within the lower elevations of the Pilgrim Creek drainage. Of the four soil borings, analyses were run on the surface (0 - 0.5 foot bgs) and 2.5 to 3 feet bgs samples for metals, explosives, VOCs, SVOCs, perchlorate, and hydrazine. Dioxins and white phosphorous analyses were run on the surface samples from two locations (PC-S2 and PC-S4) within the drainage.

Alluvial soils were logged to depths ranging from 4 to 6 feet bgs in the Pilgrim Creek temporary monitoring wells (Figure 2-2). Groundwater was observed in the northernmost (up gradient) temporary well (PC-MW01) at a depth of approximately 16.5 feet bgs, which was well below the alluvium to bedrock contact, and at a depth of 8.6 feet bgs in the southernmost well (PC-MW02). Groundwater was not encountered in the third Pilgrim Creek well located between the other two wells, where a secondary drainage feeds into the main Pilgrim Creek channel. It is believed that, due to the prolonged drought conditions in the region, perched groundwater is only present locally within the drainage, possibly collecting in areas where deeper weathering of the underlying granite has created sinks for the groundwater to collect.

A total of three deeper borings were advanced in a location away from the drainage in order to determine if groundwater is present in the bedrock at depths shallower than 50 feet bgs. At the Area Groundwater Well 1 (AGW-MW1) location, the well boring was completed with a hollow-stem auger (HSA) rig to a depth of 34.2 feet bgs where refusal occurred. Groundwater was observed the following day at a depth of 21.7 feet bgs. At the AGW-MW2 location, refusal was initially encountered at depths of 16 and 17 feet bgs. The well location was then moved approximately 50 feet south, where the boring was advanced to a depth of 36.1 feet bgs. After installation of the well and allowing the well to stand overnight, groundwater was observed at a depth of 19.9 feet bgs.

Groundwater was not encountered at proposed AGW-MW3, which was located in the central portion of the site. The well boring was extended to a depth of 47 feet bgs; however, there was no groundwater or indication of moist soil conditions observed at this proposed well location the following day. Therefore, a well was not installed.

All groundwater samples except for PC-MW1 were analyzed for metals, explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, and hydrazine. Due to the limited amount of standing groundwater in the well and extremely slow recharge, the volume of water recovered from the well was insufficient to allow SVOC, perchlorate, or hydrazine analyses. However, metals, explosives, and VOC analyses were conducted.

All soil and groundwater samples were stored in an ice chest and sent to the laboratory under proper chain-of-custody protocol, as described in the SAP (TriEco-Tt 2014a). Sampling results are discussed in Section 4.0. Investigation derived waste (IDW) from the drilling program was collected and placed in 55-gallon metal drums and retained on-site. The soil and water generated was then characterized and disposed of at an approved waste disposal facility. Documentation of the IDW management is provided in Appendix K.

3.7 BIOLOGICAL AND CULTURAL MONITORING, MINIMIZATION AND AVOIDANCE

All RI work was conducted in accordance with the project's Biological and Cultural Monitoring Plans (TriEco-Tt 2014b). The Biological Monitoring Summary Report, Results of the SKR Trap and Hold Program, and Cultural Monitoring Field Report prepared by ECORP are provided in Appendix A. A brief summary of each of the activities are provided below.

3.7.1 Biological Monitoring

All planned work areas were inspected by the project biologist prior to initiating any ground disturbance activities. This included the inspection of all access routes, staging areas, and areas of proposed excavations. In addition, a site-specific Environmental Awareness Training Program was developed and presented to all personnel working on the site to avoid and minimize potential impacts to special-status species and communities of concern. The site was inspected daily for the presence of the SKR, CAGC, SWFL, LBVI, and other species that could be affected by the field work or prior to any new intrusive activities. Biological monitoring continued throughout the field investigation and is summarized in the Biological Monitoring Summary Report (Appendix A).

3.7.2 SKR Trap and Hold

A trapping program for SKR was implemented during the week prior to initiating the field investigation. Because the site had burned in the summer of 2014, vegetation was sparse at the time of project activities and very little vegetation removal was necessary prior to project activities. Even though trapping was completed before RI activities began, an approved biologist was present for all vegetation removal required for the project to monitor for SKR presence and activity. Five days of exclusion trapping resulted in the capture of nine SKR: two females and seven males.

These individuals were held in captivity between 27 and 33 days, depending on the date of capture. Daily visual observations and 10-day health assessments were performed during the animals' stay in captivity. During captivity, all SKR remained in good health and, upon release, each SKR weighed 5 to 10 grams more than when it was captured.

After completion of the RI fieldwork, the SKR were released into receiver burrows constructed as close as possible to the original capture location to allow the animal to return to its original home range. When the SKR were inserted into their receiver burrows, they entered willingly and easily, and quickly redisposed of to the end of the mailing tube that made up each receiver burrow. The animals did not appear excessively stressed during the release activities. While two individuals had chewed through the plastic cap that enclosed them in the receiver burrow during the 24-hour acclimation period, the other seven individuals were present when the caps were removed. There was no evidence of predation or other disturbances that could have affected the two escapees. A summary of the SKR Trap and Hold Program is provided in Appendix A.

3.7.3 Cultural Monitoring

The cultural and Native American monitors performed a pre-activity inspection of the work area on January 28, 2015. The work area was in the immediate vicinity of Burn Slit/Trench 3 located within the project APE. During this inspection, a mano from the previously recorded site CA-SDI-14359 was identified at Universal Transverse Mercator (UTM) 474193mE/3689831mN. The artifact was cross flagged and the crew instructed to avoid that area. Upon clearing the area for cultural features and artifacts, the monitors left the exclusion zone while excavation operations were conducted at Burn Slit/Trench 3. Upon completion of the excavation activities, the spoils piles, the two open test pits, and disturbed areas around the excavator were inspected. No cultural material was identified. Once soil samples were collected, the monitors were escorted out of the exclusion zone and work resumed. The excavator backfilled the test pits, removed the cross-flagging for the artifact, and moved the equipment to the next sample location, located approximately 600 feet north of Burn Slit/Trench 3.

Test Pits were also excavated in the vicinity of suspected Disposal Trench 1, located approximately 300 feet northwest of Burn Slit/Trench 3. The spoils piles, open test pit, and disturbed areas around the excavator were inspected and no cultural material was identified. The field notes for the cultural monitor are provided in Appendix A.

3.8 DATA QUALITY REVIEW

The MC SAP (TriEco-Tt 2014a) and MC SAP addendum (TriEco-Tt 2014c) detail the QA/QC procedures for sampling and analytical work for the RI. The SAP also clarifies the study objective, defines the most appropriate data to collect and the conditions under which to collect the data, and specifies tolerable limits on decision errors that were used as the basis for establishing the quantity and quality of data needed to support decision-making.

All samples proposed in the MC SAP, with the exception of the following, were collected during the field activities:

- Groundwater was not encountered in the AGW-MW3 location, so a well was not installed and a groundwater sample was not collected. Soil samples were collected from the boring at 0 - 0.5-, 5.0- and 10-foot depths. The sample from the bottom of the boring, at a depth of 47 feet bgs, was collected from the drill bit (due to sampler refusal). Due to the difficult drilling conditions (a concrete core bit was used for the last 5 feet), the soil sample was believed to not be representative of the bedrock materials, so the sample was not submitted for analysis.

- There was no surface water present in Pilgrim Creek, so a surface water sample was not collected.

- There was no observed evidence of a release of fluids, explosive items, munitions constituents, or other staining in the on-site structures (Keyport lockers, observation booths, and metal target frames), so wipe samples were not collected.

- In an effort to better define groundwater conditions in Pilgrim Creek channel downgradient of Disposal Trench 12, a third temporary well was installed. However, groundwater was not observed in the well, so a groundwater sample was not collected.

- Since debris fill was not encountered in suspected Disposal Trench 1, Test Pits 1 and 2; Disposal Trench 11, Test Pit 1; Surface Disturbance 1, Test Pits 1 and 2; and Surface Disturbance 2, Test Pit 2, sample collection was limited to a surficial sample and the bottom of test pits. No debris was present to be sampled.

The data quality review found that most QA/QC objectives for bias and precision were met for all analytical results. Appendix J details the data review process and qualification of the site data. All results are considered usable as qualified, except four samples which were extracted for explosives outside more than twice the holding time.

No matrix effects or method performance problems were noted in the data validation reports (Appendix J) that affected method sensitivity relative to SAP requirements or project risk screening criteria. The reporting limits and method detection limits reported for the site data were at the maximum sensitivity of current routinely used analytical methods.

3.9 BACKGROUND DATA COMPARISONS

Background threshold values (BTV) and full data sets for metals were obtained from a metals background soil study conducted at NAVWPNSTA Seal Beach Det Fallbrook in 2012 (SES-Tech 2012). BTVs from samples using the granodiorite soil type were used since they match the soil type at MRP Site UXO1. A comparison of maximum concentrations to BTVs and two-population statistical tests were used to compare metal concentrations for individual depth intervals at each EU. Two-population statistical tests were performed using the full data set from the 2012 SES-Tech study. For more details on the background comparison methodology, see Appendix H.

3.10 HUMAN HEALTH RISK ASSESSMENT APPROACH

The specific objectives of the HHRA were to: (1) estimate the magnitude of potential risk to human health associated with current site conditions and potential future land use scenarios, (2) identify the environmental media and chemicals that pose the primary human health concerns, (3) identify the environmental media and chemicals that pose little or no threat to human health, and (4) determine if additional evaluation of areas with elevated MC and metals is necessary in the FFS.

3.10.1 Human Health Risk Assessment Methods

This section describes the methodology used to complete the HHRA for MRP Site UXO1. The complete HHRA is presented in Appendix F. The HHRA consisted of the following five overall components, described in the sections below:

- Data evaluation and identification of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Uncertainty evaluation

3.10.1.1 Data Evaluation and Identification of Chemicals of Potential Concern

The first step of the HHRA process consisted of reviewing and evaluating available data and identifying COPCs in the environmental media (soil) at the MRP Site UXO1. These data were collected during previous investigations (see Section 1.3.3). All validated soil analytical data collected during investigations for the site were initially considered for evaluation in the HHRA. Data associated with these investigations are further described in Section 4.0 of the RI.

Data Evaluation

As part of the data evaluation process, all of the analytical data underwent cursory validation, and a minimum of 10 percent of the data underwent full validation to verify they met EPA data quality criteria to be used in the risk assessment (EPA 1992). The laboratory analytical data were evaluated by an independent validation contractor using EPA Contract Laboratory Program National Functional Guidelines for Inorganic and Organic Data Review (EPA 2008, 2010a) and the associated analytical methods.

For chemicals detected in at least one sample, all validated data without qualifiers and all validated data qualified as estimated (J) and not detected (U) were used in the HHRA. For these chemicals, data qualified as not detected were incorporated into the HHRA using stochastic

methods (see Appendix H). Chemicals not detected in any samples were excluded from evaluation in the HHRA. Validated data qualified as rejected (R) were excluded from the HHRA.

Data for soil at the site were grouped into a seven exposure units. Soil data were grouped into two depth intervals: surface soil, represented by data obtained from 0 to 0.5 foot bgs; and subsurface soil, represented by data obtained from 0 to 10 feet bgs. Site conditions evaluated using the 0 to 0.5 foot bgs data set assumes minimal disturbance of the surface soils would occur now or in the future, which is most consistent with the proposed future use of the site as undeveloped secured open space with existing land use controls (fencing) in place. The deeper soil depth interval of 0 to 10 feet bgs was used to predict future exposures because intrusive development such as earthmoving or soil excavation could bring subsurface soils to the surface. Chemicals in soils from the surface down to 10 feet bgs were combined to evaluate this potential future developed site condition.

Four groundwater samples are available from MRP Site UXO1. Although NAVWPNSTA Seal Beach Det Fallbrook receives all of its potable water from the San Diego County Water Authority, groundwater exposure was evaluated for future receptors for potential use as a domestic water supply. Groundwater within the detachment is considered beneficial use by the Regional Water Quality Control Board.

Identifying Chemicals of Potential Concern

COPCs are chemicals that are carried through the quantitative exposure assessment and risk characterization portions of the HHRA. COPCs represent the chemicals assumed to account for most of any estimated health effects at a site. Data for soil and groundwater for the site were used to identify COPCs.

COPCs were identified separately for each area and for each medium sampled (surface soil, subsurface soil, and groundwater). All chemicals detected at least once in each medium, except for essential human nutrients, were identified as COPCs. The HHRA assumed that chemicals with estimated laboratory results (that is, J-qualified data) were detected. EPA guidance states that essential nutrients (specifically, calcium, magnesium, potassium, and sodium) may be excluded from risk evaluations because of the low associated toxicities when they are detected at environmental concentrations (EPA 1989).

The identified COPCs were then used to evaluate total risks for MRP Site UXO1; that is, the risk associated with exposure to all chemicals detected at the site, regardless of whether the chemicals are naturally occurring. In addition to evaluating total risks, the HHRA also evaluated background risks and incremental risks. Background risks were calculated in the HHRA by evaluating exposure to naturally occurring inorganic chemicals (metals) in soil at naturally occurring (that is, background) concentrations. Incremental risks represent the portion of risks that are attributable to site-related activities, rather than to naturally occurring background conditions. Incremental risks were evaluated in the HHRA by excluding the proportion attributable to background concentrations from total risks. Further details on the methodology used to calculate total, background, and incremental risks are provided in Section F9.0 of Appendix F.

3.10.1.2 Exposure Assessment

Under the exposure assessment, although the planned use for the site is secured open space with the existing land use controls in place, potential human populations and related exposure pathways are identified based not only on current, but potential future uses of the land. This step also involves estimating exposure point concentrations (EPC), compiling or developing receptor-specific intake assumptions, and estimating daily chemical intakes for each receptor. Together with chemical intake assumptions, EPCs are used to estimate pathway-specific intakes (doses) for use in subsequent risk calculations. The CSM, which shows the relationship of exposure routes to potential receptors, is graphically depicted on Figure 3-3.

Potentially Exposed Human Populations

The site is not currently used since the munitions quality evaluation testing program was discontinued in the early 1980's. Navy security personnel, natural resources, and cultural workers infrequently visit the secured site. A natural resources worker was selected as a current receptor for evaluation in the HHRA.

The planned future use is to remain as undeveloped secured open space with existing land use controls (fencing) in place for the MRP Site UXO1 area. Other potential future uses include industrial that incorporates commercial uses. An unrestricted (residential) land use scenario generally represents the greatest potential for exposure to site chemicals and is evaluated to provide additional information to support risk management decisions for a site. Therefore, an industrial worker and residential receptor were selected as potential future receptors for evaluation in the HHRA. The future scenarios assume that development of the area — including excavation, distribution to the surface, and regrading of soils — would be required for future use. Therefore, a future construction worker was also evaluated for each area.

Potentially Complete Exposure Pathways

Three potentially complete exposure pathways for surface soil and subsurface soil were identified for each of the four receptors selected for evaluation in the HHRA:

- Incidental ingestion of soil
- Dermal contact with soil
- Inhalation of chemicals released to outdoor air from wind erosion

Many of the exposure pathways for the future exposure scenarios (industrial worker, construction worker, and resident) are based on assumed future exposures; these pathways are considered potentially complete and are evaluated to provide a conservative estimate of risk. Not all of these pathways may actually be complete for all receptors in the future.

Groundwater data are available for MRP Site UXO1. Groundwater is not currently used at the site, thus this pathway is not evaluated for the current natural resources worker. Future use of

groundwater as a domestic supply was evaluated for the future industrial worker and future resident. Groundwater within the bedrock area was encountered at depths greater than 10 feet bgs. Thus, construction workers are not expected to encounter groundwater during excavation activities. As a result, groundwater exposure pathways are assumed to be incomplete for the construction worker.

Exposure Point Concentrations

The concentration in the medium (for example, surface soil) that a receptor may be exposed to is called the EPC (exposure point concentration). Standard EPA methods (EPA 2002, 2013) were used to estimate EPCs for direct-contact exposures (such as ingestion of soil), and the EPC was based directly on the measured COPC levels in soil or groundwater. The EPC for the reasonable maximum exposure (RME) scenario was the lesser of the maximum detected concentration and the 95 percent upper confidence limit (95 UCL), which was developed using ProUCL version 5.0 (EPA 2013). The methods used to calculate EPCs for sampled media at the site (surface soil, subsurface soil, and groundwater) are described in Appendix H.

EPCs for COPCs adsorbed to suspended soil particles were estimated using a particulate emission factor (PEF) of 1.36×10^9 cubic milligrams per kilogram (mg^3/kg) for natural resource workers, commercial/industrial workers, and residents (EPA 2015; Cal EPA 2014). A PEF of 1.0×10^6 mg^3/kg was used for evaluating construction workers (Cal/EPA 2014).

Chemical Intake Estimates

The standard EPA "Risk Assessment Guidance for Superfund" (RAGS) equations were applied (based on the site-specific exposure parameters established for each of the seven subareas) to calculate daily doses (EPA 1989, 2009). Daily doses represent an estimated amount of a COPC to which a hypothetical human receptor might be exposed and were estimated for each receptor and each complete and significant exposure pathway. Details regarding the intake equations are presented in Section F6.2 of Appendix F.

Exposure Assumptions

The exposure parameter values used in the intake equations are based on a series of reported and assumed factors related to current and potential land use patterns. Exposure parameters also account for a number of physiological factors, such as surface area of exposed skin. Exposure parameters common to all intake equations are the exposure time, exposure frequency, exposure duration, body weight, and averaging time. Each of these parameters is discussed in detail in Section F6.2.1 of Appendix F.

3.10.1.3 Toxicity Assessment

Based on the methodology for the HHRA, two sets of risks were calculated: one set using federal (EPA) toxicity criteria, and the other set using State of California toxicity criteria. The reference doses (RfD), reference concentrations (RfC), slope factors (SF), and inhalation unit risks (IUR)

are discussed in Appendix F (Sections F7.1 and F7.2). Sources used to obtain federal toxicity criteria follow the hierarchy outlined in EPA (2003).

The second set of risk estimates were calculated using a similar toxicity criteria hierarchy, except that State of California toxicity criteria, when available, were used preferentially over federal criteria for assessing cancer risks and noncancer hazards. The federal and State of California toxicity criteria used for this HHRA are presented in standard RAGS Part D format "Toxicity Data" tables in risk calculation attachments to Appendix F.

3.10.1.4 Risk Characterization

The final step in the HHRA is the characterization of the potential risks associated with exposure to detected chemicals. Cancer risks and noncancer health hazards are characterized separately. The general methodologies for estimating cancer risks and hazard indices (HI) are presented in Sections F8.1 and F8.2 of Appendix F, respectively. As discussed above, two independent sets of risks were calculated for each area: the first set is based on federal toxicity criteria, and the second set is based on State of California toxicity criteria.

Cancer risks and HIs were estimated separately for each COPC, for each receptor, and for each complete exposure pathway. Cancer risk estimates and HIs were then summed across media and exposure pathways for a combined effect estimate. In the risk characterization discussion, the site risks were compared with the acceptable risk levels where an HI is below 1 for noncancer effects and the excess lifetime cancer risk is below 1 in a million (1E-06) for cancer effects. Where noncancer HIs exceeded 1 for a receptor, effects are segregated by target organ to determine whether systemic effects would be unacceptable for a specific target organ or system. In addition, cancer risks between 1E-06 and 1E-04 (1 in 10,000) are described as being within the risk management range. A COPC that exceeds a cancer risk of 1E-06 or a noncancer hazard greater than 1 is called a "risk driver" and is identified as a contaminant of concern (COC) for risk management decisions.

The HHRA evaluated the potential for health effects from exposure to lead in soil by comparing EPCs with the California Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA 2009) lead screening values of 80 milligrams per kilogram (mg/kg) for the resident, and 320 mg/kg for the current natural resources worker and the future industrial worker. A soil screening level for the future construction worker was calculated using the EPA Adult Lead Model (ALM) (EPA 2009) with inputs recommended by the State of California as appropriate (Cal/EPA 2009; DTSC 2014). These screening concentrations are based on a biomarker (blood lead levels); for this reason, the risks from exposure to lead are characterized separately in the HHRA and are not included in cumulative risk calculations.

Total, background, and incremental (total minus background) risks were calculated for each scenario based on federal (EPA) (EPA 2015) and State of California (2015) toxicity criteria. All detected chemicals were included as COPCs for the total risk evaluation, except essential human nutrients, and regardless of background concentrations. The background risk evaluation estimated risks associated with exposure to metals at naturally occurring background concentrations. The

incremental risk evaluation subtracts the proportion of risks attributable to background concentrations (that is, background risks) from the results of the total risk evaluation. The incremental risk evaluation provided information on health risks associated with site-related activities (that is, the increment of risk above background risks that may be attributable to site-related activities, rather than naturally occurring conditions).

3.10.1.5 Uncertainty Evaluation

Some uncertainties are inherent in the estimates of potential cancer risk and noncancer health hazards. The uncertainty evaluation presented in Section F10.0 of Appendix F includes a discussion of the following: sampling data and identification of COPCs, exposure assessment, toxicity assessment, and risk characterization.

3.11 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT APPROACH

This section presents a summary of the methodology of the ecological risk assessment (ERA) presented in Appendix G. A SLERA and Step 3a risk refinement was conducted for this RI, which assessed potential risks to ecological receptors associated with exposure to COPECs at the site. The ERA was conducted following the Tier 1 approach presented in Navy guidance for conducting ecological risk assessments (Navy 1999, 2004) and is similar to guidance from the EPA (EPA 1997) and the Department of Toxic Substances Control (DTSC) (DTSC 1996a, 1996b). The SLERA used conservative assumptions and available scientific literature to evaluate potential risk to ecological receptors in an approach consistent with Steps 1 and 2 of the eight-step process described in guidance from the EPA (1997, 2001). According to Navy guidance, an intermediate refinement step may be conducted (Step 3a) if the SLERA indicates unacceptable or uncertain risk. Appendix G includes the complete SLERA and Step 3a risk refinement for MRP Site UXO1.

The SLERA and Step 3a risk refinement assessed potential risks to terrestrial receptors (plants, invertebrates, birds, and mammals) associated with exposure to COPECs in soil at the following 7 EUs at MRP site UXO1:

- Exposure Unit 1 – Suspected Disposal Trench 1 and Burn Slit/Trench 3 Area
- Exposure Unit 2 – Northwest Suspected Buried Trenches Area (Trenches 2 to 8)
- Exposure Unit 3 – Drop Test Tower and possible Surface Disturbance 1
- Exposure Unit 4 – Pilgrim Creek Drainage, Metal Burn Barrels, and Burn Slit/Trench 1
- Exposure Unit 5 – Former Range Floor, Target Berm (including Trenches 9 to 11) and Surface Disturbance 2
- Exposure Unit 6 – Disposal Trench 12 and Range Impact Area

- Exposure Unit 7 – Burn Slit/Trench 2

Section 3.11.1 describes the methodology that was used to conduct the Tier 1 SLERA for each EU. Section 3.11.2 presents the Step 3a risk refinement approach for further evaluation in Tier 2.

3.11.1 Tier 1 SLERA Methodology

A SLERA includes four primary phases: (1) problem formulation, (2) estimates of exposure, (3) evaluation of ecological effects, and (4) risk characterization. An ecological conceptual site model is developed during the problem formulation phase to describe exposure pathways at the site, which guides selection of assessment and measurement endpoints (see Figure 3-4). In the exposure assessment, conservative exposure parameters for representative receptors are identified using published literature and knowledge of the site. Contaminant exposure levels that represent conservative thresholds for adverse ecological effects are identified from the literature during the ecological effects evaluation. Finally, the potential risks to selected assessment endpoints associated with the site are conservatively estimated during the risk characterization phase. A detailed description of the SLERA methodology is provided in Appendix G.

Assessment Endpoints

EPA defines an assessment endpoint as an "explicit expression of an environmental value to be protected" (EPA 1997). The following eight assessment endpoints were used to evaluate the potential ecological risk at each EU:

- Protection and maintenance of terrestrial plants
- Protection and maintenance of soil invertebrates
- Protection of herbivorous birds typical to the area
- Protection of omnivorous birds typical to the area
- Protection of carnivorous birds typical to the area
- Protection of herbivorous mammals typical to the area
- Protection of omnivorous mammals typical to the area
- Protection of carnivorous mammals typical to the area

Assessment endpoints are not amenable to direct measurement; therefore, measurement endpoints related to assessment endpoints were identified.

Measurement Endpoints and Selection of Representative Receptors

The following measurement endpoints were used in evaluating potential ecological impacts on the assessment endpoints identified for MRP Site UXO1:

- For terrestrial plants, comparison of the concentrations of chemicals in soil with Ecological Soil Screening Levels (Eco-SSL) or Oak Ridge National Laboratory (ORNL) toxicity benchmarks for plants.
- For terrestrial invertebrates, comparison of concentrations of chemicals in soil with Eco-SSL or ORNL toxicity benchmarks for invertebrates.
- For birds and mammals, reproductive or physiological impacts were evaluated using the hazard quotient (HQ) approach, by comparing modeled doses to literature-derived high and low toxicity reference values (TRV).

If no benchmark or TRV is available for a COPEC for a receptor group, no conclusions could be drawn in the SLERA about the risk posed to the receptor group. The risks from these COPECs were therefore considered unknown and were further evaluated in the Step 3a risk refinement.

Six vertebrate receptors were selected as representative of the feeding guilds associated with MRP Site UXO1:

- The mourning dove (*Zenaida macrocura*) was used as a surrogate for herbivorous birds.
- The white-crowned sparrow (*Zonotrichia leucophrys*) was used as a surrogate for insectivorous birds.
- The northern harrier (*Circus cyaneus*) was used as a surrogate for carnivorous birds.
- The California ground squirrel (*Spermophilus beecheyi*) was used as a surrogate for herbivorous mammals and burrowing mammals.
- The deer mouse (*Peromyscus maniculatus*) was used as a surrogate for omnivorous mammals.
- The coyote (*Canis latrans*) was used as a surrogate for carnivorous mammals.

Selection of Chemicals of Potential Ecological Concern

Soil data collected between 2008 and 2015 were used in the ERA. The data set included the results of analyses for metals, dioxins, explosives, and VOCs. Both previously collected data and new data from the RI were combined for the evaluation. Data for soil (0 to 0.5 and 0 to 6 feet bgs) were used to support the SLERA. Data from 0 to 0.5 foot bgs was used in the evaluation of

invertebrates, birds, and non-burrowing mammals. Data from 0 to 6 feet bgs were used in the evaluation of plants and the California ground squirrel, a burrowing mammal.

All chemicals detected in soils within these two depth intervals, with the exception of essential nutrients, were retained as COPECs. Essential nutrients that are not priority pollutants, including calcium, iron, magnesium, potassium, and sodium, were not retained as COPECs. EPA recommends that aluminum be considered a COPEC only in soils with acidic pH of less than 5.5 (EPA 2003b). Soils at MRP Site UXO1 are generated from weathered granodiorite, which are typically slightly acidic with a pH of 6.0 to 6.5 (Bowman 1973). National Cooperative Soil Survey (2003) information indicates the "Fallbrook series of soils consist of deep, well drained soils that formed in material weathered from granitic rocks." The pH of the various soil types range from 6.0 to 6.5 in the area. Therefore, since site pH is likely greater than 5.5, aluminum was not discussed further as a COPEC.

Exposure Estimate and Risk Calculations for Plants and Invertebrates

Exposure estimates for plants and invertebrates were assumed to be the maximum concentration of each COPEC detected in samples collected from 0 to 6 feet bgs for plants and 0 to 0.5 foot bgs for invertebrates at each EU. Exposure estimates for COPECs were compared with Eco-SSLs (EPA 2010) or, if Eco-SSLs were not available, with ORNL toxicity-based benchmarks (Efroymson and others 1997a, 1997b) to identify chemicals that pose a potentially unacceptable risk for plants and invertebrates. If no benchmark was available for a chemical, it was qualitatively evaluated in the Step 3a risk refinement.

Exposure Estimate and Risk Calculations for Birds and Mammals

The total exposure from ingestion for each receptor of concern was calculated as the sum of the dietary exposure estimates. The following generic equation was adapted for each representative receptor:

$$\text{Dose}_{\text{total}} = \frac{([\text{IR}_{\text{prey}} \times \text{C}_{\text{prey}}] + [\text{IR}_{\text{soil}} \times \text{C}_{\text{soil}}]) \times \text{SUF}}{\text{BW}}$$

where:

$\text{Dose}_{\text{total}}$ = Estimated dose from ingestion (milligrams per kilogram body weight day [mg/kg/day])

IR_{prey} = Ingestion rate of prey (kilograms per day [kg/day])

C_{prey} = Concentration in dry weight of COPEC in prey (milligrams per kilogram [mg/kg])

IR_{soil} = Ingestion rate of soil (kg/day)

C_{soil} = Concentration in dry weight of COPEC in soil (mg/kg)

SUF = Site use factor (unitless)

BW = Adult body weight (kg)

Estimated COPEC concentrations in prey were based on the soil concentration and a bioaccumulation model as described in EPA's Eco-SSL guidance (EPA 2007). The bioaccumulation factors used in the food chain models (FCM) are described in Appendix G.

Toxicological Effects on Birds and Mammals and Calculation of the Hazard Quotient

Site-specific daily ingestion dose estimates were compared with high and low TRVs to estimate the potential adverse biological effects on each receptor. The risk to representative receptors was characterized based on this comparison, which is consistent with EPA's HQ methodology (EPA 1986), as follows:

$$HQ = \frac{Dose}{TRV}$$

where:

HQ	=	Hazard quotient (unitless)
Dose	=	COPEC-, receptor-, and site-specific daily dose estimate (mg/kg/day)
TRV	=	COPEC- and receptor-specific TRV (mg/kg/day)

It is Navy policy that resulting HQ values should not be compared or added together because of the differences in the degree of conservatism in TRVs selected for various COPECs and receptors; instead, they should be considered individually (Navy 1999).

Toxicity Reference Values

TRVs used in the FCMs were primarily from the Navy Biological Technical Advisory Group (BTAG) working group technical memorandum (Navy 1998). However, additional sources of TRVs were used if BTAG TRVs are not available. TRVs were derived separately for birds and mammals using available toxicological literature.

Risk Characterization

Interpretation of the Hazard Quotients for Birds and Mammals

For birds and mammals, by calculating both an $HQ_{(dose\ /high\ TRV)}$ and $HQ_{(dose\ /low\ TRV)}$, a risk manager can more definitively assess risk to the typical individual in the overall population.

The interpretation of each HQ is summarized in the following table.

Hazard Quotient Interpretation		
Low TRV	**Between Low and High TRV**	**High TRV**
$HQ_{(dose/low\ TRV)}$ <1 indicates little or no risk to the receptor	$HQ_{(dose/low\ TRV)}$ >=1 and $HQ_{(dose/high\ TRV)}$ < 1 indicates potential for risk to the receptor. However, the magnitude of the potential risk is uncertain	$HQ_{(dose/high\ TRV)}$ >=1 indicates potential significant risk to the receptor

Uncertainty is inherent in sampling and data analysis, toxicity benchmarks, estimated doses, toxicity reference values, HQs, and the analysis of bioavailability. Uncertainty associated with the SLERA and the potential effects of uncertainty on the risk assessment are discussed in Section G5.0 of Appendix G.

3.11.2 Tier 2 Step 3a Risk Refinement Methodology

COPECs identified as posing potential risks in the Tier 1 SLERA and those that do not have benchmarks or TRVs were reevaluated in Step 3a. The purposes of Step 3a were to reevaluate the COPECs retained from Tier 1 to eliminate from further consideration those that were retained because very conservative exposure scenarios were used, and to consider site-specific conditions (EPA 2001). Many of the assumptions in the SLERA process are conservative and result in overestimates of site-specific parameters that bias the estimates toward an overestimation of risk. Elements of the SLERA exposure model that caused an overestimate of risk included the use of maximum COPEC concentrations to represent site conditions, the assumption of bioavailability of COPECs to receptors, and the assumption that each receptor is feeding exclusively in the habitat area where they are modeled. COPECs identified as risk drivers in the SLERA (Step 2) were reconsidered under Step 3a using site specific assumptions for a number of parameters in the food chain model. Specific variables assessed included background concentrations of metals, spatial variations in the exposure point concentration, receptor site use, and available toxicological literature. The Step 3a risk refinement included a screen against background to eliminate from further consideration those chemicals with exposure unit concentrations less than background.

The 95 UCL concentrations in soil for plants and invertebrates were compared with benchmark values for the refined assessment. Doses were recalculated for birds and mammals based on the 95 UCL concentration for soil and a more realistic site-use factor. Refined doses for each COPEC were then compared with the TRV to evaluate the risk to each representative receptor that showed potential risks in the SLERA. Revised site-use factors were calculated by dividing the site acreage by the foraging range of the receptors to yield a more realistic prediction of the receptors' use of the sites and exposure to COPECs. If the calculation yielded a site-use factor greater than 1.0, the default value of 1.0 was used.

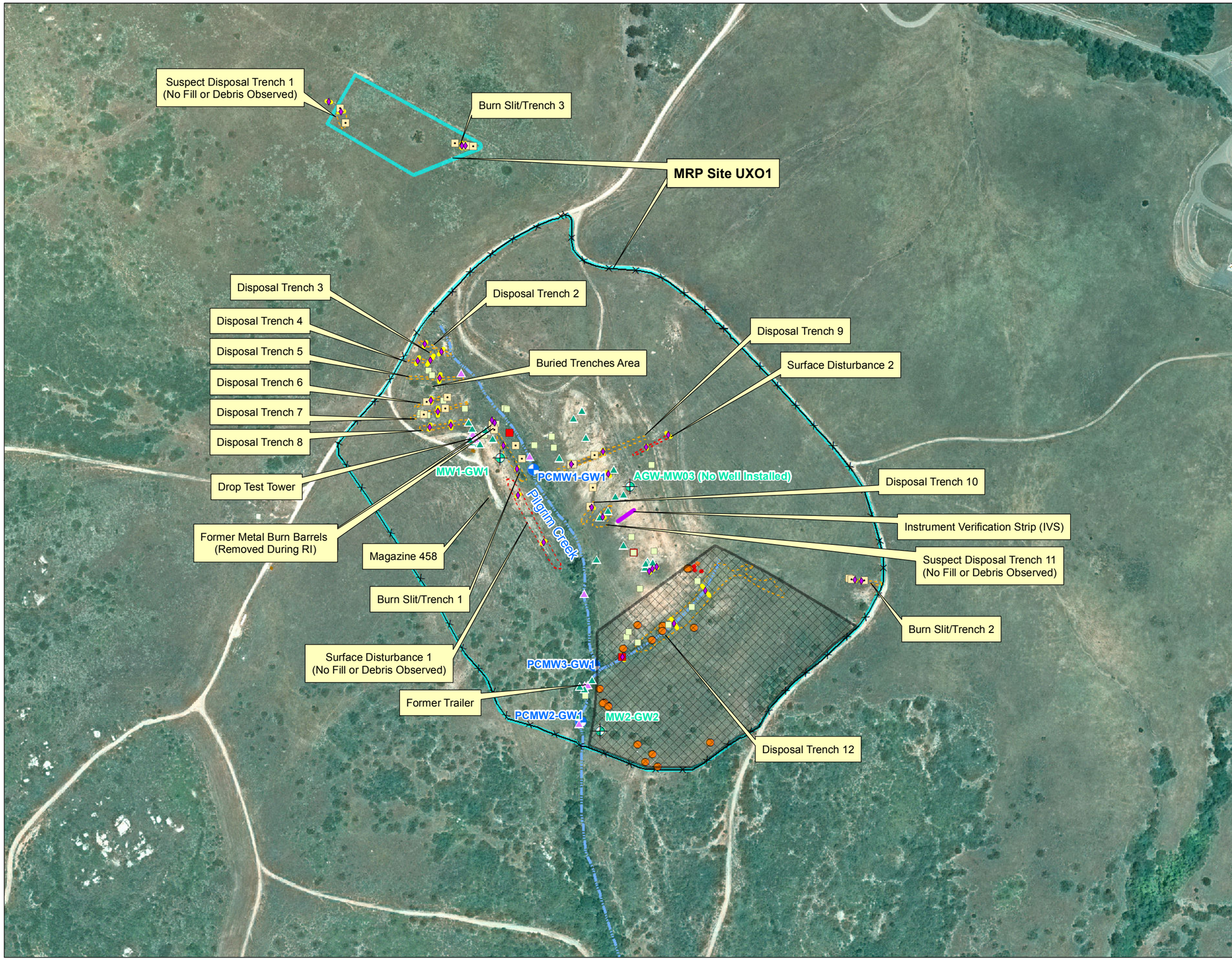
The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a Baseline Ecological Risk Assessment (BERA). The exit criteria for Step 3a are as follows (Navy 2004):

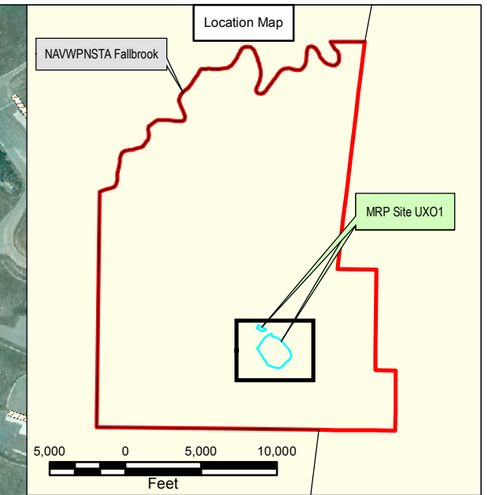
- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **supports** an acceptable risk determination, the site exits the ecological risk assessment (ERA) process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

- The SLERA is included as Appendix G of this RI report, and the results are summarized for each EU in Section 4.0.

SECTION 3.0 FIGURES





MRP Site UXO1 Boundary
Road
Drainage Channel (Approximate)
Range Fencing
Surface Disturbances (From Historic Aerial Photo)
Disposal Trench Limits (Approximate)
MDAS (Removed)
MPPEH (Removed)
Metal Debris (Removed)
2015 Geophysical Survey Area (TriEco-Tt)
RI Soil Sample Location (2015)
SI Soil Sample Location (2010)
SI Soil Boring Sample Location (2010)
RI Test Pit Excavation Soil Sample (2015)
Shallow Monitoring Well
Area Monitoring Well
IVS Location
Test Pit

Note:
Detail of Test Pit Sample Locations provided on figures in Section 4.0

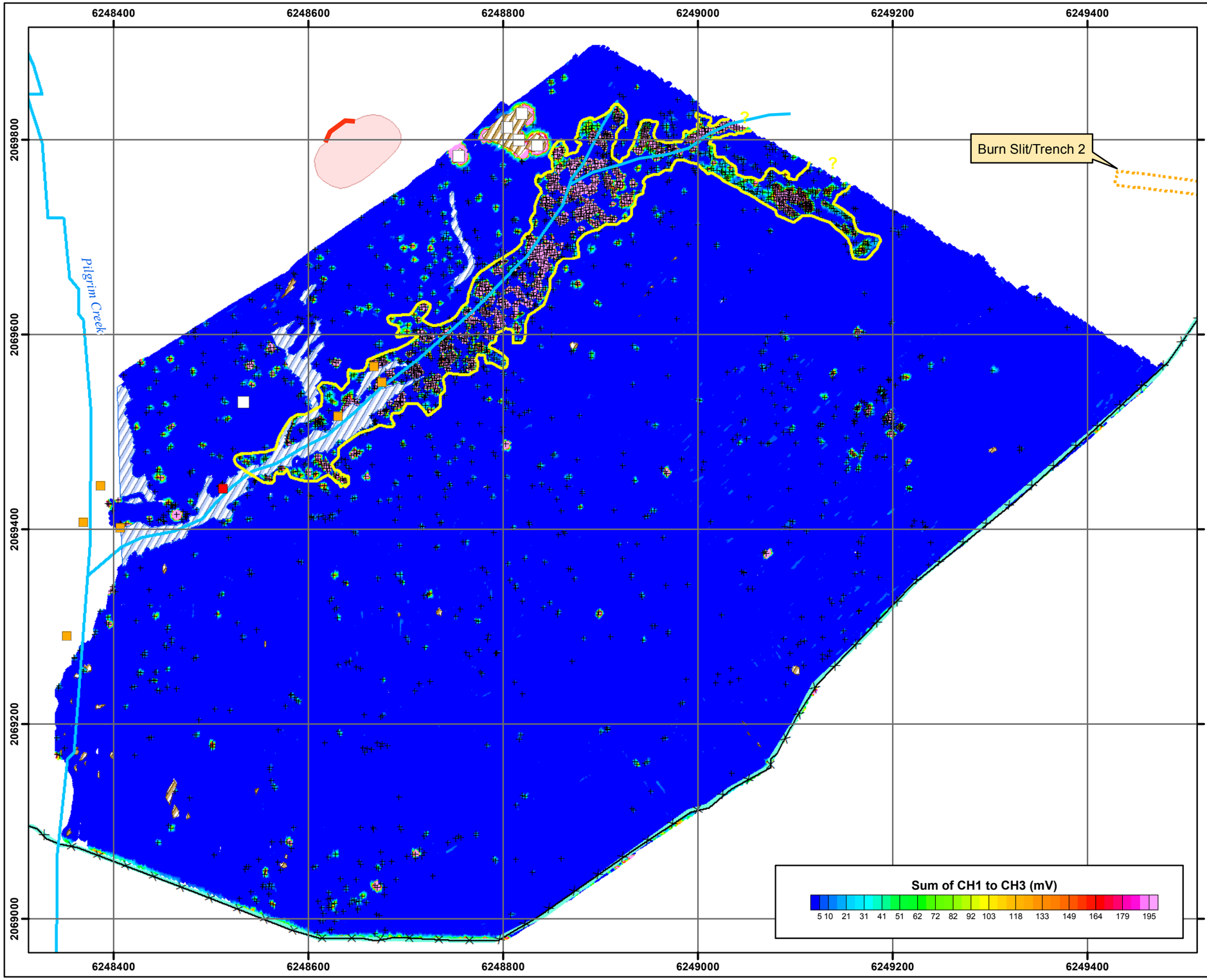
200 100 0 200 400
Feet

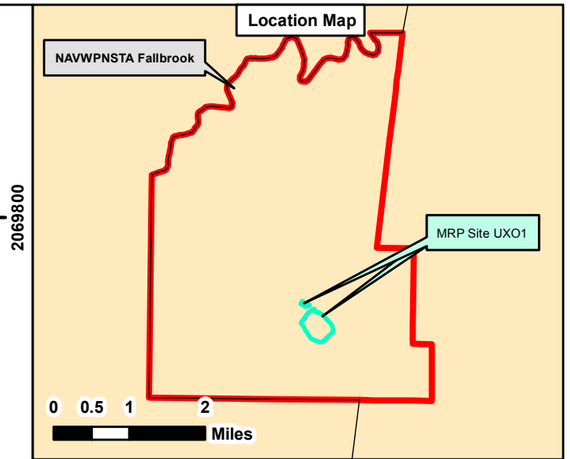
TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 3-1
MRP Site UXO1 Sample Location Overview
MRP Site UXO1 RI

2015-06-17 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_3_1_Sampling_Locations__.mxd TriEco-Tt Mario





MRP Site UXO1 Boundary
Fencing
Obstruction (Inaccessible Area not Surveyed)
Drainage (Inaccessible Area not Surveyed)
Earthen Target Berm
Standing Metal Target
Pilgrim Creek or Associated Drainage
Apparent Limits of Disposal Trench 12/ Backfilled Drainage
Burn Slit/Trench 2
4-lb Incendiary Bomb (Body)
Surface Structure (Concrete Observation Booth, Metal Kickout Screen)
Non-Munitions Related Debris (Cans, Metal Banding, Ammunition Containers, Scrap Metal)
Target Anomaly

Note:
Aerial: ESRI World Imagery 2015
Inset: ESRI Street Map 2015
Coordinate System: NAD 1983 California State Plane Zone 6, U.S. Survey Feet

CH	Channel
DGM	Digital Geophysical Mapping
MCB	Marine Corps Base
MPPEH	Material Potentially Posessing Explosive Hazard
NAD	North American Datum
NAVWPNSTA	Naval Weapons Station

N

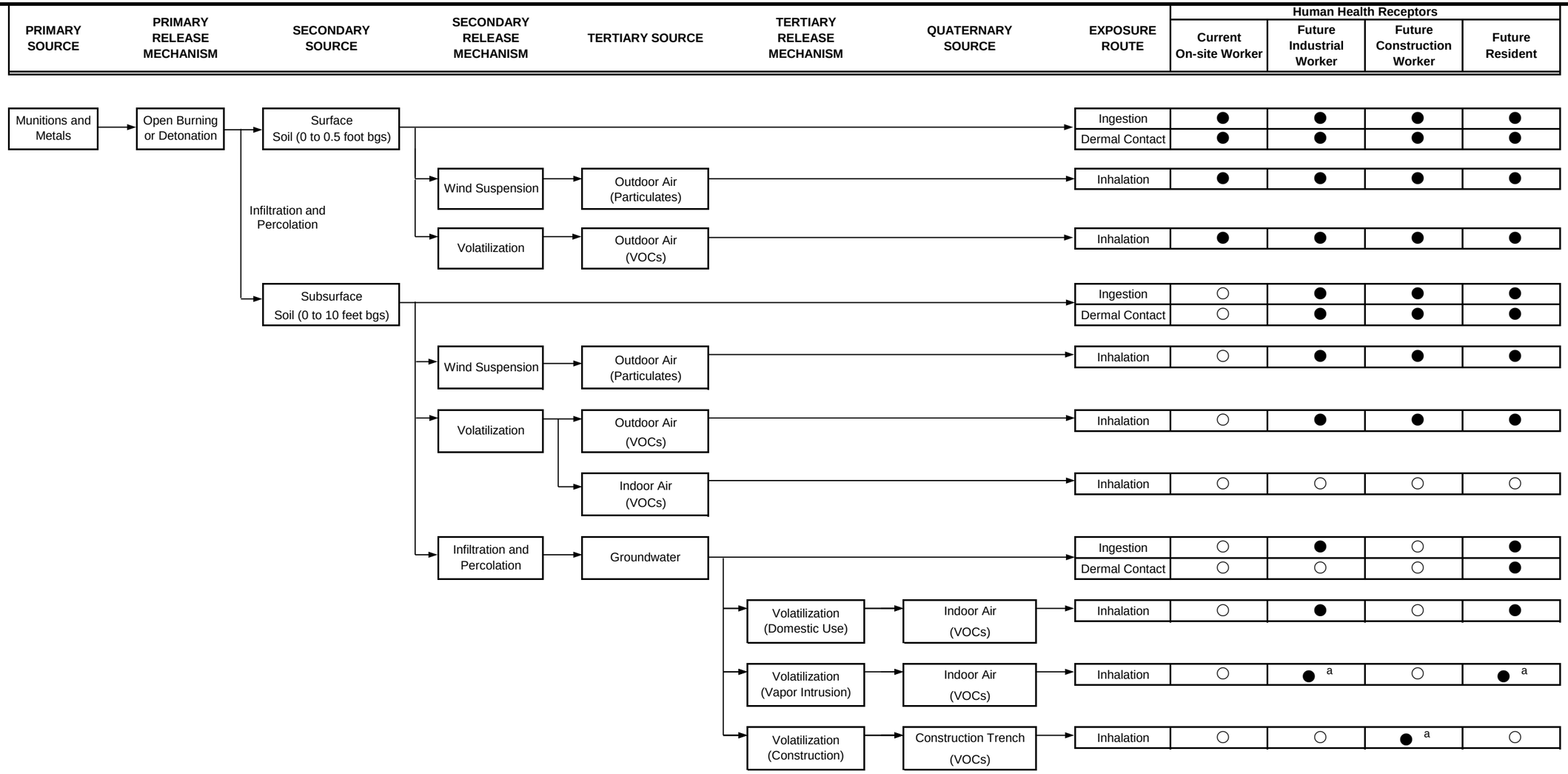
0 50 100 200 Feet

TriEco A Joint Venture

NAVWPNSTA SEAL BEACH DETACHMENT
FALLBROOK, CALIFORNIA

FIGURE 3-2
DGM Survey Results
MRP Site UXO1 RI

6/16/2015 V:\Fallbrook\Figures\MRP Site UXO1 RI\RI Report\Figure_3-DGM_Survey_Results.mxd Tt-SD



Notes:

● Potentially complete exposure pathway evaluated in risk assessment

○ Incomplete or negligible exposure pathway

a Potentially complete exposure pathway but groundwater concentrations of volatile compounds below a level of concern, so pathway is not evaluated quantitatively.

bgs Below ground surface

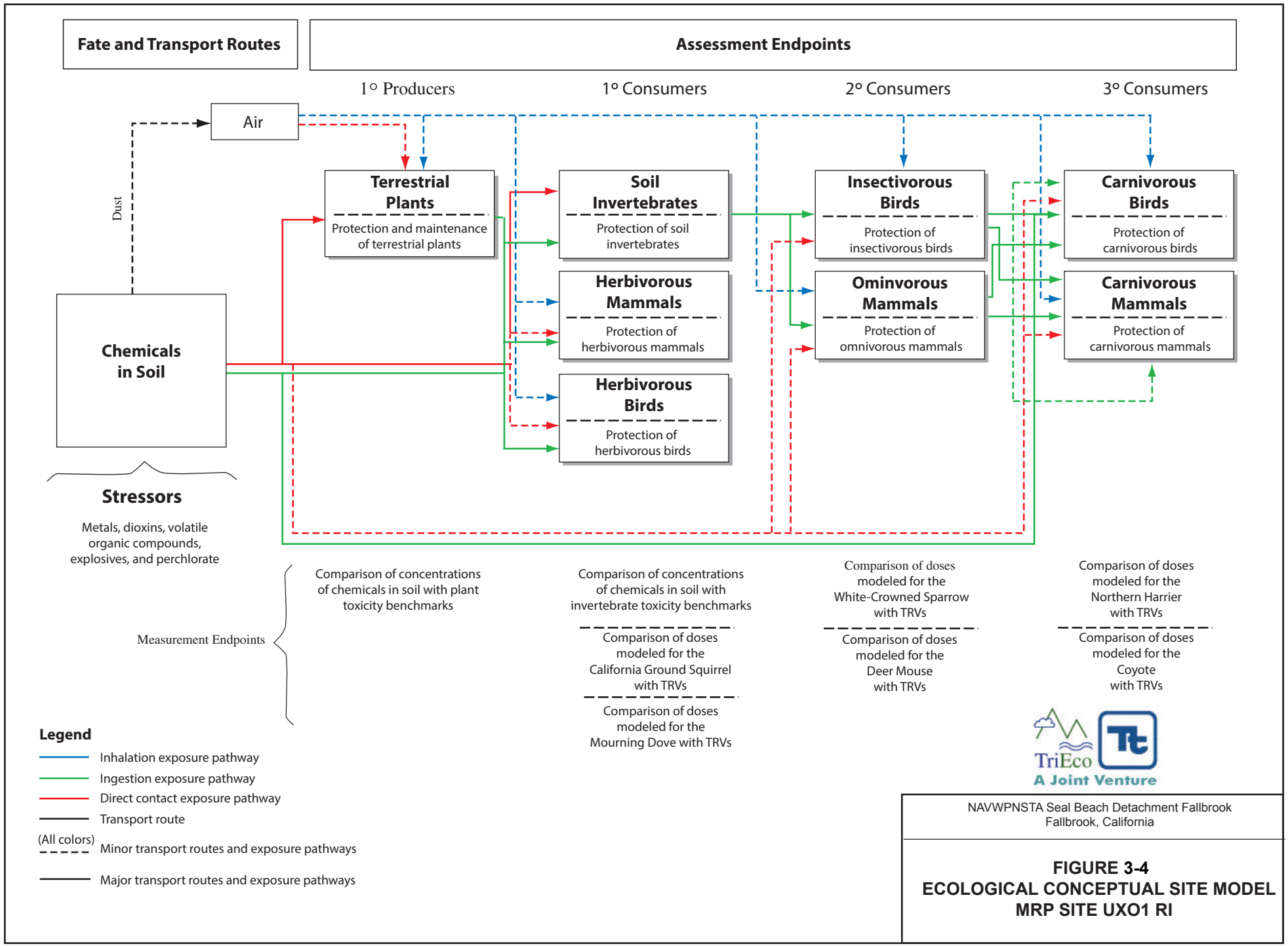
VOC Volatile organic compound

NAVWPNSTA Seal Beach
Det Fallbrook

FIGURE 3-3

CONCEPTUAL SITE MODEL FOR HUMAN HEALTH RISK ASSESSMENT

Remedial Investigation Report for Munitions Response Program Site UX01



NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

FIGURE 3-4
ECOLOGICAL CONCEPTUAL SITE MODEL
MRP SITE UXO1 RI

SECTION 3.0 TABLE

NAVWPNSTA Det Fallbrook
MRP Site UXO1 Remedial Investigation
MEC / MPPEH Control Log
Final (2/6/15)

Demo Operation Number	Item Type	Description	Date Identified	Location Found	Treatment	Date Treated
1	MPPEH	(1 ea) Grenade Fuze	5/2/2010*	Range Floor	Controlled Detonation	1/23/2015
1	MPPEH	(1 ea) Incendiary Bomb (body)	5/2/2010*	Range Floor	Controlled Detonation	1/23/2015
1	MPPEH	(1 ea) 40mm Smoke Grenade	5/2/2010*	Range Floor	Controlled Detonation	1/23/2015
1	MC	(1 ea.) Incendiary Mixture (Flare Candle)	5/2/2010*	Range Floor	Controlled Detonation	1/23/2015
1	MPPEH	(1 ea) 40mm Smoke Grenade	1/23/15	East of Drop Test Tower within Pilgrim Creek Drainage	Controlled Detonation	1/23/2015
2	MPPEH	(150 ea) Flare components	1/27/15	Burn / Slit Trench 2	Controlled Detonation	1/28/2015
2	MPPEH	(2 ea) 40mm Smoke Cartridge, (2 ea) Signal Smoke Grenade	1/27/15	Burn / Slit Trench 2	Controlled Detonation	1/28/2015
3	MPPEH	(21 ea) Incendiary Bomb components	1/30/15	Disposal Trench 2 - Test Pit 1	Controlled Detonation	2/4/2015
3	MPPEH	(2 ea) Shipping Containers, (1 ea) Ammunition Canister, (26 ea) Incendiary Bomb components	2/2/15	Disposal Trench 2 - Test Pit 2	Controlled Detonation	2/4/2015
3	MPPEH	(1 ea) 4.5" Barrage Rocket Body	2/4/15	Disposal Trench 10 - Test Pit 2	Controlled Detonation	2/4/2015
4	MPPEH	(1ea) 105mm Flare, (1 ea) 40mm Smoke Cartridge, (2 ea) Fire bomb components	2/5/15	Potential Range Impact Area, A098, A064, A082, and A039.	Controlled Detonation	2/5/2015

Notes: * Chadux-TT Site Inspection Report May, 2010

4.0 REMEDIAL INVESTIGATION RESULTS FOR EXPOSURE UNITS

This section describes the results of the RI field investigation at MRP Site UXO1 for the individual exposure units. The boundaries of the exposure units are indicated in Figure 4-0. Sample locations from the previous 2010 SI and this RI are shown on Figures 4-1 through 4-7 in the following sections. Included within the respective EU sections are the figures, boring and/or test pits logs, photographic logs, and summary screening tables presenting the analytical results. A full set of analytical results are provided in Appendix I.

Throughout the HHRA and the RI text, risk from dioxins and furans is described as "dioxins" for brevity, although furans may also contribute to the risk. The term "dioxins" is used to refer collectively to seventeen 2,3,7,8-substituted chlorinated dibenzo-p-dioxins and dibenzo-p-furans congeners that have similar toxicological effects. Dioxin concentrations in risk assessments are expressed in terms of toxicity equivalents (TEQ). Dioxin TEQs allow concentrations of dioxin/furan mixtures to be expressed as a single value computed by multiplying each congener concentration by a toxicity weight (toxicity equivalence factor [TEF]) and summing across the congeners. TEFs are expressed as a fraction equal to or less than 1, with 1 corresponding to the most toxic dioxin congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The resulting derived dioxin TEQ values can then be compared to toxicity values for 2,3,7,8-TCDD in the risk evaluations. Additional details regarding the calculation of dioxin TEQ is provided in the HHRA appendix, Appendix F, Section F7.5 and in the ERA Appendix G, Section G2.3.1.

4.1 NATURE AND EXTENT OF CONTAMINATION FOR EU 1

The following sections describe the investigation results and provide discussion on the nature and extent of both the munitions-related items and MCs.

4.1.1 Investigation Results and Discussion at EU 1

EU 1 is located north of the fenced portion of MRP Site UXO1 (Figure 4-1) and contains two Features, Burn Slit/Trench 3 and suspected Disposal Trench 1. Previous sampling during the SI (ChaduxTt 2010) included collection of samples at three locations within the limits of the Burn Slit/Trench. One sample was collected east of the corrugated metal cover and two samples to the west of the metal cover. The samples were collected using hand augers at depths of 0 to 0.5 foot and four to six feet below the trench bottom surface grade. The deeper samples were analyzed for metals, explosives, perchlorate while the surface samples were analyzed for dioxins.

Prior to sampling during the RI, the corrugated metal cover was removed from the trench to facilitate sampling within the central portion of the trench. Two test pits were excavated to a depth of approximately six feet below the surface grade within the central portion of the trench (Test Pit Logs 4-1). The trench bottom was approximately seven feet bgs as indicated on the Test Pit Logs. Approximately one foot of slough was observed lying on top of the weathered bedrock/colluvium. A layer of burn ash or burned debris was noted in this upper surficial soil layer in both test pits. Samples were collected at a depth of 0 to 0.5 (slough/burn ash) foot and also at a depth of three to four (weathered bedrock/colluvium) feet below the trench bottom surface grade.

Samples were also collected from the location of the suspect disposal trench in soil borings completed during the 2010 SI and also from the test pits during this RI. Neither debris nor evidence of trench backfill were encountered in either the soil borings or Test Pit 1. To evaluate the possibility that the trench was incorrectly located, a detector-aided surface sweep was conducted by the UXO team within the area surrounding the suspect trench in an effort to locate buried debris. Test Pit 2 was excavated in an area where slightly elevated detector response was noted by the UXO team. No debris or fill was observed at this location. The underlying granitic bedrock was heavily weathered with a medium to dark red brown appearance and very dense, suggesting it may contain a slightly higher iron mineral content possibly resulting in anomalous detector responses.

4.1.2 Extent of MPPEH and MC at EU 1

Results of the sampling program indicate there is no buried debris at the location of suspected Disposal Trench 1. A relatively thin layer of burn ash was observed within the central portion of Burn Slit/Trench 3. Neither MPPEH nor MDAS were observed in this trench.

Analytical results indicate concentrations of some metals and dioxins that exceed screening levels are present in the surficial soils within the central portion of the disposal trench. There were no TPH-d, VOCs, SVOCs, explosives, PCP, white phosphorous, or hydrazine detected above screening levels. Dioxin (humans/mammals) ranged from 0.362 to 5.57 ng/kg; arsenic was detected in all samples at concentrations of 1.12J to 2.41J mg/kg, which was below background values; and thallium at a concentration of 0.781 mg/kg that exceeded the residential screening level of 0.780 mg/kg. Results from the lowest samples (four to six feet trench bgs) collected from the granite bedrock below the surficial soils (slough) within Burn Slit/Trench 3 indicates that there has not been vertical migration of the detected metals. A summary of soil analytical results compared with screening criteria and exceedances for EU 1 are provided at the end of this section, respectively (Tables 4-1A and 4-1B).

4.1.3 Human Health Risk Assessment Findings

4.1.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 6E-09 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.0002 for federal toxicity criteria and 0.00002 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 1 is 5.01 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 1.

4.1.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 3E-07 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.01 for federal toxicity criteria and 0.001 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 1 is 5.01 mg/kg. This concentration is below the risk-

based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified in surface soil for the future industrial worker at EU 1.

The estimated cancer risk from exposure to subsurface soil is 3E-07 for the federal toxicity values and 5E-07 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.05 for federal toxicity criteria and 0.06 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 1 is 6.06 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified in subsurface soil for the future industrial worker at EU 1.

4.1.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 5E-08 for the federal toxicity values and 8E-08 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.2 for federal toxicity criteria and 0.3 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 1 is 6.06 mg/kg. This concentration is below the risk-based screening level of 39 mg/kg for the future construction worker. No chemical risk drivers were identified in subsurface soil for the future construction worker at EU 1.

4.1.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 1E-06 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in surface soil. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.1 for federal toxicity criteria and 0.01 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 1 is 5.01 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. **Dioxins** are identified as COCs in surface soil at EU 1.

The estimated cancer risk from exposure to subsurface soil is 1E-06 for federal toxicity criteria and 2E-06 for State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in surface soil. The estimated HI for subsurface soil is 0.7 for federal toxicity criteria and 0.8 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 1 is 6.06 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. **Dioxins** are identified as COCs in subsurface soil at EU 1.

The table below provides a summary of the human health risk assessment findings for EU 1:

SUMMARY OF INCREMENTAL RISK DRIVERS							
Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
1	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Dioxins

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.1.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 1 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.1.4.1 Results of the Step 2 SLERA for EU 1

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 1:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 1	COPECs without Benchmarks or TRVs
Plants	barium, chromium, cobalt, manganese, vanadium	strontium, dioxins, perchlorate
Invertebrates	chromium	cobalt, molybdenum, thallium, vanadium, dioxins, perchlorate
Birds	lead, zinc	antimony, beryllium, thallium, perchlorate
Non-Burrowing Mammals	cadmium, nickel, vanadium, zinc, dioxins	perchlorate
Burrowing Mammals	barium	perchlorate

In summary, the SLERA indicates that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.1.4.2 Results of the Step 3a Risk Refinement for EU 1

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) supports an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, no COECs were identified for EU 1.

4.1.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 1:

- There was no evidence that suspected Disposal Trench 1 exists. No further investigation is recommended for this previously suspected feature.

- Burn ash was observed at or near the surface within the central portion of Burn Slit/Trench 3. This material is approximately one to two feet thick and contained within the Burn Slit/Trench. No MEC, MPPEH, MDAS or other debris were found.

- There were no explosives, VOCs, SVOCs, PCP, TPD-d, perchlorate, white phosphorous, or hydrazine detected at concentrations above initial screening levels.

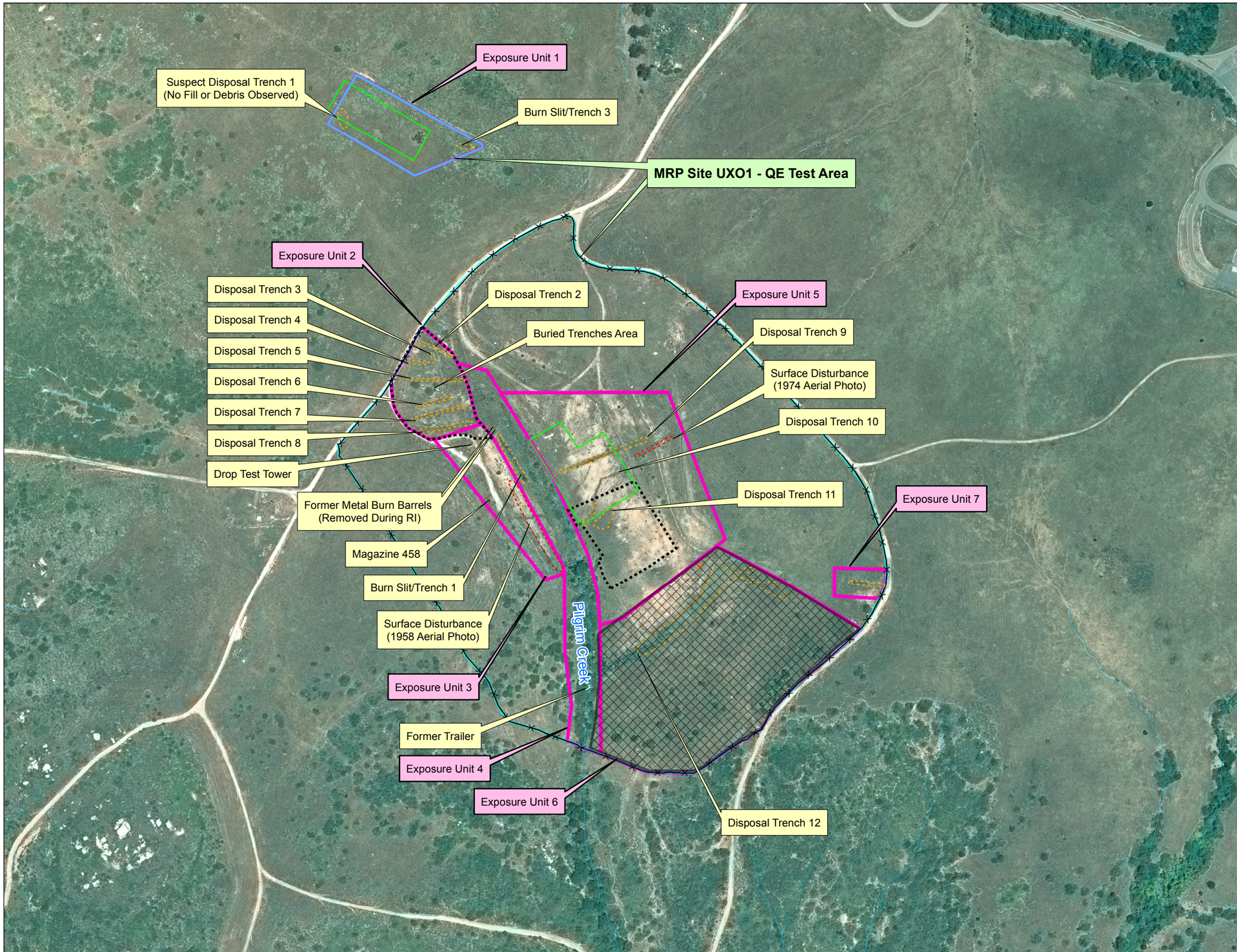
- The HHRA indicates that dioxins are a risk driver for cancer risk for surface and subsurface soils under a hypothetical future resident scenario. The cancer risk from dioxins is within the risk management range at 1E-06 (using federal toxicity values) and residential development is not a planned use for this site.

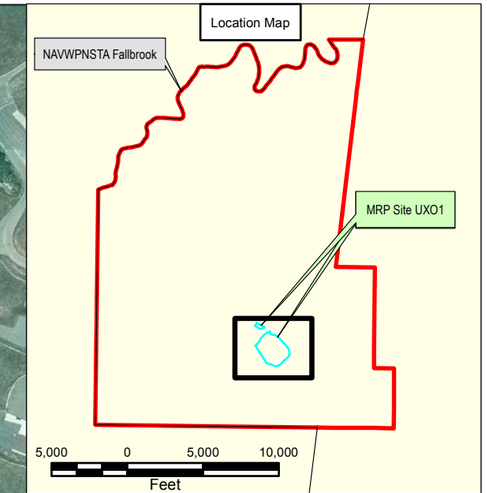
- The ERA Step 3a refinement indicates there are no COECs for this EU.

    - Analytical data obtained from the bedrock below the fill containing the burn ash indicates that the COC dioxin is not migrating vertically into the underlying bedrock material.

- No further evaluation of this EU is recommended.

SECTION 4.1 FIGURES





MRP Site Boundary
Road
Stream
Fencing Installed
Risk Assessment Exposure Unit
2010 SI Geophysical Survey Area (ChaduxTt)
2015 Geophysical Survey Area (TriEco-Tt)
Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
Surface Disturbance (From Historical Photo)
Disposal Trench Limits (Approximate)

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

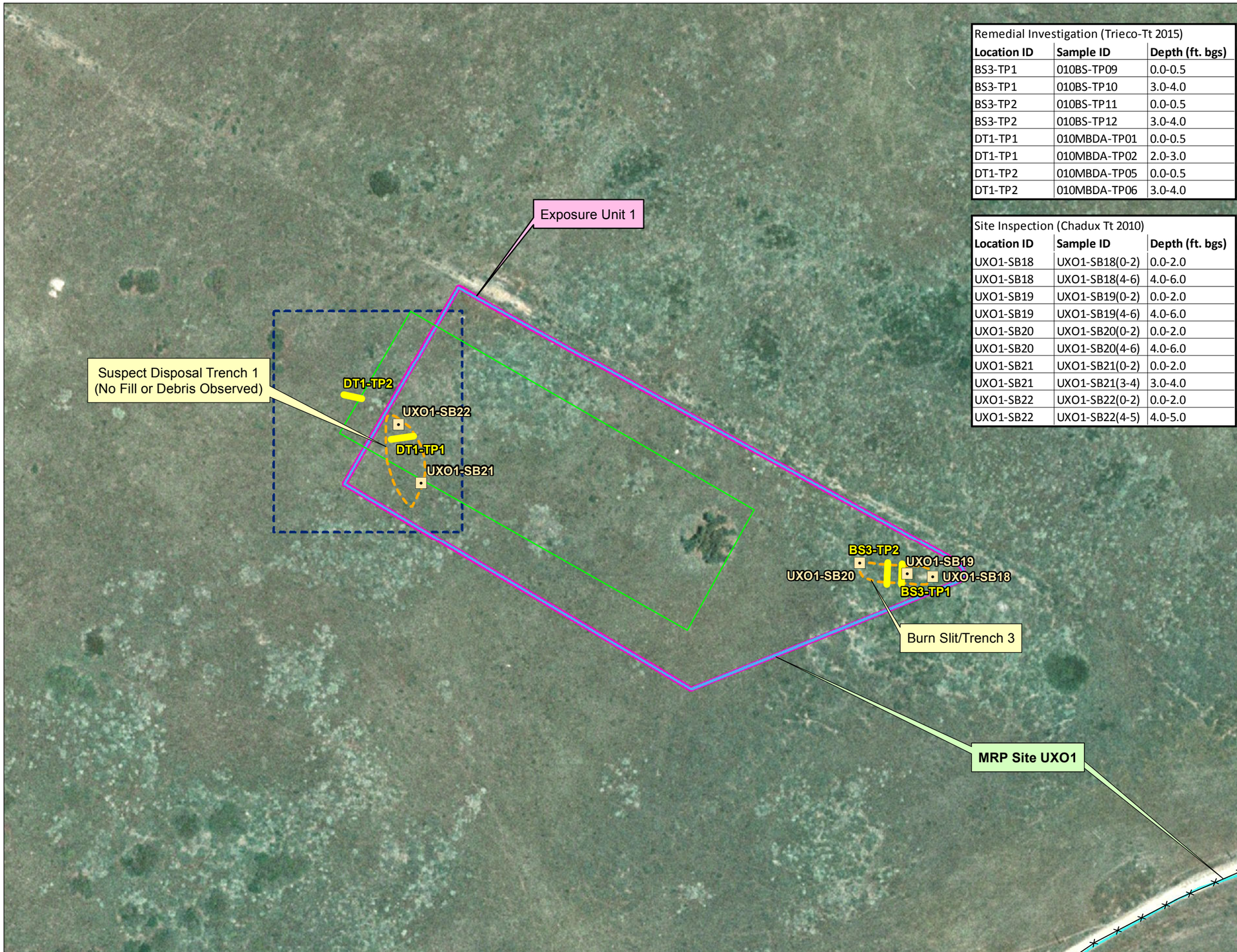
200 0 200 400
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

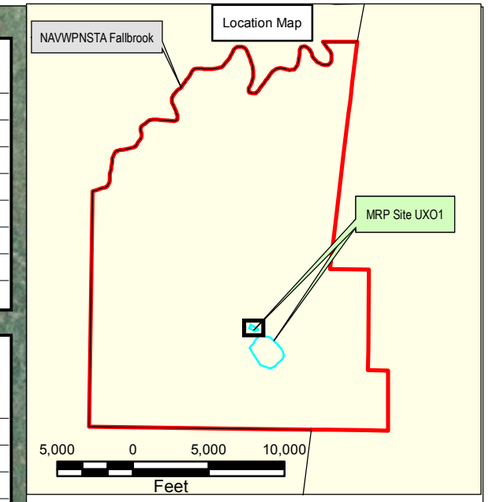
Figure 4-0
Exposure Unit Boundaries Map
MRP Site UXO1 RI

11/20/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_0_Exposure_UnitBoundaries.mxd Tt-SD Mario



Remedial Investigation (Trieco-Tt 2015)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
BS3-TP1	010BS-TP09	0.0-0.5
BS3-TP1	010BS-TP10	3.0-4.0
BS3-TP2	010BS-TP11	0.0-0.5
BS3-TP2	010BS-TP12	3.0-4.0
DT1-TP1	010MBDA-TP01	0.0-0.5
DT1-TP1	010MBDA-TP02	2.0-3.0
DT1-TP2	010MBDA-TP05	0.0-0.5
DT1-TP2	010MBDA-TP06	3.0-4.0

Site Inspection (Chadux Tt 2010)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
UXO1-SB18	UXO1-SB18(0-2)	0.0-2.0
UXO1-SB18	UXO1-SB18(4-6)	4.0-6.0
UXO1-SB19	UXO1-SB19(0-2)	0.0-2.0
UXO1-SB19	UXO1-SB19(4-6)	4.0-6.0
UXO1-SB20	UXO1-SB20(0-2)	0.0-2.0
UXO1-SB20	UXO1-SB20(4-6)	4.0-6.0
UXO1-SB21	UXO1-SB21(0-2)	0.0-2.0
UXO1-SB21	UXO1-SB21(3-4)	3.0-4.0
UXO1-SB22	UXO1-SB22(0-2)	0.0-2.0
UXO1-SB22	UXO1-SB22(4-5)	4.0-5.0



- MRP Site UXO1 Boundary
- Range Fencing
- Exposure Unit Boundary
- Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
- Disposal Trench Limits (Approximate)
- SI Soil Boring Sample Location (2010)
- Test Pit
- Approximate Limit of Detector-Aided Surface Sweep

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

N

50 0 50 100
Feet

TriEco Tt
A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 4-1
Exposure Unit 1 Features and Sample Locations
MRP Site UXO1 RI

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SECTION 4.1 TABLES

TABLE 4-1A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 1

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 16	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
MOTOR OIL RANGE ORGANICS	1/4	19.0 J	19.0 J	BS3-TP1	0.00 - 0.50	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 10	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	12/12	20,600 J	10,500	UXO1-SB22	0.00 - 2.00	--	17,393	17,393	0	0	12	6	77,000	1,100,000	50 +	14,710
ANTIMONY	3/12	1.95 J	0.166 J	UXO1-SB19	0.00 - 2.00	--	--	--	0	0	1	--	31	470	0.27	--
ARSENIC	12/12	2.41 J	0.901 J	UXO1-SB22	0.00 - 2.00	--	1.7005	1.7005	12	12	0	0	0.062	0.25 #	18	3.105
BARIUM	12/12	790	60.1	UXO1-SB21	3.00 - 4.00	--	330.2	330.2	0	0	1	4	15,000	220,000	330	200.5
BERYLLIUM	8/12	0.490 J	0.119 J	UXO1-SB22	0.00 - 2.00	--	0.371	0.371	0	0	0	2	15.2	183 #	21	0.359
CADMIUM	6/12	0.145 J	0.108 J	UXO1-SB22	0.00 - 2.00	--	0.137	0.137	0	0	0	0	4.58	6.37 #	0.36	0.158
CALCIUM	12/12	7,750	760	UXO1-SB21	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	12/12	48.6	9.96	UXO1-SB19	0.00 - 2.00	--	33.44	33.44	0	0	6	6	100,000	100,000 *	26	20.3
COBALT	12/12	14.1	4.24	UXO1-SB19	0.00 - 2.00	--	11	11	0	0	1	8	23	350	13	9.39
COPPER	12/12	46.1	2.87	UXO1-SB19	0.00 - 2.00	--	35.46	35.46	0	0	2	6	3,100	47,000	28	7.785
IRON	12/12	25,700	11,400 J	UXO1-SB22	0.00 - 2.00	--	22,034	22,034	0	0	--	0	55,000	100,000 *	--	27,350
LEAD	12/12	6.06	0.998 J	UXO1-SB20	0.00 - 2.00	--	4.307	4.307	0	0	0	4	80	320 #	11	4.328
MAGNESIUM	12/12	10,200	1,720	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	12/12	261	93.3 J	UXO1-SB22	0.00 - 2.00	--	219.3	219.3	0	0	4	0	1,800	26,000	220	304
MOLYBDENUM	2/2	0.423 J	0.283 J	DT1-TP2	0.00 - 0.50	--	--	--	0	0	0	0	390	5,800	2 +	0.524
NICKEL	12/12	17.4	3.05	UXO1-SB19	0.00 - 2.00	--	12.36	12.36	0	0	0	8	1,500	22,000	38	5.15
POTASSIUM	12/12	6,620	1,230	UXO1-SB20	4.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	2/12	0.121 J	0.0651 J	DT1-TP2	0.00 - 0.50	--	--	--	0	0	0	--	390	5,800	0.52	--

TABLE 4-1A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 1 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
SODIUM	10/12	750	58.9 J	UXO1-SB18	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	10/10	115	10.8 J	UXO1-SB18	0.00 - 2.00	--	57.34	57.34	--	--	--	--	--	--	--	--
THALLIUM	3/12	0.781	0.210 J	UXO1-SB22	4.00 - 5.00	--	--	--	1	0	0	1	0.78	12	1 +	0.552
VANADIUM	12/12	78.4	31.9	UXO1-SB18	0.00 - 2.00	--	64.01	64.01	0	0	12	0	390	5,800	7.8	96.4
ZINC	12/12	46.8	14.4	UXO1-SB19	0.00 - 2.00	--	34.25	34.25	0	0	1	0	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	5/8	220	0.884 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	4/8	116	1.99 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	2/8	2.59 J	0.790 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	2/8	0.741 J	0.0978 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	2/8	1.30 J	0.0747 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	3/8	6.50	0.211 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	1/8	1.28 J	1.28 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	4/8	1.76 J	0.147 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	1/8	0.104 J	0.104 J	DT1-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	2/8	2.21 J	0.407 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDD	6/8	1,800	4.70 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDF	5/8	389	1.32 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-DIOXINS	2/2	26.1	2.17	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-FURANS	2/2	14.4	0.384	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-DIOXINS	2/2	3.42	0.147	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-FURANS	2/2	3.39	0.309	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	5/6	432	0.629 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	5/6	329	0.214 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	4/6	51.8 J	0.126 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	4/6	55.9 J	0.0747 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	1/6	1.99 J	1.99 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-1A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 1 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL PECDF	2/6	7.00	0.215 J	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	2/2	0.526	0.268	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	7/8	5.77	0.0553	BS3-TP1	0.00 - 0.50	--	--	--	1	0	5	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	7/8	3.01	0.0665	BS3-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	5/16	0.00132 J	0.000658	DT1-TP2	3.00 - 4.00	--	0.00116	0.00116	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
None Detected	0/ 6	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Percent Moisture (%)																
PERCENT MOISTURE	16/16	16.1	3.00	UXO1-SB20	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-1A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 1

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-1A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 1

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-1B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 1

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	10,500	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,900	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	18,800	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,000	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,400	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,900	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,100	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	20,200	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	20,600 J	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100 J	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	110	77,000	1,100,000	**50.0**	14,700
ANTIMONY	1.95 J	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	31.0	470	**0.270**	NC
ARSENIC	1.34	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59 J	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	5.44	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38 J	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53 J	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	5.60	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.12 J	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	5.28	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.16 J	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.901 J	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	5.15	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81 J	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	5.71	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.41 J	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.41 J	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	5.84	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.73 J	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	5.49	**0.0620**	**0.250**	18.0	3.11
BARIUM	790	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	5.41	15,000	220,000	**330**	201
CHROMIUM	43.7	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	2.18	100,000	100,000	**26.0**	20.3
CHROMIUM	28.5	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	2.16	100,000	100,000	**26.0**	20.3
CHROMIUM	48.6	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	2.24	100,000	100,000	**26.0**	20.3

TABLE 4-1B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 1 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
CHROMIUM	34.9	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	2.11	100,000	100,000	**26.0**	20.3
CHROMIUM	41.4	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	2.28	100,000	100,000	**26.0**	20.3
CHROMIUM	33.4	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	2.06	100,000	100,000	**26.0**	20.3
COBALT	14.1	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	23.0	350	**13.0**	9.39
COPPER	38.6	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	2.18	3,100	47,000	**28.0**	7.79
COPPER	46.1	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	2.24	3,100	47,000	**28.0**	7.79
MANGANESE	242 J	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	1,800	26,000	**220**	304
MANGANESE	255	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	2.84	1,800	26,000	**220**	304
MANGANESE	229	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	2.57	1,800	26,000	**220**	304
MANGANESE	261	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	2.92	1,800	26,000	**220**	304
THALLIUM	0.781	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	0.549	**0.780**	12.0	1.00	0.552
VANADIUM	31.9	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	41.7	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	78.4	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	1.09	390	5,800	**7.80**	96.4
VANADIUM	55.2	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	1.08	390	5,800	**7.80**	96.4
VANADIUM	74.7	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	390	5,800	**7.80**	96.4
VANADIUM	56.2	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	1.06	390	5,800	**7.80**	96.4
VANADIUM	60.4	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	1.14	390	5,800	**7.80**	96.4
VANADIUM	64.9	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	1.03	390	5,800	**7.80**	96.4
VANADIUM	51.3	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	1.14	390	5,800	**7.80**	96.4
VANADIUM	44.1	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	1.08	390	5,800	**7.80**	96.4
VANADIUM	69.4	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	1.17	390	5,800	**7.80**	96.4
VANADIUM	54.5	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	1.10	390	5,800	**7.80**	96.4
ZINC	46.8	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	11.2	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	5.77	BS3-TP1	010BS-TP09	0.00 - 0.50	01/29/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.362	BS3-TP1	010BS-TP10	2.00 - 4.00	01/29/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.36	BS3-TP2	010BS-TP11	0.00 - 0.50	01/29/15	0.0	4.90	22.0	**0.200**	NC

TABLE 4-1B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 1 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.280	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.550	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC

Notes:
1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID Identification
J Estimated value
mg/kg Milligrams per kilogram
ng/kg Nanograms per kilogram
TEQ Toxicity equivalence quotient

SECTION 4.1 PHOTOGRAPHS

SECTION 4.1 – EXPOSURE UNIT 1 PHOTOGRAPHIC LOG

Photograph 4.1-1
Burn Slit/Trench 3 Prior to Remedial Investigation

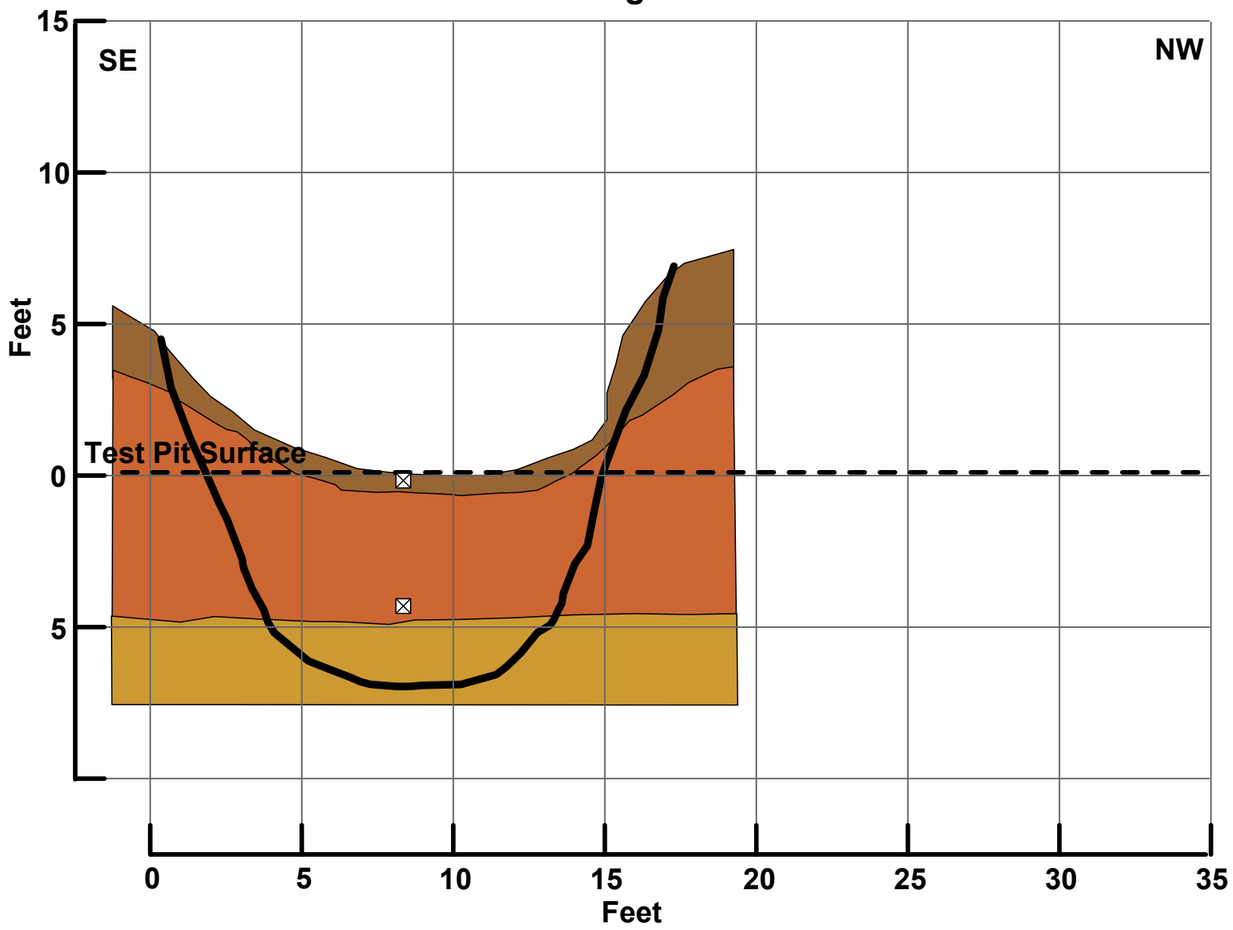
Photograph 4.1-2
Burn Slit Trench 3 – Test Pit 1

Photograph 4.1-3
Disposal Trench 1 Test Pit 1 with Excavator

Photograph 4.1-4
Disposal Trench 1 Test Pit 1
No Fill or Debris Observed

SECTION 4.1 TEST PIT LOGS

Trench Profile BS3-TP1
View Looking Southwest



Debris Content

Other Some burn ash in top 0.5 ft [10%] (30 lbs)

Total Depth

12 feet below adjacent grade
6 feet below lowest surface grade

Samples

010BS-TP09
(0.0-0.5 ft bgs)

010BS-TP10
(3.0-4.0 ft bgs)

Date Excavated:	29 January 2015	**Trench No.:**	BS3-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Cole
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 3	**Project No:**	103G1959010

Topsoil
Reddish brown silty sand, moist, loose, not competent with some burn ash and roots

Weathered Bedrock/Colluvium
Light brown silty sand, dry to moist, loose, with weathered granite

Bedrock
Light brown weathered granite, breaks to fine to coarse silty sand. Low competency, increasing competency with depth

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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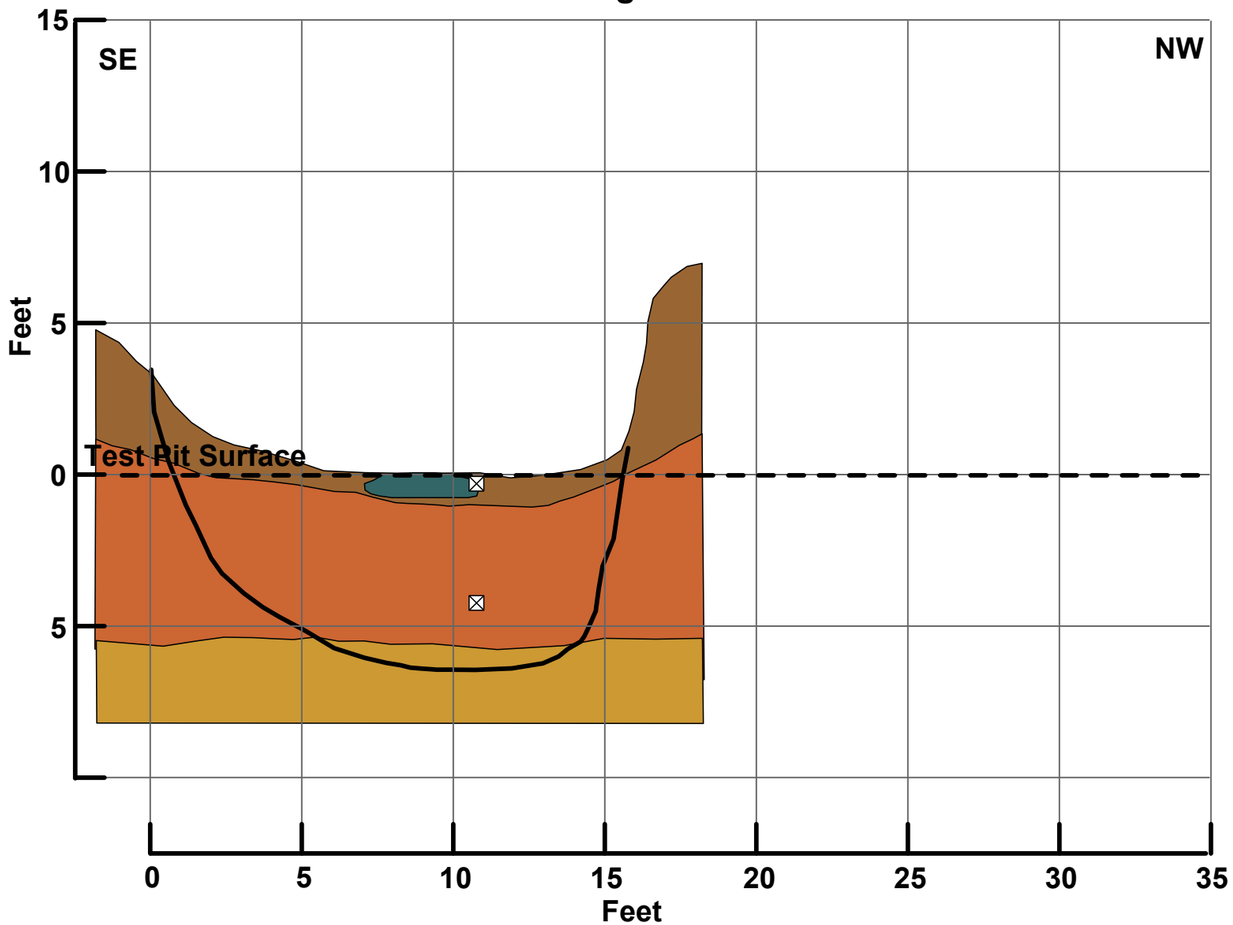
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS3-TP1 TRENCH LOG

Trench Profile BS3-TP2
View Looing Southwest



Samples

010BS-TP11
(0.0-0.5 ft bgs)

010BS-TP12
(3.0-4.0 ft bgs)

Debris Content

Other Some burn ash in top 0.5 ft [15-20%] (50 lbs)

Total Depth

13 feet below adjacent grade
6 feet below lowest surface grade

Date Excavated:	29 January 2015	**Trench No.:**	BS3-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Cole
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 3	**Project No:**	103G1959010

Topsoil
Reddish brown silty sand, moist, loose, not competent with some burn ash throughout

Burn Ash
Burn ash lens 0.5 ft thick

Weathered Bedrock/Colluvium
Light brown silty sand, dry to moist, loose, with weathered granite

Bedrock
Light brown weathered granite, breaks to fine to coarse silty sand. Low competency, increasing competency with depth

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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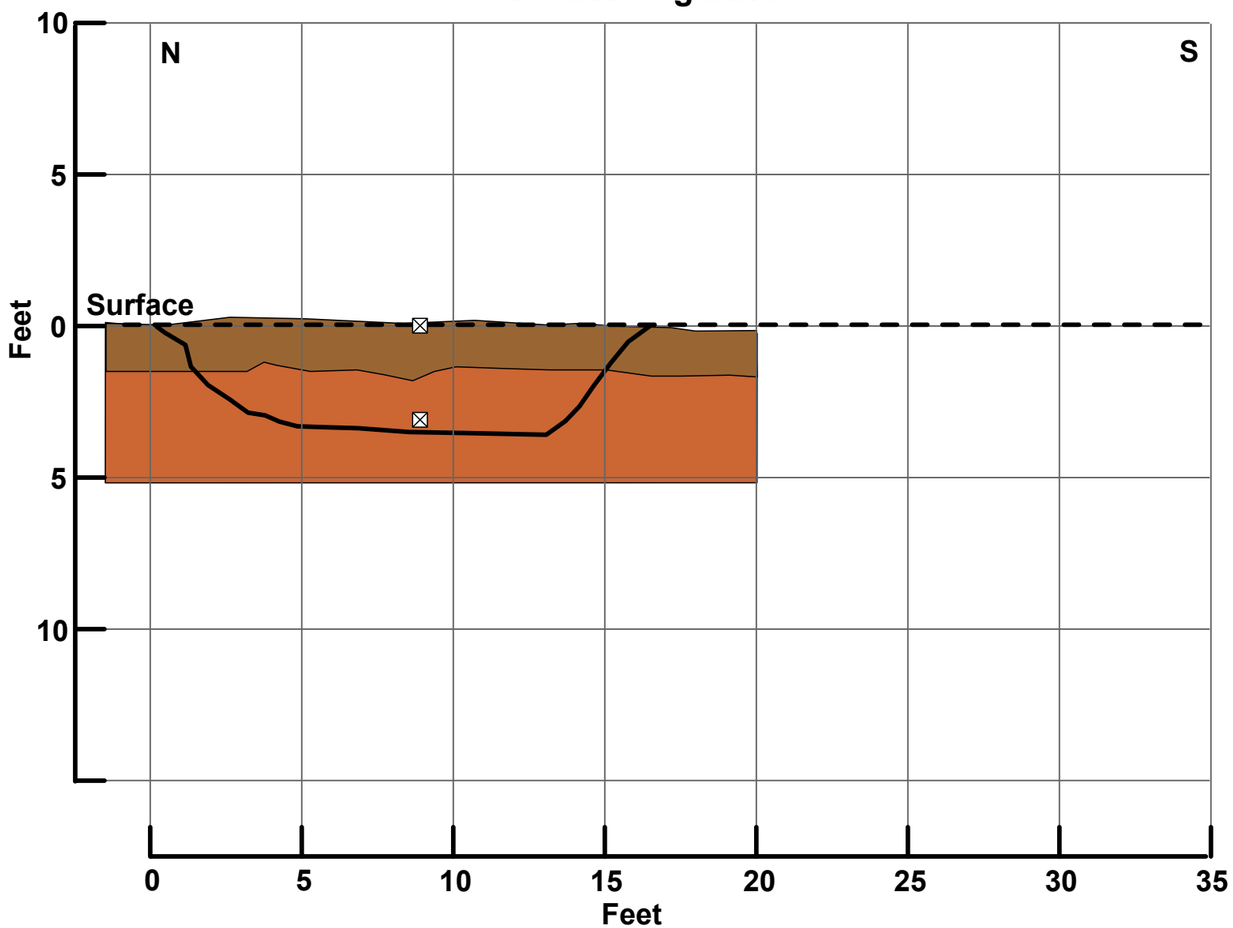
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS3-TP2 TRENCH LOG

Trench Profile DT1-TP1
View Looking East



Debris Content

N/A

Total Depth

3 feet below adjacent grade
3 feet below lowest surface grade

Samples

010MBDA-TP01
(0.0-0.5 ft bgs)

010MBDA-TP02
(2.0-3.0 ft bgs)

Date Excavated:	29 January 2015	**Trench No.:**	DT1-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 1	**Project No:**	103G1959010

Topsoil
medium brown silty sand, moist, very loose, minor organics (rootlets)

Colluvium/Weathered Bedrock
Colluvium/weathered Bedrock – medium to dark red brown silty sand with trace of clay, damp to dry, medium dense when damp, very hard when dry, difficult to excavate. No fill or debris.

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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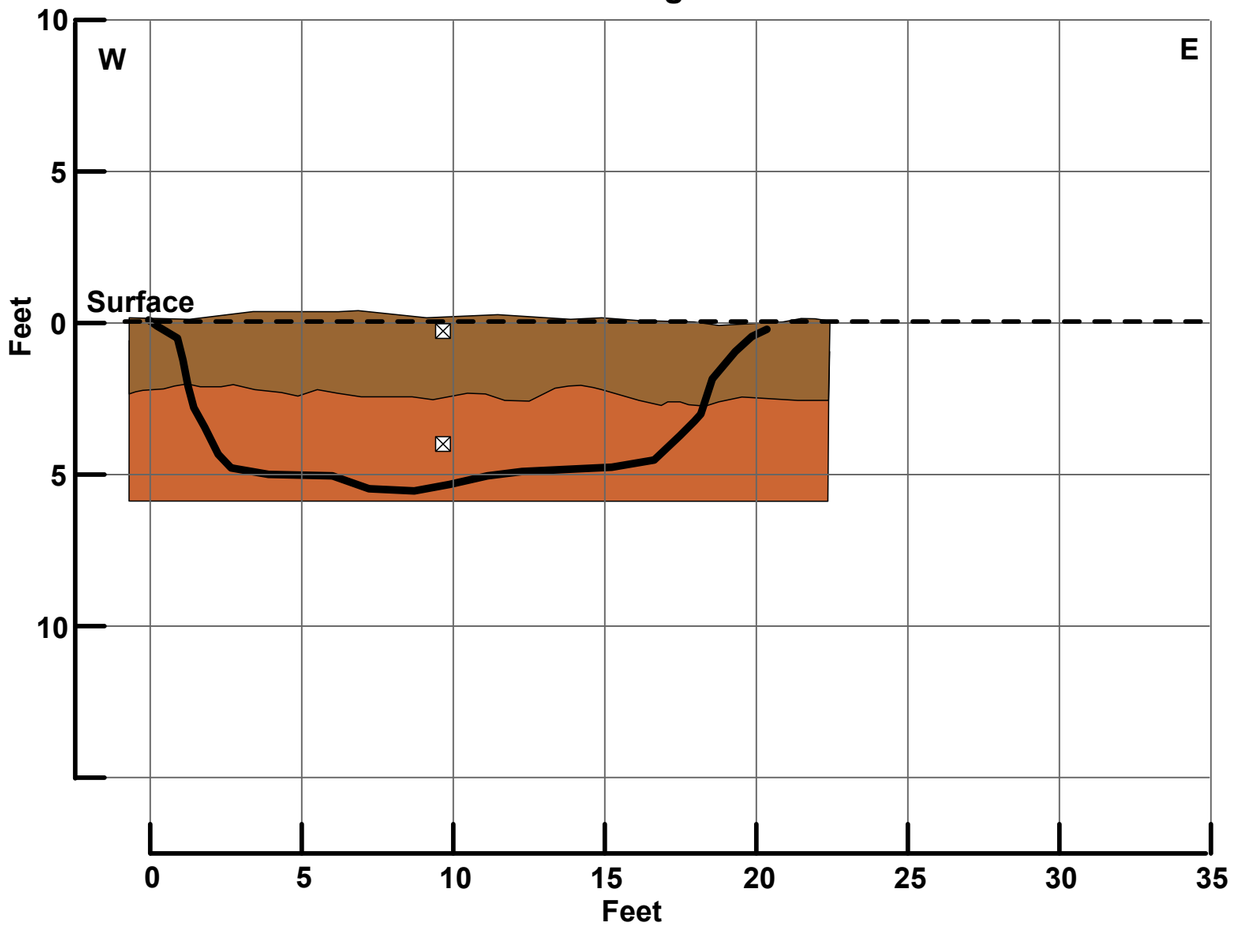
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT1-TP1 TRENCH LOG

Trench Profile DT1-TP2
View Looking North



Samples

010MBDA-TP05
(0.0-0.5 ft bgs)

010MBDA-TP06
(3.0-4.0 ft bgs)

Debris Content

N/A

Total Depth

5 feet below adjacent grade
5 feet below lowest surface grade

Date Excavated:	29 January 2015	**Trench No.:**	DT1-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 1	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, minor organics (rootlets)

Weathered Bedrock (Granite)
Medium to light red brown silty sand/granite, medium to coarse grained, damp to dry at base of test pit, very hard difficult to excavate

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
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MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT1-TP2 TRENCH LOG

4.2 NATURE AND EXTENT OF CONTAMINATION FOR EU 2

The following sections describe the investigation results and provide discussion on the nature and extent of both the munitions-related items and MCs.

4.2.1 Investigation Results and Discussion at EU 2

EU 2 is located in the northwestern portion of MRP Site UXO1 (Figure 4-2) and contains seven suspected Disposal Trenches (DT2 – DT8) that were reportedly used for OB/OD operations. The location of four of the trenches were initially identified during the PA (Malcolm Pirnie 2006). During the SI (ChaduxTt 2010), detailed historical photographic reviews and a geophysical investigation identified a total of seven suspected trenches. Previous sampling during the SI (ChaduxTt 2010) included collection of surface samples at two locations and the completion of four shallow soil borings within the limits of EU 2. Samples were analyzed for metals, explosives, dioxins, and perchlorate. Six items were identified within this area as MDAS by the UXO technicians while conducting the UXO surface sweep. During the RI, the original items found during the SI, along with additional MDAS and MPPEH, were removed during the RI.

A total of nine test pits were excavated at suspected Disposal Trench locations. Trenches containing debris fill were identified in each of the test pits (Test Pit Logs 4-2). Based on measurements from the test pits and the previous geophysical data, the lateral limits of the disposal trenches were redefined as indicated on Figure 4-2. Soil samples were collected at the surface (0 - 0.5 foot bgs), in the central portion of the debris fill (three to six feet bgs), at the debris fill to native contact (ranging from four to eight feet bgs), and approximately two feet below the fill in undisturbed bedrock (weathered granite).

4.2.2 Extent of MPPEH and MC at EU 2

Debris fill within the test pits contained an abundance of scrap metal (target frames, straps, small containers, sheet metal, wire, and pipes), fused metal (metal slag), MDAS (ammunition canisters, flare parts, shell casings, igniters, expended grenade fuzes) and other debris such as wood, burned wood, and burn ash. MPPEH items were recovered from Disposal Trench 2, Test Pit 1 (incendiary bomb components [thermite]), Test Pit 2 (ammunition canisters and shipping container), as well as Disposal Trench 7 (expended grenade fuze). The tailings were spread out adjacent to the test pit to a thickness no greater than one foot. After the UXO team had completed their detector-aided screening of the material and removal of MPPEH, MDAS and scrap metal items, soil samples were collected from the excavation tailings.

The debris fill was observed at depths ranging from four to eight feet bgs. In most test pits, the debris fill was covered with one to two feet of relatively clean fill, which is now a well-developed topsoil horizon. The lateral limits of the test pits suggest that some of the OB/OD activities were conducted in shallow natural drainages, whereas in some trenches (Disposal Trench 2 and Disposal Trench 4), the lateral walls were near-vertical, suggesting that mechanical excavation of the disposal trenches also occurred. Evidence of burning within the trenches and of the trench sidewalls, such as baked contacts with the adjacent native soil, was observed. Abundant metal

slag, concrete, and other metal debris was observed on the surface throughout the area, with the highest concentration in the vicinity of the southern portion of Disposal Trench 2 and south of Disposal Trench 3. It is likely that this material represents kick-out from the OB/OD operations.

Due to the abundance of metal debris, processing and logging of these disposal trenches progressed very slowly. The volume of debris observed ranged from 35 to up to 75 percent of the material volume with a majority of that being scrap metal and MDAS. The test pit logs and photographic logs following the text of this section provide a visual representation of the material observed in the test pits.

Analytical results indicate trinitrotoluene was detected in Disposal Trench 8 at the surface with a concentration of 1.60 mg/kg, which was the maximum concentration detected at MRP Site UXO1 but well below the residential screening level of 21 mg/kg. Concentrations of arsenic and dioxins that exceed human health screening levels are present in the surficial soils (0 to 0.5 foot bgs) and debris fill (four to eight feet bgs) within the Disposal Trenches. Arsenic was detected in all samples at concentrations of 1.17 to 6.31 mg/kg that exceed the human health screening level of 0.0620 mg/kg; cadmium exceeded the human health screening level (4.58 mg/kg) with results of 5.90 mg/kg (DT2-TP1 7.5 to 8.0 feet bgs), 19.2 mg/kg (DT4-TP1 four to eight feet bgs), 9.83 mg/kg (DT4-TP1 seven to eight feet bgs); iron exceeded the human health screening level 55,000 mg/kg with results of 66,600 mg.kg (DT2-TP1) and 56,700 mg/kg (DT7-TP1); lead was detected at a concentration of 90.7 mg/kg in DT4-TP1 at seven to eight bgs, 14,300 mg/kg in DT7-TP1 at two to three feet bgs, and 249 mg/kg directly below that at a depth of four to five feet bgs; Disposal Trench 8 also yielded a concentration of lead (325 mg/kg) at a depth of three to four feet bgs; the dioxin TEQ (humans/mammals) screening level of 4.90 ng/kg was exceeded in Disposal Trench 5, TP-1 at a depth of three to four feet bgs with a concentration of 5.05 ng/kg; Disposal Trench 7, TP-1 at depth of two to three feet bgs and four to five feet bgs with results of 8.45 and 6.55 ng/kg, respectively; and also in Disposal Trench 8, TP-1 at a depth of three to four feet bgs with a concentration of 10.9 ng/kg. Results from the deepest samples, ranging from 8 to 10 feet bgs, collected from the granite bedrock below the debris fill, yielded no elevated concentrations of the above-mentioned metals, indicating that there has not been vertical migration of the detected metals from the disposal trenches. There were no TPH-d, VOCs, SVOCs, explosives, PCP, white phosphorous, or hydrazine detected above screening levels within EU 2. Further discussion of the above mentioned metals and dioxins regarding their associated risks are provided in Section 4.2.3 and 4.2.4 below. A summary of soil analytical results compared with screening criteria and exceedances for EU 2 are provided at the end of this section, respectively (Tables 4-2A and 4-2B).

4.2.3 Human Health Risk Assessment Findings

4.2.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 4E-09 for federal toxicity criteria and 8E-09 for State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.0003 for federal toxicity criteria and 0.0006 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 2 is 52.9 mg/kg. This concentration

is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 2.

4.2.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 2E-07 for federal toxicity criteria and 4E-07 for State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.02 for federal toxicity criteria and 0.03 for State of California toxicity values. No chemical risk drivers were identified in surface soil for the future industrial worker at EU 2.

The estimated cancer risk from exposure to subsurface soil is 6E-07 for the federal toxicity values and 2E-06 for the State of California toxicity values. Most of the estimated cancer risk using State of California toxicity values is associated with incidental ingestion of, and dermal contact with, **arsenic** in subsurface soil. The noncancer HI from exposure to subsurface soil is 0.08 for federal toxicity criteria and 0.2 for State of California toxicity values. The maximum detected concentrations of lead in subsurface soil at EU 2 is 14,300 mg/kg. The mean concentration of lead in subsurface soil at is 1,695 mg/kg. This concentration is greater than the risk-based screening level of 320 mg/kg for industrial soil. Based on this comparison, lead is identified as a COC for the future industrial worker at EU 2. **Arsenic** (State of California toxicity only) is identified as a risk driver in subsurface soil for the future industrial worker at EU 2 for.

4.2.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 1E-07 for the federal toxicity values and 4E-07 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.3 for federal toxicity criteria and 0.8 for State of California toxicity values. The maximum detected concentration of **lead** in subsurface soil at EU 2 is 14,300 mg/kg. The mean concentration of lead in subsurface soil at is 1,695 mg/kg. This concentration is greater than the risk-based screening level of 39 mg/kg for a future construction worker. Based on this comparison, lead is identified as a COC for the future construction worker at EU 2.

4.2.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 8E-07 for federal toxicity criteria and 1E-06 for State of California toxicity criteria. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.2 for federal toxicity criteria and 0.3 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 2 is 52.9 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. No chemical risk drivers were identified in surface soil for the future resident at EU 2.

The estimated cancer risk from exposure to subsurface soil is 2E-06 for federal toxicity criteria and 8E-06 for State of California toxicity criteria. Most of the estimated cancer risk is associated

with incidental ingestion of, and dermal contact with, **arsenic** and **dioxins** in subsurface soil. The estimated HI for subsurface soil is 0.5 for federal toxicity criteria and 2 for State of California toxicity values. The maximum detected concentrations of lead in subsurface soil at EU 2 is 14,300 mg/kg. The mean concentration of lead in subsurface soil at is 1,695 mg/kg. This concentration is greater than the risk-based screening level of 80 mg/kg for residential soil. **Arsenic** and **Dioxins and lead** are identified as COCs in subsurface soil for the future resident at EU 2.

However, if the location of the maximum detected lead concentration is considered a "hotspot" and removed from the data set as an outlier, then the maximum concentration is reduced to 325 mg/kg and the 95 UCL is reduced to 76.6 mg/kg. The 95 UCL (after a potential hotspot removal) is 76.6 mg/kg which is less than the OEHHA residential and industrial soil screening levels (Cal/EPA 2009) of 80 mg/kg and 320 mg/kg. Thus, lead would be below a level of concern for subsurface soil after hotspot removal at sample 010MBDA-TP34 (Disposal Trench 7 Test Pit 1) at sample depth two to three feet bgs.

The table below provides a summary of the human health risk assessment findings for EU 2:

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
2	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Arsenic [c] Lead	Lead	Arsenic [c] Dioxins Lead

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
c Based on State of California toxicity values only.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.2.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 2 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.2.4.1 Results of the Step 2 SLERA for EU 2

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 2:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 2	COPECs without Benchmarks or TRVs
Plants	antimony, barium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, vanadium, zinc	strontium, dioxins, perchlorate
Invertebrates	chromium , zinc	cobalt, molybdenum, silver, thallium, vanadium, dioxins, perchlorate
Birds	cadmium*, chromium, copper, lead, nickel, zinc, trinitrotoluene (TNT)	antimony, beryllium, thallium, perchlorate
Non-Burrowing Mammals	antimony, barium, cadmium, copper, lead, nickel, selenium, vanadium, zinc, TNT*	perchlorate
Burrowing Mammals	barium*, cadmium, copper, lead, molybdenum, nickel, zinc, TNT*	perchlorate

Note:

* Indicates COPEC is a risk driver (has an HQ greater than 1 using the high TRV).

In summary, the SLERA indicates that maximum concentrations of several metals pose potential or potentially significant risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.2.4.2 Results of the Step 3a Risk Refinement for EU 2

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **supports** an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, lead (in Disposal Trench 7), and zinc (in Disposal Trenches 4 and 7) were identified as posing risk to plants. Cadmium were

identified as posing risk to insectivorous birds. Therefore, chemicals in soil at EU 2 may pose unacceptable risk to ecological receptors and warrant further evaluation. The table below presents a summary of the ERA results:

Exposure Unit	Chemicals of Ecological Concern Identified after the Step 3a Risk Refinement				
	Receptor Group and Depth Interval				
	Plants	Invertebrates	Birds	Non-Burrowing Mammals	Burrowing Mammals
	(0-6 feet bgs)	(0-0.5 feet bgs)	(0-0.5 feet bgs)	(0-0.5 feet bgs)	(0-6 feet bgs)
2	lead (Disposal Trench 7) zinc (Disposal Trenches 4 and 7)	--	cadmium	--	--

Notes:
-- No chemicals require further evaluation for the receptor group
bgs Below ground surface

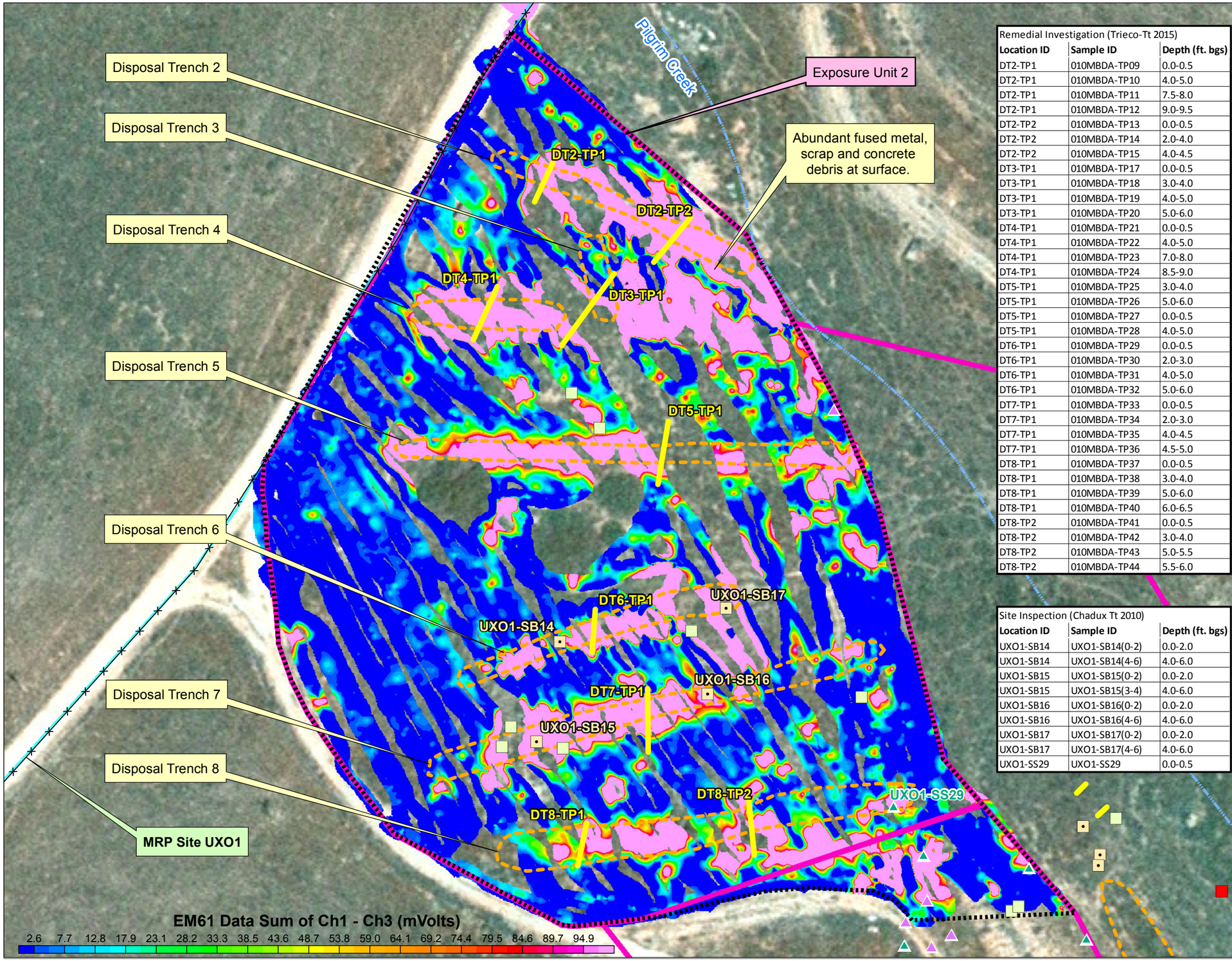
4.2.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 2:

- A total of seven Disposal Trenches were identified during the investigation. Up to 70 percent of the trench fill was debris consisting of MPPEH, MDAS, scrap metal, and metal slag.
- All of the trenches were covered with one to two feet of fill or topsoil.
- A significant amount of metal debris (fused metal of slag) was observed at the surface within the area. The highest concentration located south of Disposal Trenches 2 and 3. This material likely represents “kick-out” from the OB/OD operations.
- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected at concentrations that exceed initial screening levels.
- The HHRA indicates that arsenic and lead are a risk drivers for subsurface soils under industrial worker scenario, and in the subsurface under a construction worker scenario. Arsenic, dioxins and lead are risk drivers for future residents in subsurface soil. The arsenic cancer risk is within the risk management decision range, however the mean lead concentration exceeds the RBSL.
- The ERA Step 3a refinement indicates that lead and zinc are COECs for plants to a depth of six feet and, at the surface, cadmium is a risk drivers for birds.

- Analytical data indicates that COCs identified are not migrating vertically into the underlying bedrock material.
- Based on the above, further response action should be considered in the FS due to the possible presence of MEC/MPPEH, lead in the subsurface and ecological receptors.

SECTION 4.2 FIGURES

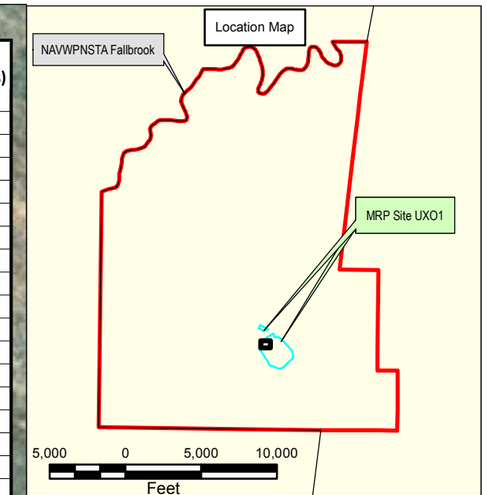


Remedial Investigation (Trieco-Tt 2015)

Location ID	Sample ID	Depth (ft. bgs)
DT2-TP1	010MBDA-TP09	0.0-0.5
DT2-TP1	010MBDA-TP10	4.0-5.0
DT2-TP1	010MBDA-TP11	7.5-8.0
DT2-TP1	010MBDA-TP12	9.0-9.5
DT2-TP2	010MBDA-TP13	0.0-0.5
DT2-TP2	010MBDA-TP14	2.0-4.0
DT2-TP2	010MBDA-TP15	4.0-4.5
DT3-TP1	010MBDA-TP17	0.0-0.5
DT3-TP1	010MBDA-TP18	3.0-4.0
DT3-TP1	010MBDA-TP19	4.0-5.0
DT3-TP1	010MBDA-TP20	5.0-6.0
DT4-TP1	010MBDA-TP21	0.0-0.5
DT4-TP1	010MBDA-TP22	4.0-5.0
DT4-TP1	010MBDA-TP23	7.0-8.0
DT4-TP1	010MBDA-TP24	8.5-9.0
DT5-TP1	010MBDA-TP25	3.0-4.0
DT5-TP1	010MBDA-TP26	5.0-6.0
DT5-TP1	010MBDA-TP27	0.0-0.5
DT5-TP1	010MBDA-TP28	4.0-5.0
DT6-TP1	010MBDA-TP29	0.0-0.5
DT6-TP1	010MBDA-TP30	2.0-3.0
DT6-TP1	010MBDA-TP31	4.0-5.0
DT6-TP1	010MBDA-TP32	5.0-6.0
DT7-TP1	010MBDA-TP33	0.0-0.5
DT7-TP1	010MBDA-TP34	2.0-3.0
DT7-TP1	010MBDA-TP35	4.0-4.5
DT7-TP1	010MBDA-TP36	4.5-5.0
DT8-TP1	010MBDA-TP37	0.0-0.5
DT8-TP1	010MBDA-TP38	3.0-4.0
DT8-TP1	010MBDA-TP39	5.0-6.0
DT8-TP1	010MBDA-TP40	6.0-6.5
DT8-TP2	010MBDA-TP41	0.0-0.5
DT8-TP2	010MBDA-TP42	3.0-4.0
DT8-TP2	010MBDA-TP43	5.0-5.5
DT8-TP2	010MBDA-TP44	5.5-6.0

Site Inspection (Chadux Tt 2010)

Location ID	Sample ID	Depth (ft. bgs)
UXO1-SB14	UXO1-SB14(0-2)	0.0-2.0
UXO1-SB14	UXO1-SB14(4-6)	4.0-6.0
UXO1-SB15	UXO1-SB15(0-2)	0.0-2.0
UXO1-SB15	UXO1-SB15(3-4)	4.0-6.0
UXO1-SB16	UXO1-SB16(0-2)	0.0-2.0
UXO1-SB16	UXO1-SB16(4-6)	4.0-6.0
UXO1-SB17	UXO1-SB17(0-2)	0.0-2.0
UXO1-SB17	UXO1-SB17(4-6)	4.0-6.0
UXO1-SS29	UXO1-SS29	0.0-0.5



MRP Site UXO1 Boundary
Drainage Channel (Approximate)
Range Fencing
Exposure Unit Boundaries
2010 SI Geophysical Survey Area (ChaduxTt)
Disposal Trench Limits (Approximate)
MDAS (Removed)
MPPEH (Removed)
RI Soil Sample Location (2015)
SI Soil Sample Location (2010)
SI Soil Boring Sample Location (2010)
Test Pit

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

25 0 25 50
Feet

TriEco Tt
A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 4-2
Exposure Unit 2 Features and Sample Locations
MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_2_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.2 TABLES

TABLE 4-2A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 2

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 8	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
DIESEL RANGE ORGANICS	1/16	23.0	23.0	DT3-TP1	4.00 - 5.00	--	--	--	0	0	--	--	96	440	--	--
MOTOR OIL RANGE ORGANICS	5/16	67.0	12.0 J	DT8-TP1	3.00 - 4.00	--	28.08	27	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 8	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	46/46	19,800	7,270	DT2-TP1	4.00 - 5.00	11,768	12,000	12,372	0	0	46	5	77,000	1,100,000	50 +	14,710
ANTIMONY	34/46	13.6	0.113 J	DT7-TP1	2.00 - 3.00	2.575	3.601	3.281	0	0	24	--	31	470	0.27	--
ARSENIC	46/46	6.31	1.17	DT7-TP1	2.00 - 3.00	1.708	2.359	2.359	46	46	0	5	0.062	0.25 #	18	3.105
BARIUM	46/46	1,530	51.1	DT2-TP1	4.00 - 5.00	157.4	353.4	409.1	0	0	6	13	15,000	220,000	330	200.5
BERYLLIUM	46/46	0.461 J	0.167 J	DT8-TP2	5.50 - 6.00	0.291	0.282	0.281	0	0	0	3	15.2	183 #	21	0.359
CADMIUM	45/46	19.2	0.122 J	DT4-TP1	4.00 - 5.00	0.89	3.081	3.445	3	2	20	40	4.58	6.37 #	0.36	0.158
CALCIUM	46/46	5,180	633	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	46/46	31.1	8.78	DT7-TP1	2.00 - 3.00	11.61	14.36	14.69	0	0	2	4	100,000	100,000 *	26	20.3
COBALT	46/46	13.7	3.24	DT8-TP2	5.50 - 6.00	6.217	6.9	6.971	0	0	1	3	23	350	13	9.39
COPPER	46/46	956	3.61	DT2-TP1	4.00 - 5.00	20.22	176.5	181.7	0	0	14	26	3,100	47,000	28	7.785
IRON	46/46	66,600	11,500	DT2-TP1	4.00 - 5.00	17,210	23,970	24,866	2	0	--	7	55,000	100,000 *	--	27,350
LEAD	46/46	14,300	2.65	DT7-TP1	2.00 - 3.00	26	1,898	1,695	5	2	18	33	80	320 #	11	4.328
MAGNESIUM	46/46	5,830	1,670	DT4-TP1	8.50 - 9.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	46/46	644	74.6	DT7-TP1	2.00 - 3.00	249.4	274.7	277.8	0	0	31	9	1,800	26,000	220	304
MERCURY	17/46	0.116	0.0113 J	UXO1-SB15	3.00 - 4.00	0.0158	0.0249	0.0258	0	0	1	--	23	350	0.1 +	--
MOLYBDENUM	34/35	5.39	0.117 J	DT2-TP1	4.00 - 5.00	--	2.32	1.821	0	0	5	13	390	5,800	2 +	0.524
NICKEL	46/46	57.3	2.27	DT2-TP1	4.00 - 5.00	4.43	15.65	15.83	0	0	2	19	1,500	22,000	38	5.15

TABLE 4-2A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
POTASSIUM	46/46	5,090	994	DT4-TP1	8.50 - 9.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	42/46	0.656	0.0602 J	UXO1-SB16	0.00 - 2.00	0.141	0.22	0.206	0	0	2	--	390	5,800	0.52	--
SILVER	22/46	37.5	0.0569 J	DT2-TP1	4.00 - 5.00	0.406	2.972	5.318	0	0	2	--	390	4,700	4.2	--
SODIUM	30/46	502	46.7 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	8/8	19.1	8.11 J	UXO1-SB16	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	35/46	0.475 J	0.181 J	DT4-TP1	8.50 - 9.00	0.272	0.258	0.272	0	0	0	0	0.78	12	1 +	0.552
VANADIUM	46/46	67.1	31.2	DT4-TP1	8.50 - 9.00	48.28	46	47.38	0	0	46	0	390	5,800	7.8	96.4
ZINC	46/46	2,690	18.3	DT4-TP1	4.00 - 5.00	133.2	698.6	644.3	0	0	22	22	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	26/29	146	1.23 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	23/29	47.4 J	1.05 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	4/29	0.830 J	0.586 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	14/29	3.45	0.0642 J	DT7-TP1	2.00 - 3.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	20/29	1.74 J	0.0955 J	DT7-TP1	4.00 - 4.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	17/29	18.1	0.516 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	11/29	1.49 J	0.143 J	DT5-TP1,	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	17/29	10.8	0.290 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	2/29	0.189 J	0.132 J	DT2-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	12/29	3.52	0.0711 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	15/29	1.72 J	0.0784 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	13/29	1.90 J	0.163 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	18/29	2.75 J	0.0650 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	10/29	0.908	0.0923 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	12/29	3.74 J	0.0912 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDD	27/29	676 J	8.13 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDF	19/29	47.6	3.76 J	UXO1-SB15	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-DIOXINS	2/2	86.9	13.2	UXO1-SB15	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-2A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HEPTA-FURANS	2/2	40.9	8.07	UXO1-SB15	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-DIOXINS	2/2	6.30	1.28	UXO1-SB15	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-FURANS	1/2	2.29	2.29	UXO1-SB15	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	27/27	295	1.46 J	DT7-TP1	2.00 - 3.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	25/27	99.4 J	0.155 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	25/27	142	0.168 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	27/27	38.7	0.0396 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	17/27	40.1	0.134 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	21/27	23.3 J	0.119 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	1/2	0.486	0.486	UXO1-SB17	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	10/27	17.5	0.0992 J	DT8-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	16/29	61.5 J	0.129 J	DT5-TP1	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	27/29	10.9	0.106	DT8-TP1	3.00 - 4.00	--	5.2158	5.03	4	0	25	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	27/29	10.9	0.142	DT8-TP1	3.00 - 4.00	--	6.3457	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
2,4,6-TRINITROTOLUENE	2/46	1.60	0.310 J	DT8-TP1	0.00 - 0.50	--	--	--	0	0	0	--	21	96	8 &	--
PERCHLORATE	32/43	0.0385	0.000370	DT8-TP1	6.00 - 6.50	--	0.00276	0.00472	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
None Detected	0/ 31	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Percent Moisture (%)																
PERCENT MOISTURE	43/43	20.9	2.30	DT8-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-2A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 2

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-2A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 2

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	10,800	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,800	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	17,100	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,600	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,490 J	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,500 J	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300 J	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,470 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,290 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,520 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,500	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,700	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,700	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,600	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,760	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,000	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,690	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,600	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,740	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,960	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,870	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,200	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,300	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,800	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	14,400	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,900	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,860	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,000	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,600	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,270	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,970	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,860	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,820	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,830	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,100	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,700	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,460	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	114	77,000	1,100,000	**50.0**	14,700
ANTIMONY	1.76 J	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	31.0	470	**0.270**	NC
ANTIMONY	0.372 J	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	31.0	470	**0.270**	NC
ANTIMONY	0.928 J	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	31.0	470	**0.270**	NC
ANTIMONY	0.364 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	0.978 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	31.0	470	**0.270**	NC
ANTIMONY	0.523 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	31.0	470	**0.270**	NC
ANTIMONY	0.535 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	31.0	470	**0.270**	NC
ANTIMONY	0.776 J	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	31.0	470	**0.270**	NC
ANTIMONY	0.616 J	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.393 J	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	31.0	470	**0.270**	NC
ANTIMONY	6.87 J	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	31.0	470	**0.270**	NC
ANTIMONY	0.407 J	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	31.0	470	**0.270**	NC

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ANTIMONY	4.03	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	31.0	470	**0.270**	NC
ANTIMONY	13.6	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	5.50	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.421 J	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	31.0	470	**0.270**	NC
ANTIMONY	0.295 J	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	12.7	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	31.0	470	**0.270**	NC
ANTIMONY	4.41	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	0.725	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	31.0	470	**0.270**	NC
ANTIMONY	0.688	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	31.0	470	**0.270**	NC
ANTIMONY	2.25	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	31.0	470	**0.270**	NC
ANTIMONY	0.321 J	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	31.0	470	**0.270**	NC
ANTIMONY	0.960 J	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	1.12	31.0	470	**0.270**	NC
ARSENIC	1.42	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.76	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.48	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.72	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.94	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.77	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.22	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.38	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.07	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.23	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.03	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.28	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.527	**0.0620**	**0.250**	18.0	3.11

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.17	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.50	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.58	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.61	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.518	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	6.31	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.89	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.39	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.56	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.60	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.47	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.63	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.88	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.11	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.86 J	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.24 J	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	5.49	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.29 J	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	5.54	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.14 J	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	5.61	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.52 J	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	5.54	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.96 J	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	5.52	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.75 J	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	5.77	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66 J	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	5.59	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.25 J	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	5.53	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60 J	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81 J	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	5.68	**0.0620**	**0.250**	18.0	3.11

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
BARIUM	1,530	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	2.63	15,000	220,000	**330**	201
BARIUM	403	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	15,000	220,000	**330**	201
BARIUM	1,440	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	2.61	15,000	220,000	**330**	201
BARIUM	409 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	15,000	220,000	**330**	201
BARIUM	581	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	15,000	220,000	**330**	201
BARIUM	439	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	5.54	15,000	220,000	**330**	201
CADMIUM	1.06	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	4.58	6.37	**0.360**	0.158
CADMIUM	4.41	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	4.58	6.37	**0.360**	0.158
CADMIUM	5.90	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	**4.58**	6.37	**0.360**	0.158
CADMIUM	2.76	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	4.58	6.37	**0.360**	0.158
CADMIUM	1.25	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	4.58	6.37	**0.360**	0.158
CADMIUM	2.01	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	4.58	6.37	**0.360**	0.158
CADMIUM	0.588	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	4.58	6.37	**0.360**	0.158
CADMIUM	0.611	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	4.58	6.37	**0.360**	0.158
CADMIUM	1.35	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	4.58	6.37	**0.360**	0.158
CADMIUM	0.640	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	4.58	6.37	**0.360**	0.158
CADMIUM	19.2	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	9.83	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	2.52	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	4.58	6.37	**0.360**	0.158
CADMIUM	0.786	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	4.58	6.37	**0.360**	0.158
CADMIUM	0.722	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	4.58	6.37	**0.360**	0.158
CADMIUM	1.88	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	4.58	6.37	**0.360**	0.158
CADMIUM	0.665	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	4.58	6.37	**0.360**	0.158
CADMIUM	0.562	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	4.58	6.37	**0.360**	0.158
CADMIUM	0.530 J	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	4.58	6.37	**0.360**	0.158
CADMIUM	0.737	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	0.561	4.58	6.37	**0.360**	0.158
CHROMIUM	30.6	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	100,000	100,000	**26.0**	20.3
CHROMIUM	31.1	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	100,000	100,000	**26.0**	20.3
COBALT	13.7	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	23.0	350	**13.0**	9.39

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
COPPER	956	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	3,100	47,000	**28.0**	7.79
COPPER	202	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	3,100	47,000	**28.0**	7.79
COPPER	474	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	3,100	47,000	**28.0**	7.79
COPPER	91.3 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	3,100	47,000	**28.0**	7.79
COPPER	29.7	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	3,100	47,000	**28.0**	7.79
COPPER	37.6	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	3,100	47,000	**28.0**	7.79
COPPER	33.0	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	3,100	47,000	**28.0**	7.79
COPPER	56.9	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	3,100	47,000	**28.0**	7.79
COPPER	41.6	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	3,100	47,000	**28.0**	7.79
COPPER	547	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	3,100	47,000	**28.0**	7.79
COPPER	96.0	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	3,100	47,000	**28.0**	7.79
COPPER	48.2	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	3,100	47,000	**28.0**	7.79
COPPER	67.1	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.21	3,100	47,000	**28.0**	7.79
COPPER	247	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.24	3,100	47,000	**28.0**	7.79
IRON	66,600	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	527	**55,000**	100,000	NC	27,400
IRON	56,700	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	107	**55,000**	100,000	NC	27,400
LEAD	25.5	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	80.0	320	**11.0**	4.33
LEAD	13.1	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	80.0	320	**11.0**	4.33
LEAD	20.9	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	80.0	320	**11.0**	4.33
LEAD	20.8	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	80.0	320	**11.0**	4.33
LEAD	73.1	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	80.0	320	**11.0**	4.33
LEAD	90.7	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**80.0**	320	**11.0**	4.33
LEAD	17.7	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	80.0	320	**11.0**	4.33
LEAD	244	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	**80.0**	320	**11.0**	4.33
LEAD	20.9	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	80.0	320	**11.0**	4.33
LEAD	52.9	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	80.0	320	**11.0**	4.33
LEAD	14,300	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	10.7	**80.0**	**320**	**11.0**	4.33
LEAD	249	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	**80.0**	320	**11.0**	4.33
LEAD	24.6	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	80.0	320	**11.0**	4.33

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
LEAD	325	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	**80.0**	**320**	**11.0**	4.33
LEAD	44.6	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	80.0	320	**11.0**	4.33
LEAD	18.0	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.21	80.0	320	**11.0**	4.33
LEAD	50.2	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.24	80.0	320	**11.0**	4.33
LEAD	13.7	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	2.31	80.0	320	**11.0**	4.33
MANGANESE	244	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	1,800	26,000	**220**	304
MANGANESE	490	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	1,800	26,000	**220**	304
MANGANESE	247	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	1,800	26,000	**220**	304
MANGANESE	338	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	1,800	26,000	**220**	304
MANGANESE	251	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	1,800	26,000	**220**	304
MANGANESE	270	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	1,800	26,000	**220**	304
MANGANESE	237	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	1,800	26,000	**220**	304
MANGANESE	262	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	1,800	26,000	**220**	304
MANGANESE	248	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	1,800	26,000	**220**	304
MANGANESE	274	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	1,800	26,000	**220**	304
MANGANESE	378	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	1,800	26,000	**220**	304
MANGANESE	341	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	1,800	26,000	**220**	304
MANGANESE	302	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	1,800	26,000	**220**	304
MANGANESE	387	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	1,800	26,000	**220**	304
MANGANESE	260	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	1,800	26,000	**220**	304
MANGANESE	339	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	1,800	26,000	**220**	304
MANGANESE	232	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	1,800	26,000	**220**	304
MANGANESE	245	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	271	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	1,800	26,000	**220**	304
MANGANESE	644	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	260	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	1,800	26,000	**220**	304
MANGANESE	239	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	1,800	26,000	**220**	304
MANGANESE	355	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	1,800	26,000	**220**	304
MANGANESE	224	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	1,800	26,000	**220**	304

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	235	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	1,800	26,000	**220**	304
MANGANESE	244	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	1,800	26,000	**220**	304
MANGANESE	324	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	281	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.77	1,800	26,000	**220**	304
MANGANESE	275	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.81	1,800	26,000	**220**	304
MANGANESE	227	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	2.77	1,800	26,000	**220**	304
MANGANESE	238	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	2.76	1,800	26,000	**220**	304
MERCURY	0.116	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	0.112	23.0	350	**0.100**	NC
MOLYBDENUM	5.39	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	5,800	**2.00**	0.524
MOLYBDENUM	3.16	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	5,800	**2.00**	0.524
MOLYBDENUM	3.13	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	390	5,800	**2.00**	0.524
MOLYBDENUM	2.07	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	390	5,800	**2.00**	0.524
MOLYBDENUM	4.43	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**2.00**	0.524
NICKEL	57.3	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	1,500	22,000	**38.0**	5.15
NICKEL	43.2	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	1,500	22,000	**38.0**	5.15
SELENIUM	0.571	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**0.520**	NC
SELENIUM	0.656	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	0.554	390	5,800	**0.520**	NC
SILVER	37.5	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	4,700	**4.20**	NC
SILVER	16.3	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	4,700	**4.20**	NC
VANADIUM	40.1	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	33.1	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	47.3	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	390	5,800	**7.80**	96.4
VANADIUM	57.1	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	5,800	**7.80**	96.4
VANADIUM	31.2	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	39.5	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	44.6	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	58.4	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	36.1	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	38.0	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	390	5,800	**7.80**	96.4

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	37.1	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	390	5,800	**7.80**	96.4
VANADIUM	46.6	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	390	5,800	**7.80**	96.4
VANADIUM	40.6	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	390	5,800	**7.80**	96.4
VANADIUM	60.4	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	67.1	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	390	5,800	**7.80**	96.4
VANADIUM	54.0	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	58.8	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	32.5	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	44.0	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	40.1	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	390	5,800	**7.80**	96.4
VANADIUM	38.6	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	38.9	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.518	390	5,800	**7.80**	96.4
VANADIUM	41.7	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	38.7	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	43.9	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	40.2	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	36.3	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	41.2	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	43.9	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	64.7	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	47.2	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	48.3	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	390	5,800	**7.80**	96.4
VANADIUM	40.8	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	55.4	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	61.0	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	52.3	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4
VANADIUM	32.0	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	1.10	390	5,800	**7.80**	96.4
VANADIUM	33.4	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4
VANADIUM	38.3	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	1.12	390	5,800	**7.80**	96.4

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	39.3	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4
VANADIUM	48.1	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	1.10	390	5,800	**7.80**	96.4
VANADIUM	47.0	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	1.15	390	5,800	**7.80**	96.4
VANADIUM	45.2	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	1.12	390	5,800	**7.80**	96.4
VANADIUM	35.1	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	52.1	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	57.9	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	1.14	390	5,800	**7.80**	96.4
ZINC	79.7	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	2.63	23,000	350,000	**46.0**	50.1
ZINC	57.3	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	2.61	23,000	350,000	**46.0**	50.1
ZINC	121 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	2.64	23,000	350,000	**46.0**	50.1
ZINC	137 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	2.61	23,000	350,000	**46.0**	50.1
ZINC	124 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	2.56	23,000	350,000	**46.0**	50.1
ZINC	2,690	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	13.0	23,000	350,000	**46.0**	50.1
ZINC	395	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	2.59	23,000	350,000	**46.0**	50.1
ZINC	380	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	2.55	23,000	350,000	**46.0**	50.1
ZINC	464	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	69.5	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	646	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	254	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	2.66	23,000	350,000	**46.0**	50.1
ZINC	2,660	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	1,040	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	2.60	23,000	350,000	**46.0**	50.1
ZINC	108	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	2.62	23,000	350,000	**46.0**	50.1
ZINC	338	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	174	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	56.3	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	2.68	23,000	350,000	**46.0**	50.1
ZINC	87.7	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	11.1	23,000	350,000	**46.0**	50.1
ZINC	225	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	11.1	23,000	350,000	**46.0**	50.1
ZINC	1,410	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	11.2	23,000	350,000	**46.0**	50.1
ZINC	99.1	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	11.5	23,000	350,000	**46.0**	50.1

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.500	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.354	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.311	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.913	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.503	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.19	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.94	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	3.63	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.05	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.870	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.280	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.219	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.452	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.318	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.83	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	8.45	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	6.55	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.57	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	10.9	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	4.17	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.529	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.464	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.313	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.06	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.329	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC

TABLE 4-2B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 2 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID	Identification
J	Estimated value
mg/kg	Milligrams per kilogram
NC	No criteria
ng/kg	Nanograms per kilogram
TEQ	Toxicity equivalence quotient

SECTION 4.2 PHOTOGRAPHS

SECTION 4.2 – EXPOSURE UNIT 2 PHOTOGRAPHIC LOG

Photograph 4.2-1
Northwest Trenches Area
Concrete and other Debris in Upper Pilgrim Creek Drainage

Photograph 4.2-2
Northwest Trenches Area
Flare Body Exposed in Pilgrim Creek Drainage

SECTION 4.2 – EXPOSURE UNIT 2 PHOTOGRAPHIC LOG

Photograph 4.2-3
Disposal Trench 2 – Test Pit 1

Photograph 4.2-4
Disposal Trench 2 – Test Pit 1
Fused Metal Slag

Photograph 4.2-5
Disposal Trench Disposal Trench 2 – Test Pit 2

Photograph 4.2-6
Disposal trench 2 – Test Pit 2 Fused Metal from Test Pit 1
Adjacent to Existing Surface Debris (Metal and Concrete)

Photograph 4.2-7
Disposal Trench 2 – Test Pit 2
MPPEH (Bomb Components)

Photograph 4.2-8
Disposal Trench 2 – Test Pit 2
MDAS and Scrap Metal

Photograph 4.2-9
Disposal Trench 3 – Test Pit 1
Metal Debris in Sidewall

Photograph 4.2-10
Disposal Trench 3 – Test Pit 1
Metal Debris

Photograph 4.2-11
Disposal Trench 4 – Test Pit 1
Metal Debris (Aluminum Containers, Pipes, Flare Components)

Photograph 4.2-12
Disposal Trench 4 – Test Pit 1
Metal Debris

Photograph 4.2-13
Disposal Trench 7 – Test Pit 1
Metal Debris and Burned Wood

Photograph 4.2-14
Disposal trench 7 – Test Pit 1
Baked Bedrock Contact with Burned Debris

Photograph 4.2-15
Disposal Trench 7 – Test Pit 1
MDAS (Grenade Fuses, Igniters, Other)

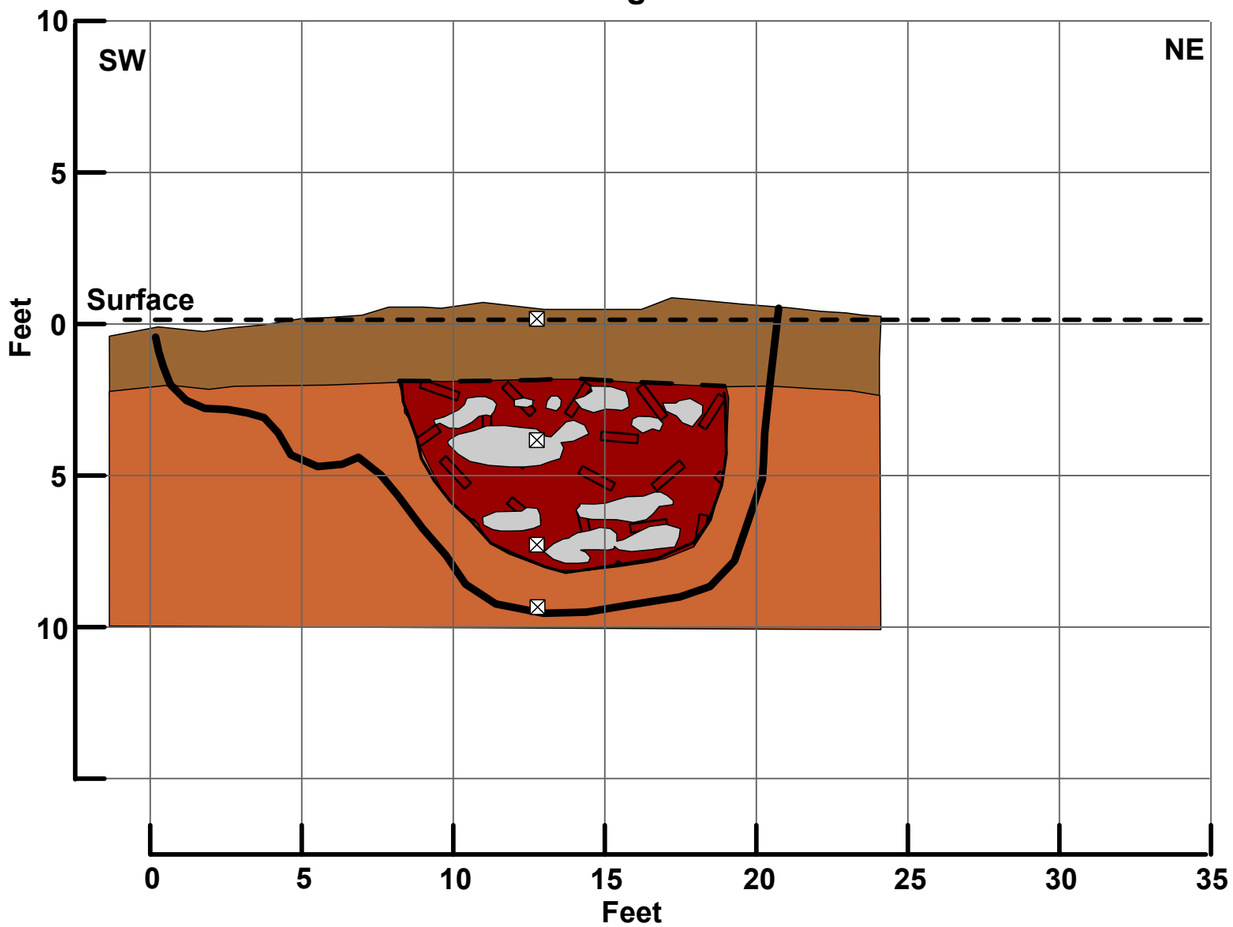
Photograph 4.2-16
Disposal Trench 7 – Test Pit 1
Scrap Metal Debris

Photograph 4.2-17
Disposal Trench 8 – Test Pit 1
Burned Debris Layer

Photograph 4.2-18
Disposal Trench 8 – Test Pit 2
Burned Debris Layer

SECTION 4.2 TEST PIT LOGS

Trench Profile DT2-TP1
View Looking Northwest



Debris Content

MDAS Incendiary bomb components [40–50%] (450 lbs)

MPPEH Incendiary bomb components [5%] (50 lbs)

Scrap Fused metal, scrap, containers, metal straps [20%] (700 lbs)

Total Depth

9 feet below adjacent grade
9 feet below lowest surface grade

Samples

010MBDA-TP09
(0.0-0.5 ft bgs)

010MBDA-TP10
(4.0-5.0 ft bgs)

010MBDA-TP11
(7.5-8.0 ft bgs)

010MBDA-TP12
(9.0-9.5 ft bgs)

Date Excavated:	2 February 2015	**Trench No.:**	DT2-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 2	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, minor organics (rootlets), some metal straps above debris fill

Debris Fill
Medium red-brown silty sand, damp to dry, loose, difficult to excavate due to abundant debris

Large Debris
Metal slag (60%-70%), some scrap metal(10%-15%) metal straps, braces, buckets, nails

MPPEH – 6lbs incendiary bomb pieces (partial).

Weathered Bedrock (Granite)
Medium red-brown granite, damp to dry, upper 2 feet below top soil highly weathered, lower material grey-brown, very dense, difficult to excavate

Limits of Excavation

Geologic Contact (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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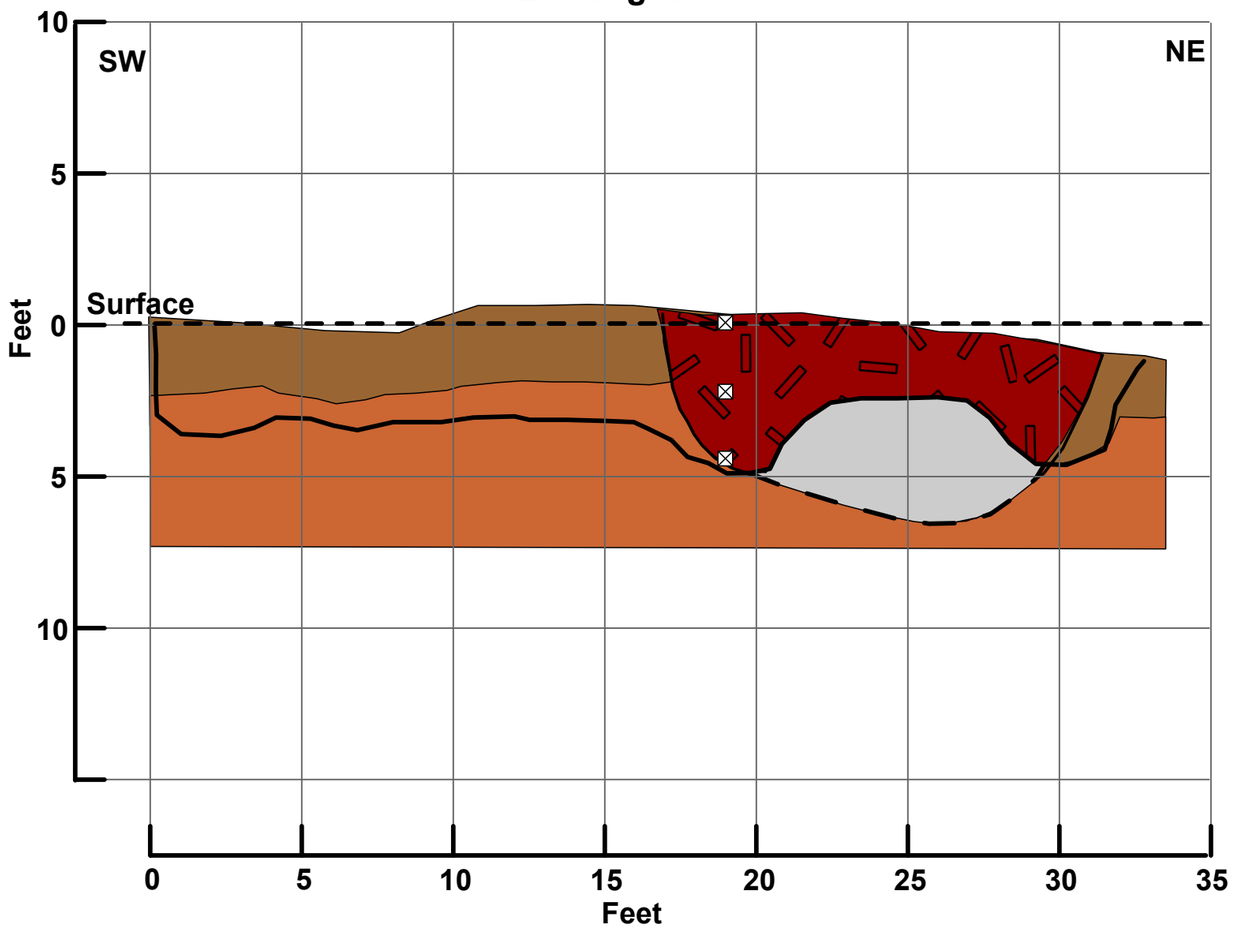
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT2-TP1 TRENCH LOG

Trench Profile DT2-TP2
View Looking Northwest



Samples

010MBDA-TP13
(0.0-0.5 ft bgs)

010MBDA-TP14
(2.0-4.0 ft bgs)

010MBDA-TP15
(4.0-4.5 ft bgs)

Date Excavated: 30 January 2015
Elevation (Ft. MSL):
Excavation Method: CAT 330B Excavator
Location: Disposal Trench 2

Trench No.: DT2-TP2
Logged by: S. Bradley
Project: Fallbrook UXO1
Project No: 103G1959010

Topsoil
Medium brown silty sand, very damp, very loose, some organics (rootlets and roots)

Debris Fill
Medium brown sand with debris, damp, loose, contains large metal debris (steel plates, straps, metal slag), concrete cinder blocks and slabs

Large Debris
Slag debris

Colluvium
Medium red-brown silty sand with some clay, damp to dry, dense to very dense, blocky fracture, rootlets, some caliche.

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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Debris Content

MDAS Abundant metal debris and fused metal [20%] (200 lbs)

MPPEH Magnesium "thermite" bomb components, 21 items [5%] (20 lbs)

Scrap Metal straps, braces, buckets, nails, steel plates, slag [25-30%] (500 lbs)

Other Concrete, cinder blocks [20%] (300 lbs)

Total Depth

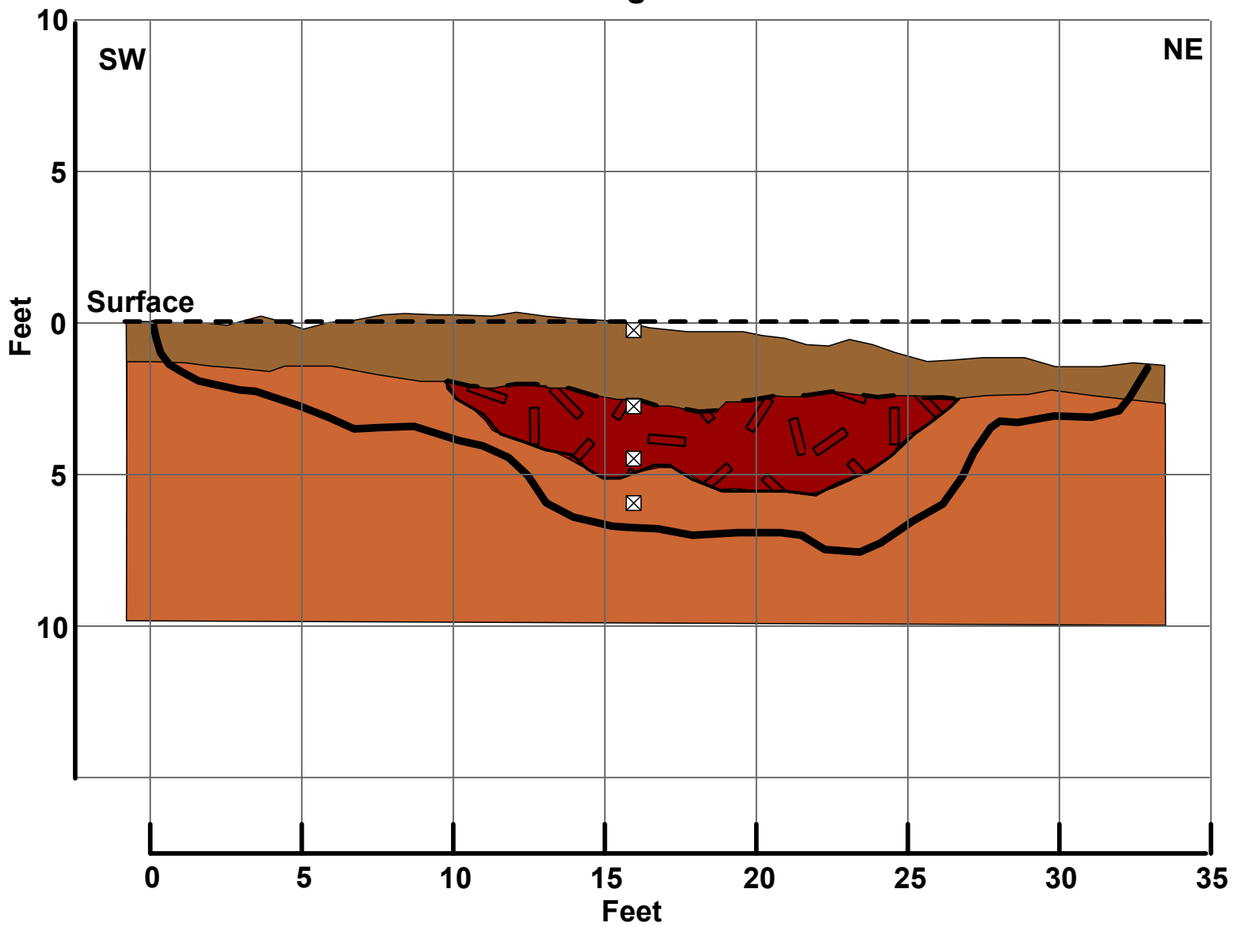
5 feet below adjacent grade
4 feet below lowest surface grade

Note: Expanded DT2-TP2 15 ft west to confirm edge of buried debris

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT2-TP2 TRENCH LOG

Trench Profile DT3-TP1
View Looking Northwest



Debris Content

Scrap Ammunition canisters, aluminum transport containers, galvanized pipe (1”), small arms cartridges [50%] (300 lbs)

Total Depth

6 feet below adjacent grade
5 feet below lowest surface grade

Samples

010MBDA-TP17
(0.0-0.5 ft bgs)

010MBDA-TP18
(3.0-4.0 ft bgs)

010MBDA-TP19
(4.0-5.0 ft bgs)

010MBDA-TP20
(5.0-6.0 ft bgs)

Date Excavated:	30 January 2015	**Trench No.:**	DT3-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 3	**Project No:**	103G1959010

Topsoil
medium brown silty sand, moist, very loose

Debris Fill
medium to bright red brown silty sand with abundant metal debris, damp to dry, very loose.

Colluvium
Light red brown to grey granite, upper contact red brown, dry, very dense, difficult to excavate

Limits of Excavation

Limits of Disposal Trench (Inferred Where Dashed)

Soil Sample

0 5
Feet

One Inch = Five Feet

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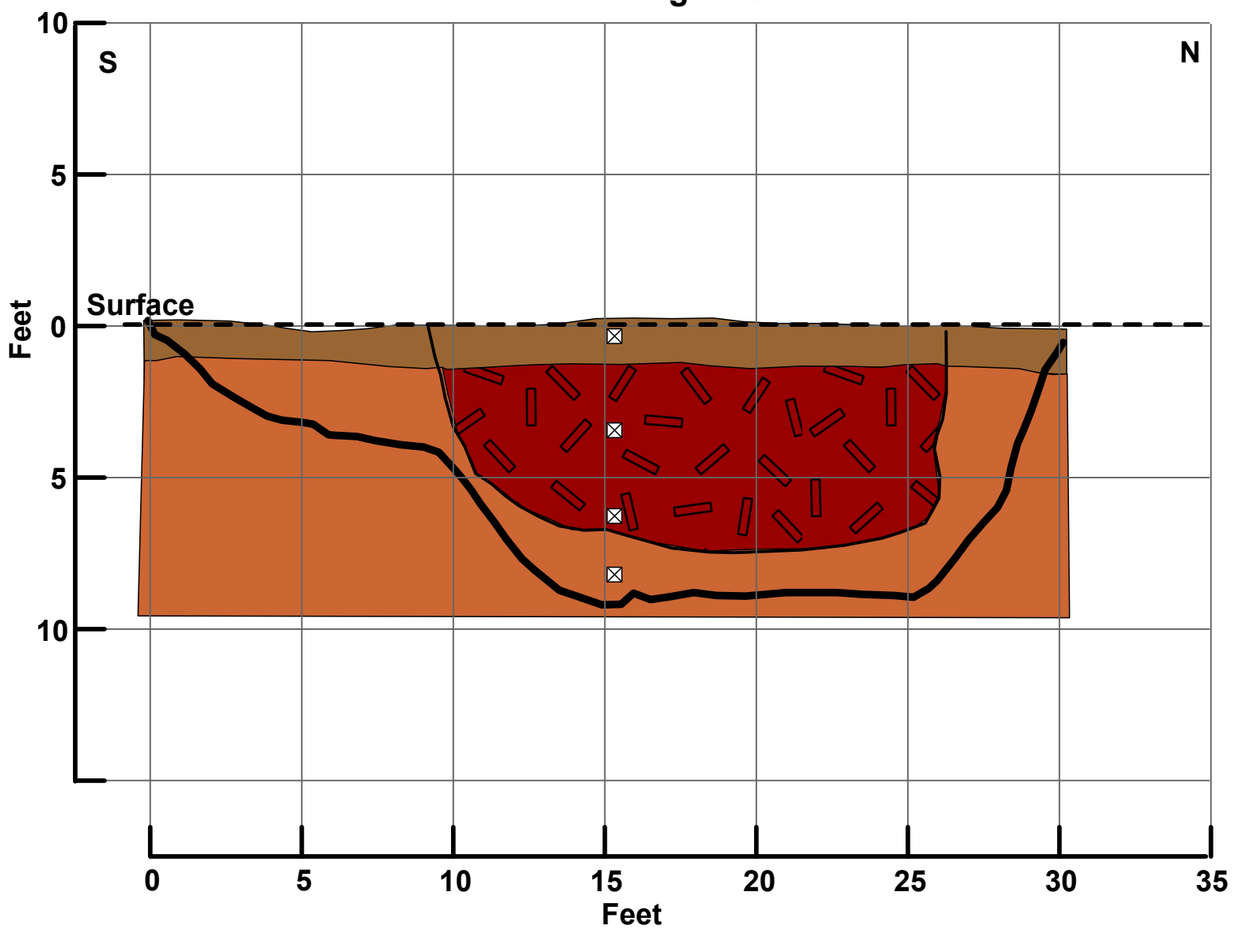
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT3-TP1 TRENCH LOG

Trench Profile DT4-TP1
View Looking West



Debris Content

MDAS Shipping containers for propellant canisters, 20-mm cartridge, .50 cal, 5"–30 cartridges, 40-mm cartridge [<10%] (40 lbs)

Scrap Metal straps, cans, ammunition canisters, rusty pipes, aluminum [50%] (700 lbs)

Other Burned wood [<10%] (25 lbs)

Total Depth

9 feet below adjacent grade
9 feet below lowest surface grade

Samples

010MBDA-TP21
(0.0-0.5 ft bgs)

010MBDA-TP22
(4.0-5.0 ft bgs)

010MBDA-TP23
(7.0-8.0 ft bgs)

010MBDA-TP24
(8.5-9.0 ft bgs)

Date Excavated:	2 February 2015	**Trench No.:**	DT4-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 4	**Project No:**	103G1959010

Topsoil
medium brown silty sand, moist, very loose, some organics, some small metal debris

Debris Fill
Red brown silty sand, damp to dry, very loose, abundant metal debris (70%-80%), as noted

Weathered Bedrock
Light red brown to grey (moderately-weathered to silty-weathered granite), difficult to excavate

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

One Inch = Five Feet

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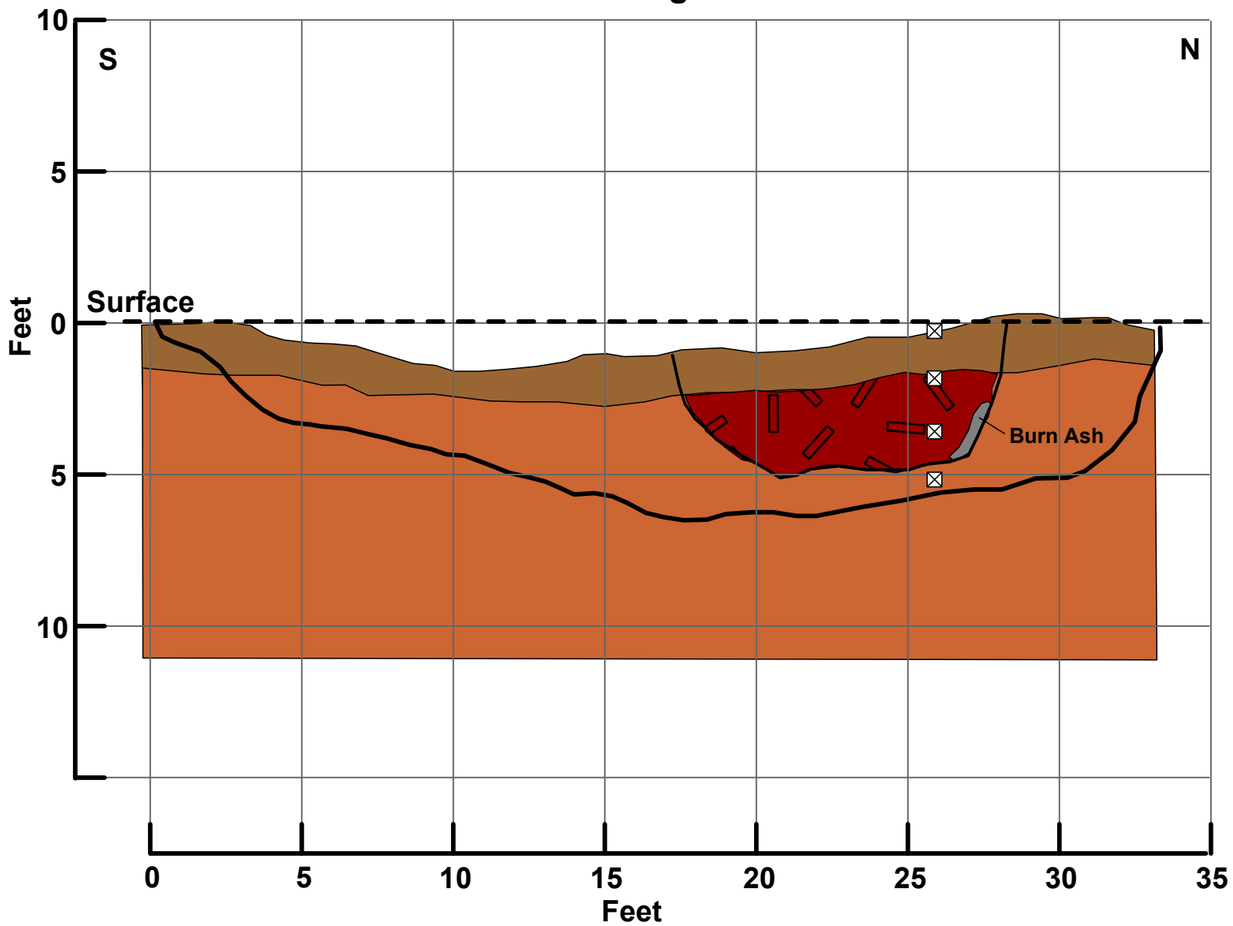
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT4-TP1 TRENCH LOG

Trench Profile DT5-TP1
View Looking West



Debris Content

MDAS 20-mm cartridge cases, 20-mm cartridges, grenade fuze [25-30%] (40 lbs)

Scrap Wire and other scrap [20%] (100 lbs)

Other Burned wood boards, plywood [10-15%] (20 lbs)

Total Depth

6 feet below adjacent grade
6 feet below lowest surface grade

Samples

010MBDA-TP27
(0.0-0.5 ft bgs)

010MBDA-TP25
(3.0-4.0 ft bgs)

010MBDA-TP28
(4.0-5.0 ft bgs)

010MBDA-TP26
(5.0-6.0 ft bgs)

Date Excavated:	3 February 2015	**Trench No.:**	DT5-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 5	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose

Debris Fill
Dark red brown silty sand, damp, very lose, abundant debris

Burn Ash

Weathered Bedrock
Light red brown to grey granite, damp to dry, dense to very dense, difficult to excavate

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

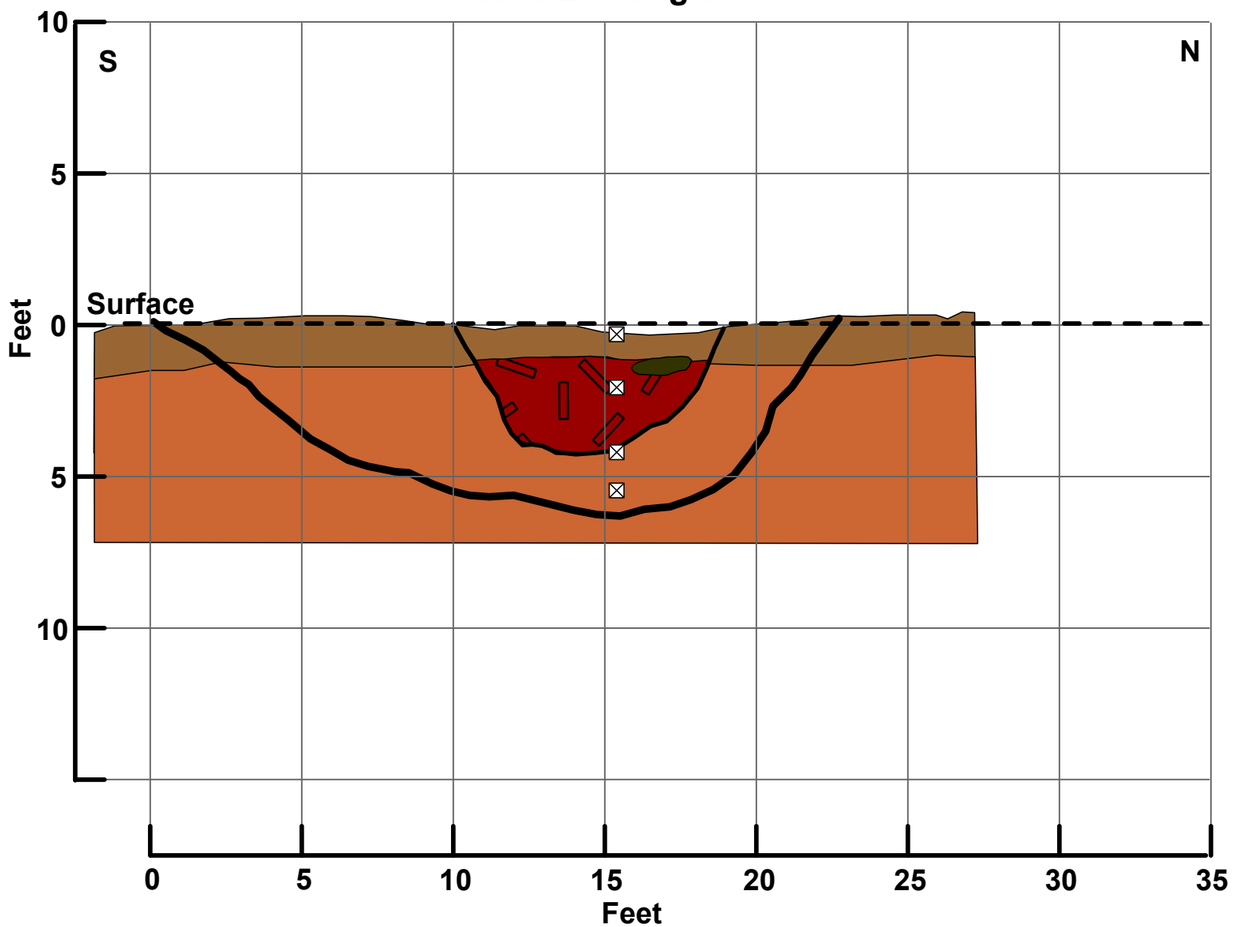
One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT5-TP1 TRENCH LOG

Trench Profile DT6-TP1
View Looking West



Debris Content

MDAS	Rifle grenade, nose cone [5%] (2 lbs)
Scrap	Metal plates, straps [30%] (75 lbs)
Other	Burned wood [<10%] (10 lbs)

Total Depth

6 feet below adjacent grade
6 feet below lowest surface grade

Samples

010MBDA-TP29
(0.0-0.5 ft bgs)

010MBDA-TP30
(2.0-3.0 ft bgs)

010MBDA-TP31
(4.0-5.0 ft bgs)

010MBDA-TP32
(5.0-6.0 ft bgs)

Date Excavated:	3 February 2015	**Trench No.:**	DT6-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 6	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, loose, some metal debris

Debris Fill
Medium brown silty sand, damp, loose, some metal debris (steel plates with frag holes, rifle grenade nose cone, burned wood)

Burned Wood Debris

Weathered Bedrock
Medium brown to yellow brown granite, some clay, medium dense to very dense at bottom, difficult to excavate

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

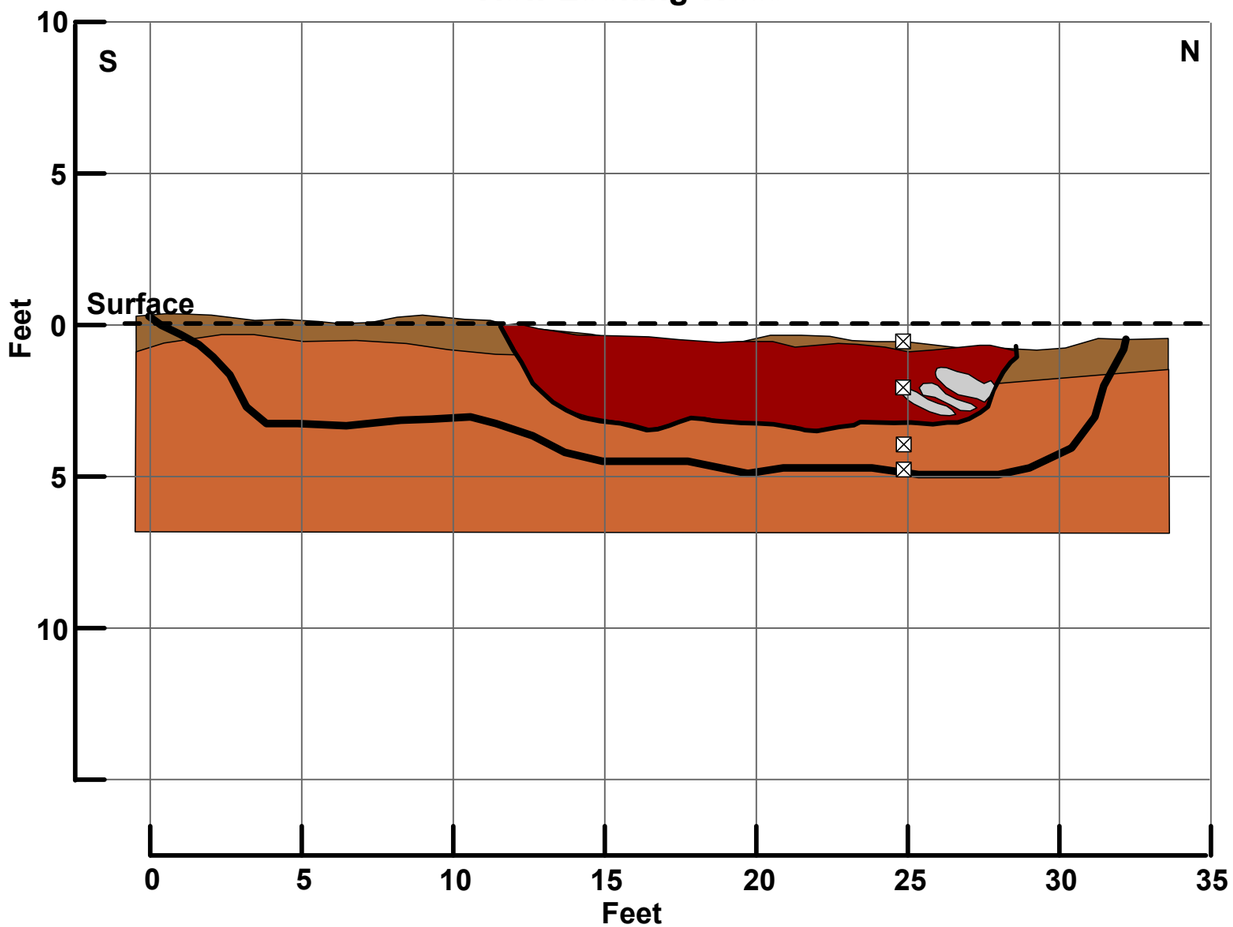
One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT6-TP1 TRENCH LOG

Trench Profile DT7-TP1
View Looking West



Samples

010MBDA-TP33
(0.0-0.5 ft bgs)

010MBDA-TP34
(2.0-3.0 ft bgs)

010MBDA-TP35
(4.0-4.5 ft bgs)

010MBDA-TP36
(4.5-5.0 ft bgs)

Date Excavated:	3 February 2015	**Trench No.:**	DT7-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 7	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, some metal debris, minor organics (roots and root hairs)

Debris Fill
Dark brown to black silty sand and debris mix, damp, very loose (caving), abundant metal debris

Large Debris
Rusted metal

Weathered Bedrock
Light to medium red brown granite, dry, very dense, difficult to excavate

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
A Joint Venture

Debris Content

MDAS Grenade fuze, igniters, ammunition canisters [25%] (30 lbs)

Scrap Scrap, iron rods, straps [30-40%] (100 lbs)

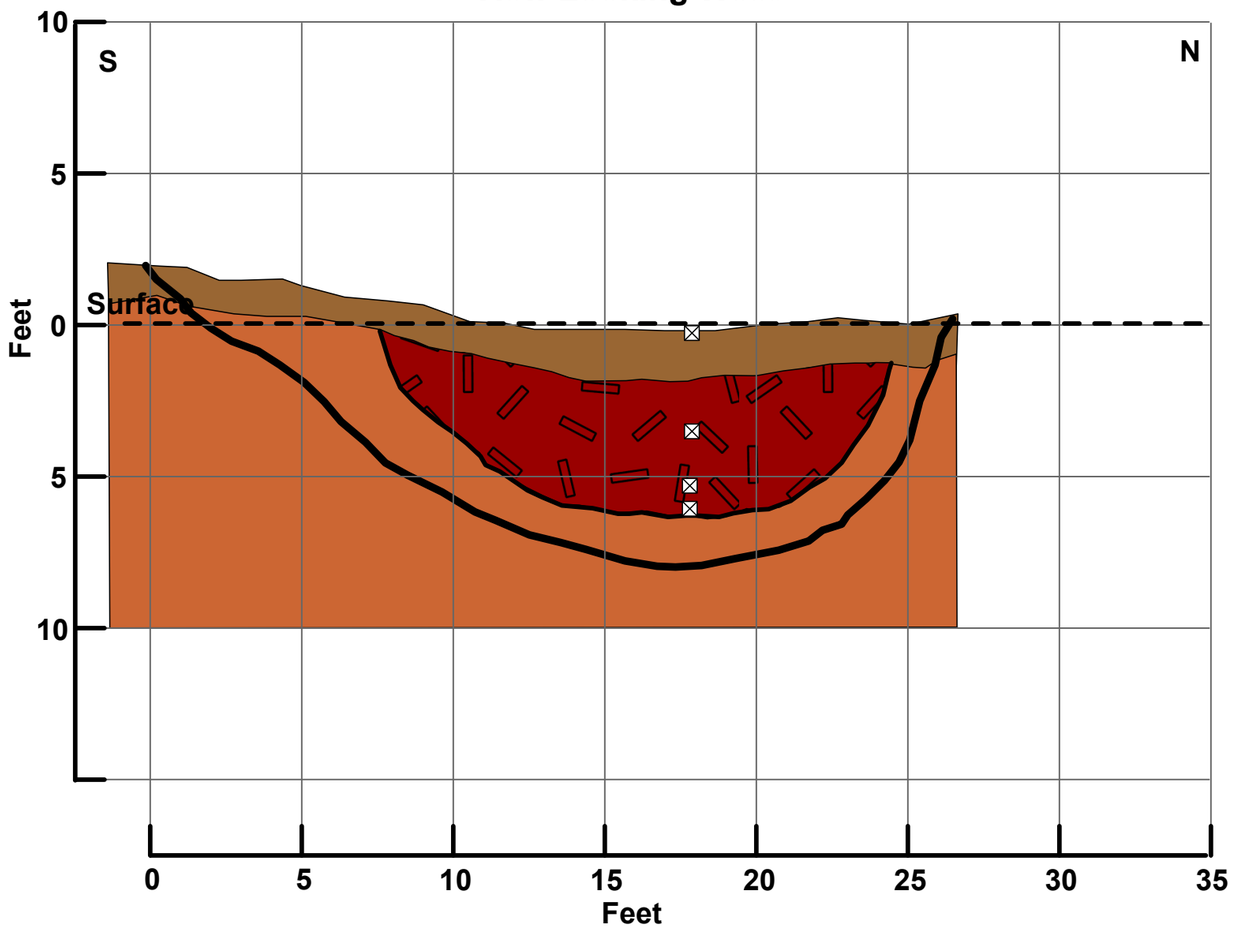
Total Depth

5 feet below adjacent grade
4 feet below lowest surface grade

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT7-TP1 TRENCH LOG

Trench Profile DT8-TP1
View Looking West



Debris Content

MDAS	20-mm casing [<5%] (5 lbs)
Scrap	Sheet metal, iron rods, straps [60%] (110 lbs)
Other	Burned wood, burn ash [10-15%] (30 lbs)

Total Depth

7 feet below adjacent grade
6.5 feet below lowest surface grade

Samples

010MBDA-TP37
(0.0-0.5 ft bgs)

010MBDA-TP38
(3.0-4.0 ft bgs)

010MBDA-TP39
(5.0-6.0 ft bgs)

010MBDA-TP40
(6.0-6.5 ft bgs)

Date Excavated:	3 February 2015	**Trench No.:**	DT8-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 8	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose

Debris Fill
Dark brown to black silty sand, dry, very loose (caving), abundant metal slag, iron rods, sheet metal, wood debris, burn ash, baked sidewalls of former trench fill (5 ft)

Weathered Bedrock
Light red brown to grey granite, dense to very dense, dry, difficult to excavate.

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

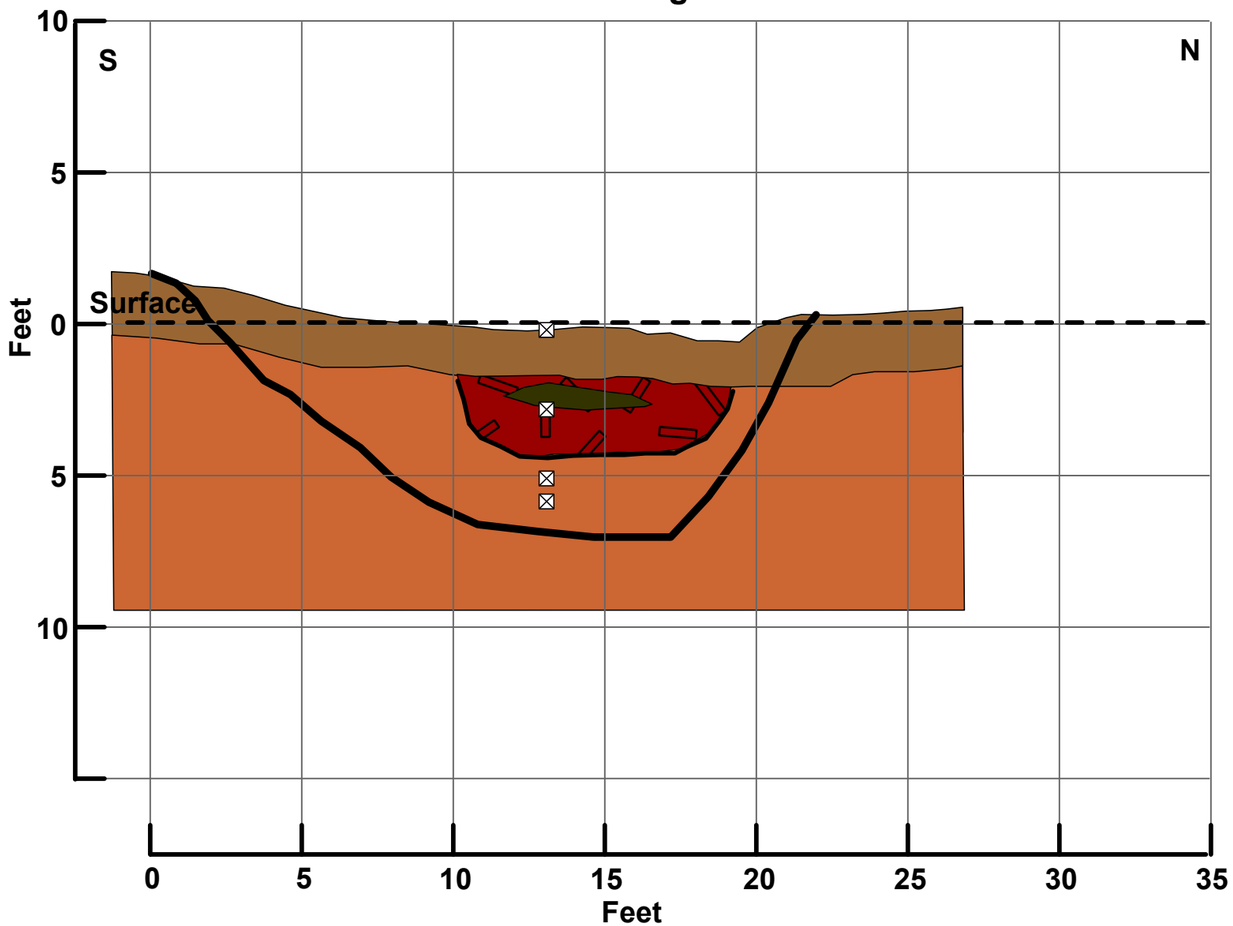
One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT8-TP1 TRENCH LOG

Trench Profile DT8-TP2
View Looking West



Debris Content

Scrap Sheet metal, Pipes, rebar [25%] (100 lbs)

Other Burned wood, burn ash [10%] (10 lbs)

Total Depth

7 feet below adjacent grade
6.5 feet below lowest surface grade

Samples

010MBDA-TP41
(0.0-0.5 ft bgs)

010MBDA-TP42
(3.0-4.0 ft bgs)

010MBDA-TP43
(5.0-5.5 ft bgs)

010MBDA-TP44
(5.5-6.0 ft bgs)

Date Excavated:	3 February 2015	**Trench No.:**	DT8-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 8	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose

Debris Fill
Dark brown to black silty sand, dry, very loose (caving), metal slag, iron rods, sheet metal, wood debris, burn ash (2-ft layer), baked sidewalls of former trench fill (5 ft)

Heavy Burn Layer
Rusted metal

Weathered Bedrock
Light red brown to grey granite, dense to very dense, dry, difficult to excavate.

Limits of Excavation

Observed Limits of Disposal Trench

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT8-TP2 TRENCH LOG

4.3 NATURE AND EXTENT OF CONTAMINATION FOR EU 3

The following sections describe the investigation results and provide discussion on the nature and extent of both the munitions-related items and MCs.

4.3.1 Investigation Results and Discussion at EU 3

EU 3 is located along the west side of the Pilgrim Creek drainage and includes the Drop Test tower, a small metal storage building, Magazine 458 (decommissioned), and a large, relatively level, pad area south of the tower and Surface Disturbance 1. Monitoring Well AGW-MW1 was also installed within this exposure unit. During the SI (ChaduxTt 2010), a total of four surface soil samples (SS22 – SS25) were collected in the immediate vicinity of the Drop Test Tower (Figure 4-3). The SI samples were analyzed for metals and explosives. Follow-up work in this area during the RI included a complete detector-aided surface sweep of an area extending approximately 100 feet out laterally from the towers test chamber. Four soil borings (DTT-S1 through DTT-S4) were hand augured in the area east of the tower at locations where MPPEH or MDAS was observed. Samples were collected at 0 to 0.5 foot bgs and three to four feet bgs. The RI samples from this area were analyzed for metals and explosives. Test pit and boring logs for EU 3 follow the text of this section.

Suspected Disposal Trench 1 was identified as a surface disturbance from historical photographs of the site taken in 1958. Two test pits were excavated across the suspected features alignment during the RI. Weathered bedrock was observed at a depth of 1.5 to 2.5 feet bgs with no evidence of debris or other fill observed in the test pits. Samples were collected from the test pits at depths of 0 to 0.5 foot bgs and three to four feet bgs and analyzed for metals, explosives, PCP, TPH-d, perchlorate, dioxin, white phosphorous, and hydrazine.

Area groundwater well AGW-MW1 was installed within EU 3 in an attempt to determine if groundwater is present in a bedrock-controlled aquifer at depths shallower than 50 feet bgs within the site. A boring was completed to a depth of approximately 35 feet bgs and a monitoring well was installed. Groundwater was measured at a depth of approximately 21 feet bgs after the well was allowed to stabilize. Soil samples were collected during installation of the well at depths of 0 – 0.5, 5, 10, and 30 feet bgs. The surface sample was analyzed for metals and dioxins, the 5, 10, and 30 foot samples for metals, with the 30 foot sample also analyzed for explosives, VOCs, SVOCs, perchlorate, dioxins, and hydrazine. The groundwater sample was analyzed for metals, explosives, VOCs, SVOCs, PCP, TPH-d, and perchlorate.

4.3.2 Extent of MPPEH and MC at EU 3

No MEC or MPPEH items were identified within EU 3. During the detector-aided surface clearance for the Drop Test Tower, monitoring well location, and Surface Disturbance 1 test pit areas by the UXO technicians, some MDAS items (small arms casings, slap flare base plates) and scrap metal were collected and placed in the on-site bins for subsequent disposal. All 19 samples collected from this area (during the SI and RI) yielded arsenic concentrations that exceeded residential and industrial screening levels at 0.0620 and 0.250 mg/kg. The results range from 0.756

to 2.97 mg/kg. Surface sampling during the SI showed two locations (UXO1-SS23 and UXO1 SS24) with slightly elevated cadmium concentrations at 4.72 and 15.6 mg/kg, respectively. These values exceed residential screening value of 4.58 mg/kg. Although the concentrations of metals are relatively low, all remaining metals and the dioxins exceed ecological screening levels. There were no explosives, VOCs, SVOCs, THP-d, perchlorate, PCP, or hydrazine samples that exceeded screening levels. A summary of soil analytical results compared with screening criteria and exceedances for EU 3 are provided at the end of this section, respectively (Tables 4-3A and 4-3B).

4.3.3 Human Health Risk Assessment Findings

4.3.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 7E-10 for federal toxicity criteria and 8E-10 for State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.0006 for federal toxicity criteria and 0.0005 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 3 is 18.6 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 3.

4.3.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 4E-08 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.03 for both federal and State of California toxicity values. No chemical risk drivers were identified in surface soil for the future industrial worker at EU 3.

The estimated cancer risk from exposure to subsurface soil is 1E-07 for the federal toxicity values and 5E-07 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.01 for federal toxicity criteria and 0.05 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 3 is 18.6 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified in subsurface soil for the future industrial worker at EU 3.

4.3.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 5E-08 for the federal toxicity values and 1E-07 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.2 for both federal and State of California toxicity values. No chemical risk drivers were identified in subsurface soil for the future construction worker at EU 3.

4.3.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 1E-07 for federal toxicity criteria and 2E-07 for State of California toxicity criteria. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.3 for both federal and State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 3 is 18.6 mg/kg. This concentration is less than the risk-based screening level of 80 mg/kg for residential soil. No chemical risk drivers were identified in surface soil for the future resident at EU 3.

The estimated cancer risk from exposure to subsurface soil is 4E-07 for federal toxicity criteria and 2E-06 for State of California toxicity criteria. Most of the estimated cancer risk estimated using State of California toxicity values is associated with incidental ingestion of, and dermal contact with, **arsenic** in subsurface soil. The estimated HI for subsurface soil is 0.1 for federal toxicity criteria and 0.5 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 3 is 18.6 mg/kg. This concentration is less than the risk-based screening level of 80 mg/kg for residential soil. **Arsenic** is a COC in subsurface soil at EU 3 only for State of California toxicity criteria.

The table below provides a summary of the human health risk assessment findings for EU 3:

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
3	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Arsenic [c]

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
c Based on State of California toxicity values only.

Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.3.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 3 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.3.4.1 Results of the Step 2 SLERA for EU 3

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 3:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 3	COPECs without Benchmarks or TRVs
Plants	chromium, copper, manganese, vanadium	dioxins
Invertebrates	chromium, copper	cobalt, molybdenum, silver, thallium, vanadium, dioxins
Birds	cadmium*, chromium, copper, lead, nickel, zinc	antimony, beryllium, thallium
Non-Burrowing Mammals	cadmium*, copper, lead, nickel, vanadium, zinc	none
Burrowing Mammals	cadmium	none

Note:

* Indicates COPEC is a risk driver (has an HQ greater than 1 using the high TRV).

In summary, the SLERA indicates that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.3.4.2 Results of the Step 3a Risk Refinement for EU 3

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) supports an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, cadmium was identified as posing risk to insectivorous birds. Therefore, chemicals in soil at EU 3 may pose unacceptable risk to ecological receptors and warrant further evaluation. The table below presents a summary of the ERA results:

Exposure Unit	Chemicals of Ecological Concern Identified after the Step 3a Risk Refinement				
	Receptor Group and Depth Interval				
	Plants	Invertebrates	Birds	Non-Burrowing Mammals	Burrowing Mammals
	(0-6 feet bgs)	(0-0.5 feet bgs)	(0-0.5 feet bgs)	(0-0.5 feet bgs)	(0-6 feet bgs)
2	--	--	cadmium	--	--

Notes:
-- No chemicals require further evaluation for the receptor group
bgs Below ground surface

4.3.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 3:

- There was no fill observed in test pits completed at Surface Disturbance 1. There is no evidence that the suspected surface feature was a disposal trench. No further investigation is recommended for this feature.
- All surface items of concern were removed by the UXO team for a distance of 100 feet out from the Drop Test Tower.
- There were no MEC or MPPEH items discovered within the EU during the surface clearance of the access routes and investigation areas.
- MDAS identified in the area consisted of fuze parts and flare debris.
- Groundwater was observed at a depth of approximately 21 feet in area monitoring well AGW-MW1. Arsenic exceeded the screening value for domestic drinking water and is discussed in the site wide groundwater section of this report.
- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected at concentrations that exceed initial screening levels.

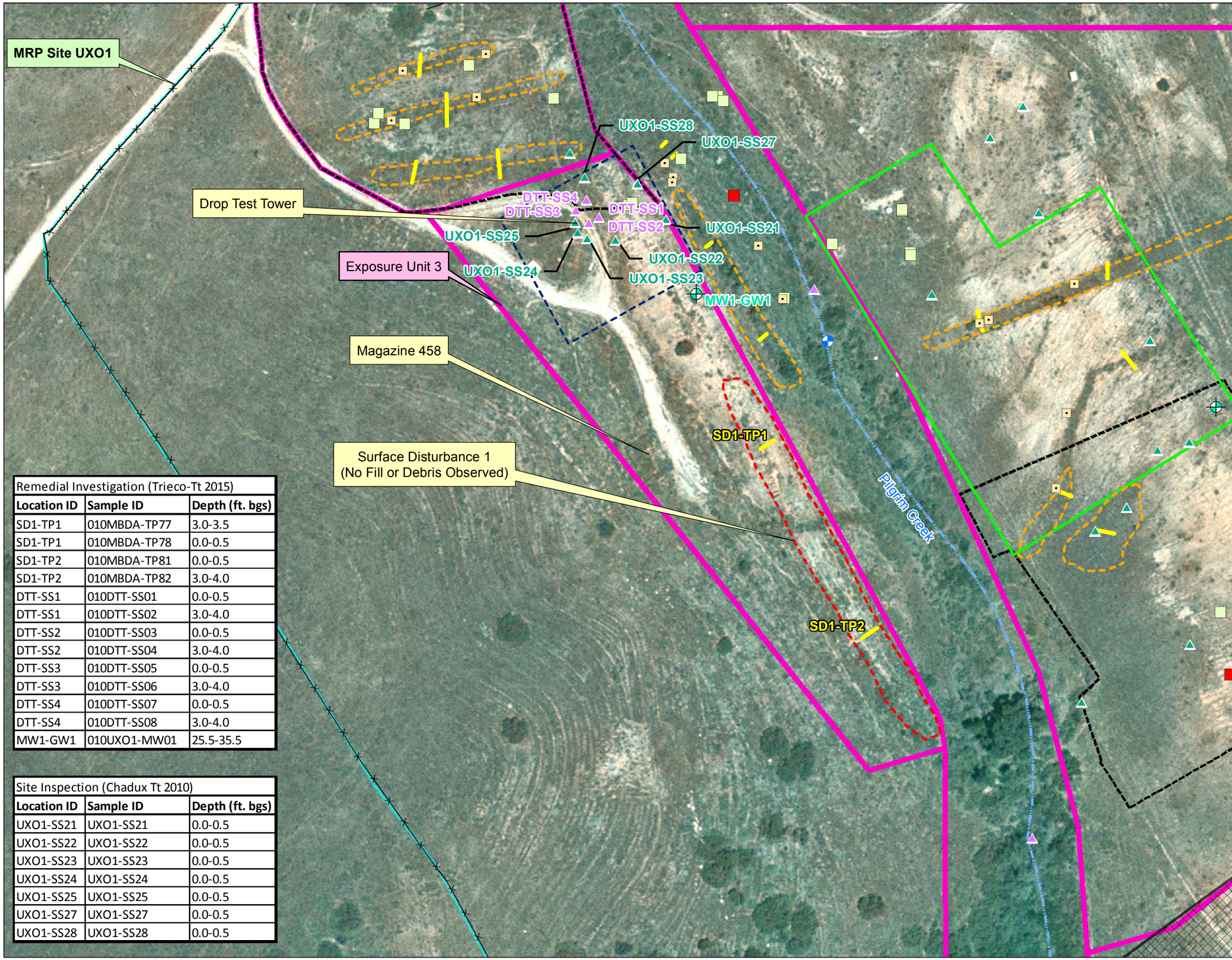
- The HHRA indicates that arsenic is a risk driver in subsurface soils for future residents. Residential development is not a planned use for this site.

- The ERA Step 3a refinement indicates that cadmium at the surface is a COEC for birds.

- Analytical data from the Drop Test Tower borings indicate that COCs associated with the surface items removed by the UXO team are not migrating vertically into the underlying bedrock material.

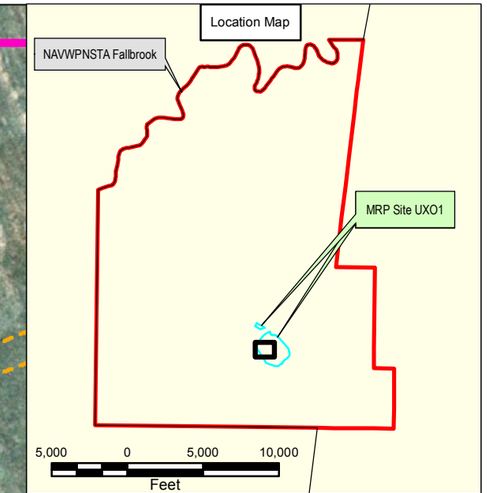
- Further response action should be considered in the FS based upon ecological risk related to surface concentrations of cadmium.

SECTION 4.3 FIGURES



Remedial Investigation (Trieco-Tt 2015)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
SD1-TP1	010MBDA-TP77	3.0-3.5
SD1-TP1	010MBDA-TP78	0.0-0.5
SD1-TP2	010MBDA-TP81	0.0-0.5
SD1-TP2	010MBDA-TP82	3.0-4.0
DTT-SS1	010DTT-SS01	0.0-0.5
DTT-SS1	010DTT-SS02	3.0-4.0
DTT-SS2	010DTT-SS03	0.0-0.5
DTT-SS2	010DTT-SS04	3.0-4.0
DTT-SS3	010DTT-SS05	0.0-0.5
DTT-SS3	010DTT-SS06	3.0-4.0
DTT-SS4	010DTT-SS07	0.0-0.5
DTT-SS4	010DTT-SS08	3.0-4.0
MW1-GW1	010UXO1-MW01	25.5-35.5

Site Inspection (Chadux Tt 2010)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
UXO1-SS21	UXO1-SS21	0.0-0.5
UXO1-SS22	UXO1-SS22	0.0-0.5
UXO1-SS23	UXO1-SS23	0.0-0.5
UXO1-SS24	UXO1-SS24	0.0-0.5
UXO1-SS25	UXO1-SS25	0.0-0.5
UXO1-SS27	UXO1-SS27	0.0-0.5
UXO1-SS28	UXO1-SS28	0.0-0.5



- MRP Site UXO1 Boundary
- Drainage Channel (Approximate)
- Range Fencing
- Exposure Unit Boundaries
- 2010 SI Geophysical Survey Area (ChaduxTt)
- 2015 Geophysical Survey Area (TriEco-Tt)
- Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
- Surface Disturbance (From Historical Aerial Photo)
- Disposal Trench Limits (Approximate)
- MDAS (Removed)
- MPPEH (Removed)
- RI Soil Sample Location (2015)
- SI Soil Sample Location (2010)
- SI Soil Boring Sample Location (2010)
- Shallow Monitoring Well
- Area Monitoring Well
- Test Pit
- Approximate Limit of Detector-Aided Surface Sweep

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

50 0 50 100
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 4-3
Exposure Unit 3 Features and Sample Locations
MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_3_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.3 TABLES

TABLE 4-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 3

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 1	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
None Detected	0/ 2	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 1	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	18/18	24,900	4,710	DTT-SS1	3.00 - 4.00	12,588	16,397	16,397	0	0	18	6	77,000	1,100,000	50 +	14,710
ANTIMONY	7/18	0.148 J	0.116 J	DTT-SS1	3.00 - 4.00	--	0.144	0.144	0	0	0	--	31	470	0.27	--
ARSENIC	18/18	2.97	0.756	DTT-SS1	3.00 - 4.00	1.559	1.796	1.796	18	18	0	0	0.062	0.25 #	18	3.105
BARIUM	18/18	333	29.4	MW1-S1	30.00 - 30.00	84.84	90	90	0	0	1	1	15,000	220,000	330	200.5
BERYLLIUM	18/18	0.372 J	0.0994 J	DTT-SS4	3.00 - 4.00	0.237	0.262	0.262	0	0	0	1	15.2	183 #	21	0.359
CADMIUM	18/18	15.6	0.0719 J	UXO1-SS24	0.00 - 0.50	16.2	5.545	5.545	2	1	4	12	4.58	6.37 #	0.36	0.158
CALCIUM	18/18	2,230	325	MW1-S1	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	18/18	33.8	4.42	DTT-SS3	0.00 - 0.50	22.73	17.78	17.78	0	0	2	3	100,000	100,000 *	26	20.3
COBALT	18/18	9.09	2.53	MW1-S1	30.00 - 30.00	5.565	5.905	5.905	0	0	0	0	23	350	13	9.39
COPPER	18/18	353 J	2.49 J	UXO1-SS24	0.00 - 0.50	380.1	132.1	132.1	0	0	3	6	3,100	47,000	28	7.785
IRON	18/18	26,300	6,970	MW1-S1,	30.00 - 30.00	16,439	19,749	19,749	0	0	--	0	55,000	100,000 *	--	27,350
LEAD	18/18	18.6 J	1.52	UXO1-SS23	0.00 - 0.50	10.27	9.828	9.828	0	0	2	6	80	320 #	11	4.328
MAGNESIUM	18/18	7,730	1,020	MW1-S1	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	18/18	379	96.2 J	MW1-S1	30.00 - 30.00	213.8	198.1	198.1	0	0	5	1	1,800	26,000	220	304
MOLYBDENUM	12/13	0.763	0.189 J	DTT-SS3	0.00 - 0.50	--	0.423	0.423	0	0	0	1	390	5,800	2 +	0.524
NICKEL	18/18	16.2	1.45	UXO1-SS24	0.00 - 0.50	10.36	9.673	9.673	0	0	0	3	1,500	22,000	38	5.15
POTASSIUM	18/18	7,730	939	MW1-S1	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	14/18	0.152 J	0.0568 J	UXO1-SS22	0.00 - 0.50	0.124	0.117	0.117	0	0	0	--	390	5,800	0.52	--

TABLE 4-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 3 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
SILVER	1/18	0.261 J	0.261 J	UXO1-SS24	0.00 - 0.50	--	--	--	0	0	0	--	390	4,700	4.2	--
SODIUM	17/18	269	36.1 J	MW1-S1	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	13/18	0.543	0.120 J	MW1-S1	30.00 - 30.00	0.242	0.325	0.325	0	0	0	0	0.78	12	1 +	0.552
VANADIUM	18/18	81.0	16.8 J	MW1-S1	30.00 - 30.00	42.09	52.77	52.77	0	0	18	0	390	5,800	7.8	96.4
ZINC	18/18	110 J	12.2	UXO1-SS23	0.00 - 0.50	57.66	63.32	63.32	0	0	4	2	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	4/5	14.4 J	8.67 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	5/5	3.78 J	0.0292 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	3/5	1.08 J	0.669 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	1/5	0.673 J	0.673 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	1/5	0.274 J	0.274 J	SD1-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDD	5/5	112 J	1.60 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDF	4/5	16.2 J	14.1 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	5/5	27.9 J	0.111 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	4/5	18.6 J	14.4 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	3/5	4.14 J	0.669 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	4/5	4.76 J	2.81 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	3/5	0.348 J	0.232 J	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	5/5	0.821	0.161	SD1-TP2	3.00 - 4.00	--	--	--	0	0	4	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	5/5	0.744	0.334	SD1-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	1/5	0.000831	0.000831	MW1-S1	30.00 - 30.00	--	--	--	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
HYDRAZINE	1/5	0.000570	0.000570	MW1-S1	30.00 - 30.00	--	--	--	0	0	--	--	0.23	1.1	--	--

TABLE 4-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 3 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Percent Moisture (%)																
PERCENT MOISTURE	5/5	7.40	3.90	SD1-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 3

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 3

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-3B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 3

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	12,800	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	24,900	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,610	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	22,200	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	4,710	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,500	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,260	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	22,800	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700 J	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,500	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,600	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	116	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,000	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ARSENIC	1.41	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.97	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	0.557	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.756	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	0.514	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.04	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	0.535	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.801	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.48	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.879	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.90	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	0.558	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.83	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.539	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.55	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.535	**0.0620**	**0.250**	18.0	3.11

TABLE 4-3B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 3 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.36	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.69	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.48 J	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	5.51	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.71 J	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	5.81	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.89 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.62 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	5.61	**0.0620**	**0.250**	18.0	3.11
BARIUM	333	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	15,000	220,000	**330**	201
CADMIUM	0.570	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	4.58	6.37	**0.360**	0.158
CADMIUM	4.72	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	0.569	**4.58**	6.37	**0.360**	0.158
CADMIUM	15.6	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	0.562	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	2.37	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	0.561	4.58	6.37	**0.360**	0.158
CHROMIUM	33.8	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	100,000	100,000	**26.0**	20.3
CHROMIUM	31.9	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	100,000	100,000	**26.0**	20.3
COPPER	154 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	2.28	3,100	47,000	**28.0**	7.79
COPPER	353 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	3,100	47,000	**28.0**	7.79
COPPER	47.6 J	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	2.24	3,100	47,000	**28.0**	7.79
LEAD	18.6 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	2.28	80.0	320	**11.0**	4.33
LEAD	11.8 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	80.0	320	**11.0**	4.33
MANGANESE	222 J	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	1,800	26,000	**220**	304
MANGANESE	379	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	1,800	26,000	**220**	304
MANGANESE	275 J	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	1,800	26,000	**220**	304
MANGANESE	247 J	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	1,800	26,000	**220**	304
MANGANESE	247 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.81	1,800	26,000	**220**	304
VANADIUM	41.1 J	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	390	5,800	**7.80**	96.4
VANADIUM	68.2 J	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	0.557	390	5,800	**7.80**	96.4
VANADIUM	16.8 J	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	0.514	390	5,800	**7.80**	96.4
VANADIUM	59.9 J	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	26.7	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	390	5,800	**7.80**	96.4

TABLE 4-3B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 3 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	61.1	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	29.9	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	72.4	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	0.558	390	5,800	**7.80**	96.4
VANADIUM	81.0	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	64.4	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.539	390	5,800	**7.80**	96.4
VANADIUM	44.2	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	47.7	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	53.8	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	40.3	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	46.6	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	1.16	390	5,800	**7.80**	96.4
VANADIUM	33.6	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	41.2	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	38.4	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	1.12	390	5,800	**7.80**	96.4
ZINC	50.0	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	2.60	23,000	350,000	**46.0**	50.1
ZINC	48.1 J	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	11.0	23,000	350,000	**46.0**	50.1
ZINC	110 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	11.4	23,000	350,000	**46.0**	50.1
ZINC	92.3 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	11.2	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.679	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.684	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.541	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.821	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.0	4.90	22.0	**0.200**	NC

TABLE 4-3B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 3 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID	Identification
J	Estimated value
mg/kg	Milligrams per kilogram
ng/kg	Nanograms per kilogram
TEQ	Toxicity equivalence quotient

SECTION 4.3 PHOTOGRAPHS

SECTION 4.3 – EXPOSURE UNIT 3 PHOTOGRAPHIC LOG

Photograph 4.3-1
Drop Test Tower Floor

Photograph 4.3-2
Metal Storage Building

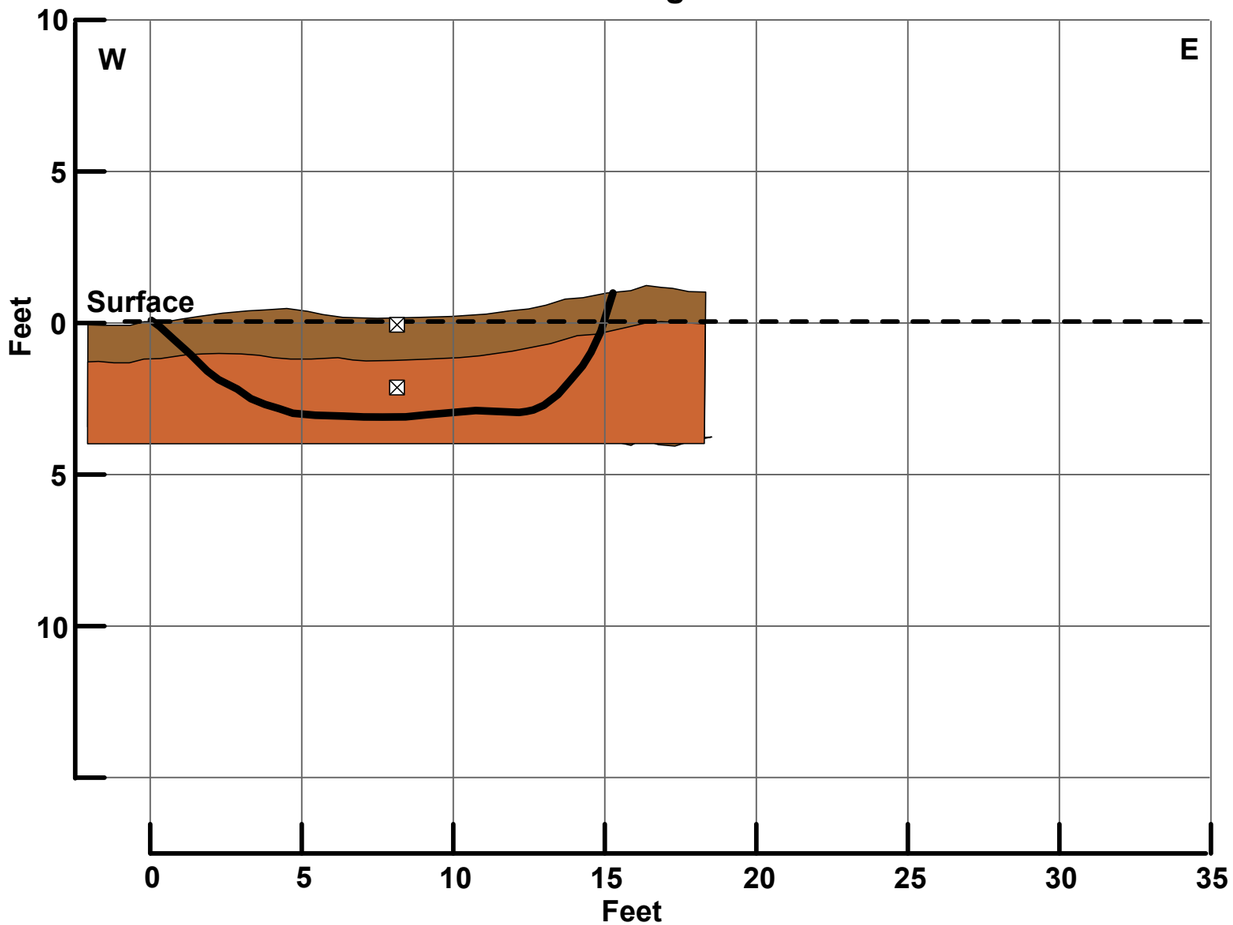
SECTION 4.3 – EXPOSURE UNIT 3 PHOTOGRAPHIC LOG

Photograph 4.3-3
Magazine 458

Photograph 4.3-4
Surface Disturbance 1 – Test Pit 2

SECTION 4.3 TEST PIT LOGS

Trench Profile SD1-TP1
View Looking North



Samples

010MBDA-TP78
(0.0-0.5 ft bgs)

010MBDA-TP77
(3.0-3.5 ft bgs)

Debris Content

N/A

Total Depth

3.5 feet below adjacent grade
3.5 feet below lowest surface grade

Date Excavated:	4 February 2015	**Trench No.:**	SD1-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Surface Disturbance 1	**Project No:**	103G1959010

Topsoil
Light brown silty sand, moist, loose, minor organics

Weathered Bedrock
Light grey, damp, very dense, difficult to excavate

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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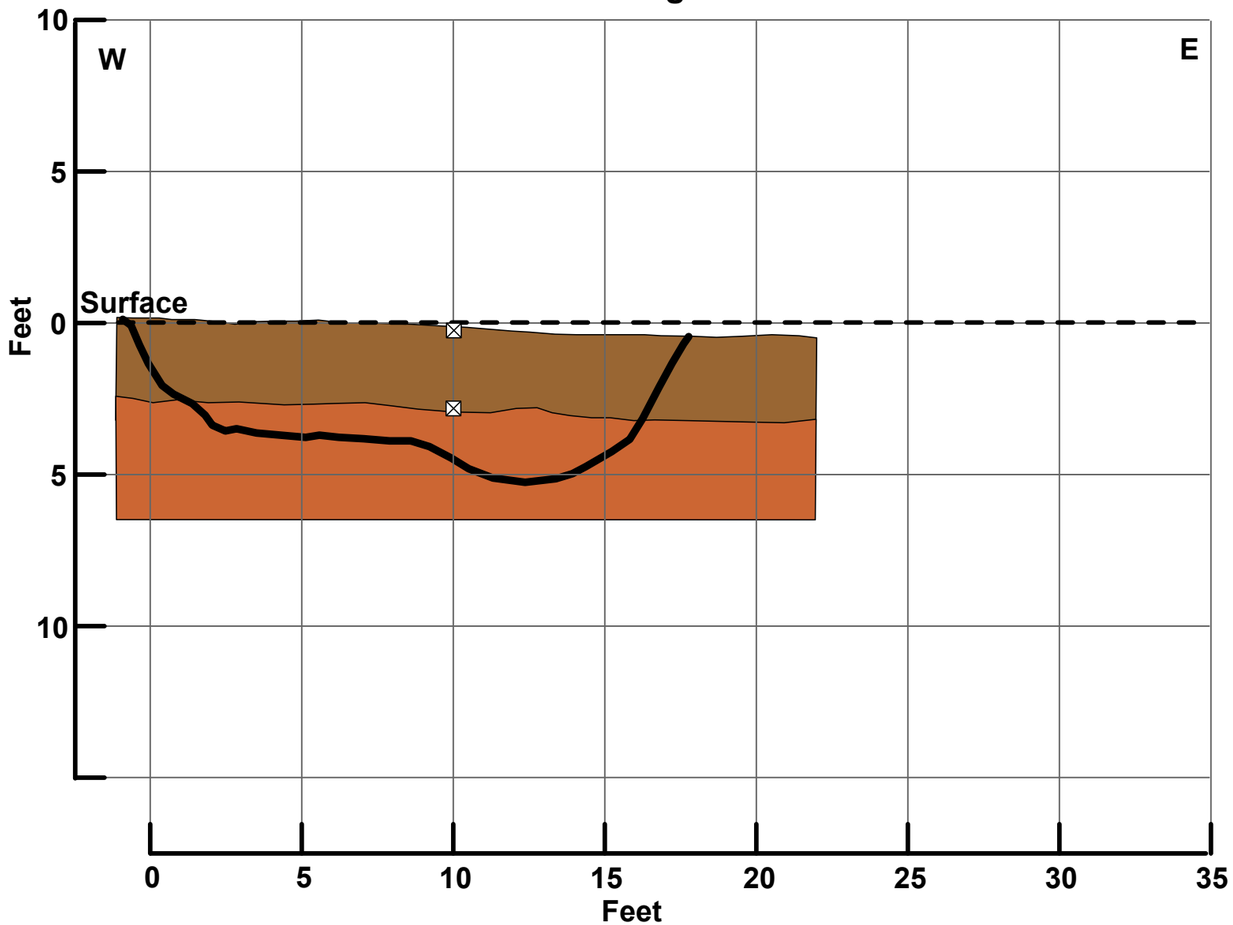
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

SD1-TP1 TRENCH LOG

Trench Profile SD1-TP2
View Looking North



Debris Content

N/A

Total Depth

5.0 feet below adjacent grade
5.0 feet below lowest surface grade

Samples

010MBDA-TP81
(0.0-0.5 ft bgs)

010MBDA-TP82
(3.0-4.0 ft bgs)

Date Excavated:	4 February 2015	**Trench No.:**	SD1-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Surface Disturbance 1	**Project No:**	103G1959010

Topsoil
Light brown silty sand, damp, very loose, minor organics (roots)

Weathered Bedrock
Light red brown granite, dry, dense to very dense

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

SD1-TP2 TRENCH LOG

4.4 NATURE AND EXTENT OF CONTAMINATION FOR EU 4

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs.

4.4.1 Investigation Results and Discussion at EU 4

EU 4 incorporates the Pilgrim Creek drainage and includes the following Features: two metal burn barrels, Burn Slit/Trench 1, and the former trailer. Temporary Monitoring Wells PC-MW1, PC-MW2 and PC-MW3 were also installed within this EU (Figure 4-4). Sampling conducted during the SI included completion of five shallow borings (SB09 – SB13), where MEC or MDAS were tentatively identified, at depths ranging from 1.5 to 6 feet bgs. These samples were analyzed for metals, explosives, and perchlorate. In the vicinity of the former trailer, four shallow surface composite samples (SS01 – SS04) were collected at depths of 0 to 0.5 foot bgs and analyzed for VOCs.

During the RI, two test pits were excavated within the central portion of Burn Slit/Trench 1, with surface (0 to 0.5 foot bgs) and subsurface (two to four feet bgs) samples collected from each test pit (Test Pit Logs 4-4). Approximately 1.5 to 2 feet of slough soil that included a significant amount of burned debris, scrap metal, and MDAS (ammunition canisters, flare components) were encountered within the test pits. The surface sample collected represented the slough or debris fill and the lower sample represented the underlying bedrock material. Samples were analyzed for metals, explosives, VOCs, SVOCs, TPH-d, perchlorate, dioxins, and hydrazine.

The two burn barrels were removed and samples were collected at the bottom of the debris fill (approximately four feet bgs) and another two feet below that at a depth of approximately six feet bgs. After removal, the excavations were backfilled with adjacent native soil. These samples (BB-E1 through BB-E4) were analyzed for metals, explosives, VOCs, and TPH-d.

Four locations were sampled within Pilgrim Creek (PC-S1 through PC-S4) to evaluate the alluvial soils. Samples were collected at 0 to 0.5 foot bgs and 2.5 to 3.0 feet bgs and analyzed for metals, explosives, VOCs, SVOCs, PCP, and hydrazine. At two locations, dioxins were also analyzed in the surface soil sample.

At the location of the former trailer, two additional surface samples were collected and analyzed for VOCs. Since the trailer had been burned, leaving only the metal frame, the samples could be collected directly below the former structure (Photographs 4-4).

Samples of the shallow groundwater were collected from two of the three temporary wells installed within Pilgrim Creek. Groundwater samples for both wells were analyzed for metals, explosives, and VOCs. Groundwater collected from PC-MW2 (down-gradient well) was also analyzed for SVOCs and perchlorate.

4.4.2 Extent of MPPEH and MC at EU 4

MPPEH identified within this EU included two expended 40-mm smoke grenades. Two test pits were excavated at Burn Slit/Trench 1 and the investigation at the two Burn Barrels resulted in their complete removal. MDAS identified in the burn Slit/Trench consisted of primarily incendiary bomb and fuze components, while the debris removed from the burn barrel consisted of primarily small arms casings, 20 mm casings, with some fuzes, and igniters.

Analytical results show arsenic exceeds residential and ecological screening levels with concentrations ranging from 0.569J to 2.68J mg/kg. The dioxin concentration from the sample at S1-TP (two to four feet bgs) exceeds the human health screening level of 4.90 ng/kg with a result of 5.71 ng/kg. There were no explosives, VOCs, SVOCs, TPH-d, perchlorate, PCP, or hydrazine that exceeded screening levels. Samples collected from the native bedrock material below the Burn Slit/Trench and metal burn barrels indicate there has not been vertical migration of COCs.

Visual inspections and surface clearance within Pilgrim Creek access routes resulted in the identification of the aforementioned 40-mm smoke grenades; the following MDAS was also identified in the drainage: rocket motor housings, ammunition carriers (empty), black powder cans, flare base plates, and flare housing components. Other items identified in the drainage area included scrap metal items included metal banding (dunnage), steel straps, target frames, sheet metal, concrete, fiberglass or asbestos wrapping, and railroad rails. A summary of soil analytical results compared with screening criteria and exceedances for EU 4 are provided at the end of this section, respectively (Tables 4-4A and 4-4B).

4.4.3 Human Health Risk Assessment Findings

4.4.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 3E-09 for both federal toxicity criteria and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.001 for both federal and State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 4 is 6.73 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 4.

4.4.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 1E-07 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.06 for both federal and State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 4 is 40.7 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified in surface soil for the future industrial worker at EU 4.

The estimated cancer risk from exposure to subsurface soil is 3E-07 for both federal and State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.01 for federal toxicity criteria and 0.003 for State of California toxicity values. No chemical risk drivers were identified in subsurface soil for the future industrial worker at EU 4.

4.4.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 4E-08 for the federal toxicity values and 5E-08 for the State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.05 for federal toxicity criteria and 0.01 for State of California toxicity values. The maximum detected concentrations of lead in subsurface soil at EU 4 is 40.7 mg/kg. This concentration is greater than the risk-based screening level of 39 mg/kg for the future construction worker. The mean lead concentration in subsurface soil at EU 4, however, is 7.3 mg/kg. This concentration is below the risk-based screening level of 39 mg/kg for the future construction worker. No chemical risk drivers were identified in subsurface soil for the future construction worker at EU 4.

4.4.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 5E-07 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.9 for federal toxicity values and 0.8 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 4 is 6.73 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. No chemical risk drivers were identified in surface soil for the future resident at EU 4.

The estimated cancer risk from exposure to subsurface soil is 1E-06 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in subsurface soil. The estimated HI for subsurface soil is 0.05 for federal toxicity criteria and 0.01 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 4 is 40.7 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. **Dioxins** are COCs in subsurface soil at EU 4.

The following table provides a summary of the human health risk assessment findings for EU 4:

SUMMARY OF INCREMENTAL RISK DRIVERS							
Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
4	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Dioxins

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.4.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 4 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.4.4.1 Results of the Step 2 SLERA for EU 4

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 4:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 4	COPECs without Benchmarks or TRVs
Plants	chromium, manganese, vanadium, zinc	strontium, dioxins, perchlorate
Invertebrates	chromium, manganese	cobalt, molybdenum, thallium, vanadium, dioxins, perchlorate
Birds	chromium, lead, zinc	antimony, beryllium, thallium, perchlorate
Non-Burrowing Mammals	antimony, cadmium, manganese, nickel, vanadium, zinc	perchlorate
Burrowing Mammals	manganese, zinc	perchlorate

In summary, the SLERA indicates that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.4.4.2 Results of the Step 3a Risk Refinement for EU 4

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) supports an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, no COECs were identified for EU 4.

4.4.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 4:

- Approximately two feet of slough/debris fill is present in Burn Slit/Trench 1. The trench is not directly connected with Pilgrim Creek drainage as previously thought.

- MPPEH items discovered within the EU included two 40-mm smoke grenades adjacent to the Pilgrim Creek drainage.

- MDAS identified in the area consisted of rocket motor housings, ammunition carriers (empty), black powder cans, flare base plates, and flare housing components.

- There were COCs or COECs identified in the eight alluvial soil samples obtained from the Pilgrim Creek drainage

- The two burn barrels and the contained debris were removed during the RI. Analytical results from soil samples collected two feet below the bottom of the barrels indicate there has not been any vertical migration of COCs to the underlying bedrock soils.

- There were no VOCs detected at the location of the former trailer. However, a significant amount of burned debris exists in and adjacent to the footprint of the former trailer.

- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, present at concentrations that exceed initial screening levels.

- The HHRA indicates that arsenic is a risk driver in subsurface soils for future residents. Residential development is not considered a likely future scenario.

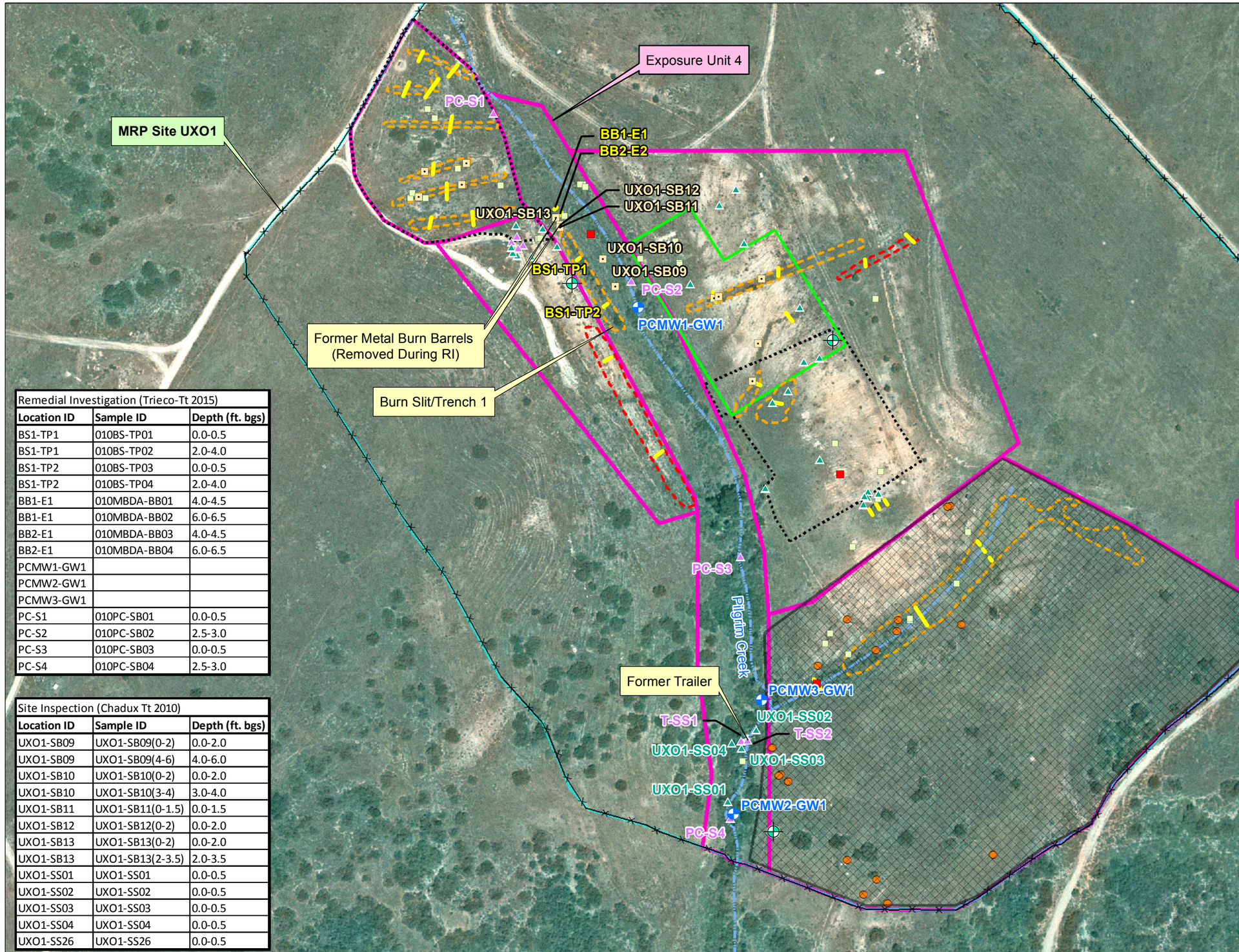
- The ERA Step 3a refinement indicates that there are no COECs for this EU.

- Analytical data indicates that COCs identified are not migrating vertically into the underlying bedrock material.

- Groundwater was observed at a depth of approximately 16.5 feet bgs in the temporary Pilgrim Creek monitoring well PC-MW1 and at a depth of eight feet bgs in PC-MW2. There was no groundwater observed in the PC-MW3 well completed to a depth of eight feet bgs. Based on this data and the understanding that the region has been in a prolonged drought, it is assumed that “perched” groundwater may occur seasonally or after periods of prolonged precipitation. Perchlorate was detected in the groundwater, but was below screening levels. Arsenic exceeded the screening value for domestic drinking water.

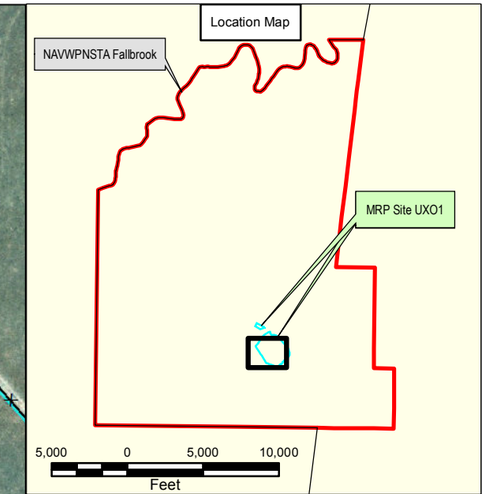
- Further response action should be considered in the FS due to the possible presence of MEC/MPPEH within Burn Slit/Trench 1.

SECTION 4.4 FIGURES



Remedial Investigation (Trieco-Tt 2015)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
BS1-TP1	010BS-TP01	0.0-0.5
BS1-TP1	010BS-TP02	2.0-4.0
BS1-TP2	010BS-TP03	0.0-0.5
BS1-TP2	010BS-TP04	2.0-4.0
BB1-E1	010MBDA-BB01	4.0-4.5
BB1-E1	010MBDA-BB02	6.0-6.5
BB2-E1	010MBDA-BB03	4.0-4.5
BB2-E1	010MBDA-BB04	6.0-6.5
PCMW1-GW1		
PCMW2-GW1		
PCMW3-GW1		
PC-S1	010PC-SB01	0.0-0.5
PC-S2	010PC-SB02	2.5-3.0
PC-S3	010PC-SB03	0.0-0.5
PC-S4	010PC-SB04	2.5-3.0

Site Inspection (Chadux Tt 2010)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
UXO1-SB09	UXO1-SB09(0-2)	0.0-2.0
UXO1-SB09	UXO1-SB09(4-6)	4.0-6.0
UXO1-SB10	UXO1-SB10(0-2)	0.0-2.0
UXO1-SB10	UXO1-SB10(3-4)	3.0-4.0
UXO1-SB11	UXO1-SB11(0-1.5)	0.0-1.5
UXO1-SB12	UXO1-SB12(0-2)	0.0-2.0
UXO1-SB13	UXO1-SB13(0-2)	0.0-2.0
UXO1-SB13	UXO1-SB13(2-3.5)	2.0-3.5
UXO1-SS01	UXO1-SS01	0.0-0.5
UXO1-SS02	UXO1-SS02	0.0-0.5
UXO1-SS03	UXO1-SS03	0.0-0.5
UXO1-SS04	UXO1-SS04	0.0-0.5
UXO1-SS26	UXO1-SS26	0.0-0.5



MRP Site UX01 Boundary
Drainage Channel (Approximate)
Range Fencing
Exposure Unit Boundaries
2010 SI Geophysical Survey Area (ChaduxTt)
2015 Geophysical Survey Area (TriEco-Tt)
Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
Surface Disturbance (From Historical Aerial Photo)
Disposal Trench Limits (Approximate)
MDAS (Removed)
MPPEH (Removed)
Metal Debris (Removed)
RI Soil Sample Location (2015)
SI Soil Sample Location (2010)
SI Soil Boring Sample Location (2010)
Shallow Monitoring Well
Area Monitoring Well
Test Pit

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

N

100 0 100 200
Feet

TriEco Tt
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NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 4-4

Exposure Unit 4 Features and Sample Locations MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_4_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.4 TABLES

TABLE 4-4A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 4

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 16	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
MOTOR OIL RANGE ORGANICS	2/6	29.0	25.0	BS1-TP1	0.00 - 0.50	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 4	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	23/23	14,800	5,150	PC-S4	2.50 - 3.00	--	10,849	10,849	0	0	23	1	77,000	1,100,000	50 +	14,710
ANTIMONY	9/23	4.93 J	0.193 J	UXO1-SS26	0.00 - 2.00	--	1.008	1.026	0	0	6	--	31	470	0.27	--
ARSENIC	23/23	2.68 J	0.569 J	UXO1-SS26	0.00 - 2.00	--	1.616	1.616	23	23	0	0	0.062	0.25 #	18	3.105
BARIUM	23/23	190	37.9	UXO1-SB11	0.00 - 1.50	--	116.1	116.1	0	0	0	0	15,000	220,000	330	200.5
BERYLLIUM	23/23	0.355 J	0.0875 J	BB1-E1	6.00 - 6.50	--	0.251	0.251	0	0	0	0	15.2	183 #	21	0.359
CADMIUM	19/23	0.399 J	0.116 J	UXO1-SB11	0.00 - 1.50	--	0.251	0.251	0	0	2	13	4.58	6.37 #	0.36	0.158
CALCIUM	23/23	2,560	448	UXO1-SS02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	23/23	19.7	6.10	UXO1-SB10	3.00 - 4.00	--	13	13	0	0	0	0	100,000	100,000 *	26	20.3
COBALT	23/23	11.7	2.71	PC-S3	0.00 - 0.50	--	6.688	6.688	0	0	0	2	23	350	13	9.39
COPPER	23/23	53.0	2.65 J	UXO1-SS26	0.00 - 2.00	--	12.05	12.05	0	0	1	11	3,100	47,000	28	7.785
IRON	23/23	27,700	8,320	UXO1-SS26	0.00 - 2.00	--	17,372	17,372	0	0	--	1	55,000	100,000 *	--	27,350
LEAD	23/23	40.7	1.76	UXO1-SS26	0.00 - 2.00	--	10.67	10.67	0	0	5	12	80	320 #	11	4.328
MAGNESIUM	23/23	5,910 J	1,190	UXO1-SS01	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	23/23	1,670 J	69.9 J	PC-S3	0.00 - 0.50	--	570.1	570.1	0	0	10	5	1,800	26,000	220	304
MERCURY	4/23	0.254 J	0.0146 J	BB1-E1	4.00 - 4.50	--	0.0504	0.0504	0	0	1	--	23	350	0.1 +	--
MOLYBDENUM	9/10	0.558	0.139 J	PC-S2	2.50 - 3.00	--	0.357	0.347	0	0	0	1	390	5,800	2 +	0.524
NICKEL	23/23	8.69	1.80	UXO1-SB10	3.00 - 4.00	--	4.871	4.871	0	0	0	4	1,500	22,000	38	5.15
POTASSIUM	23/23	4,680	1,110	UXO1-SS01	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-4A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
SELENIUM	18/23	0.262 J	0.0573 J	UXO1-SB11	0.00 - 1.50	--	0.17	0.17	0	0	0	--	390	5,800	0.52	--
SODIUM	18/23	483	59.2 J	BB1-E1	6.00 - 6.50	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	3/3	10.7 J	8.93 J	UXO1-SB09	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	14/23	0.529 J	0.119 J	UXO1-SS01	0.00 - 2.00	--	0.276	0.276	0	0	0	0	0.78	12	1 +	0.552
VANADIUM	23/23	73.2	20.6	UXO1-SS01	0.00 - 2.00	--	47.19	47.19	0	0	23	0	390	5,800	7.8	96.4
ZINC	23/23	360	10.2	BB1-E1	4.00 - 4.50	--	97.25	97.25	0	0	10	9	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	5/9	89.7	6.86	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	6/9	13.7 J	0.168 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	6/9	1.06 J	0.220 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	7/9	1.40 J	0.178 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	8/9	6.34	0.263 J	BS1-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	8/9	3.83	0.439 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	8/9	2.59 J	0.142 J	BS1-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	8/9	3.04 J	0.347 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	3/9	0.603 J	0.202 J	UXO1-SB09	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	3/9	1.39 J	0.220 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	5/9	2.54 J	0.265 J	BS1-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	8/9	1.92 J	0.152 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	4/9	3.38	0.369 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	2/9	0.901 J	0.347 J	UXO1-SB09	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	2/9	3.95	2.25	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDD	6/9	805 J	1.30 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDF	5/9	71.3 J	1.46 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-DIOXINS	3/3	19.9	9.83	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-FURANS	3/3	3.78	2.21	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-DIOXINS	3/3	6.12	1.23	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-4A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HEXA-FURANS	3/3	3.15	1.57	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	6/6	152	0.252 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	4/6	65.9 J	5.80 J	PC-S4	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	5/6	34.8	1.23 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	5/6	27.8	0.867 J	BS1-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	3/6	10.6	0.491 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	4/6	33.2	1.55 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-DIOXINS	2/3	0.909	0.698	UXO1-SB09	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	3/3	3.85	0.810	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	3/6	3.26	0.153 J	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	6/9	35.0	0.386	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TETRA-DIOXINS	1/3	0.736	0.736	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	9/9	5.71	0.177	BS1-TP2	2.00 - 4.00	--	--	--	1	0	8	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	9/9	10.7	0.349	BS1-TP2	2.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	9/22	0.00566	0.000720	PC-S4	2.50 - 3.00	--	0.00173	0.00173	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
None Detected	0/ 12	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Percent Moisture (%)																
PERCENT MOISTURE	22/22	31.3	4.60	BS1-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-4A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 4

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-4A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 4

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-4B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 4

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	13,400	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,870	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,810	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,730	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,800	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,570	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,150	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,800	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	118	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,510	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,960	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,700	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,130	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,700	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,990	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,850	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,340 J	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	123	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,410 J	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,900 J	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	119	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,470	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ANTIMONY	0.312 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	31.0	470	**0.270**	NC
ANTIMONY	1.09	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	2.95	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	31.0	470	**0.270**	NC
ANTIMONY	0.277 J	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	31.0	470	**0.270**	NC
ANTIMONY	1.50 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	1.17	31.0	470	**0.270**	NC
ANTIMONY	4.93 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	1.10	31.0	470	**0.270**	NC

TABLE 4-4B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.54	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.952	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.22	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.09	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.83	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.05	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	0.537	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.21	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.569 J	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	0.589	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.10 J	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65 J	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.01 J	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	5.48	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.71 J	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	5.65	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60 J	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53 J	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	5.46	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65 J	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	5.83	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	5.51	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.28 J	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	6.13	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.79 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	5.85	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.32 J	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	5.75	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.10 J	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	5.94	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.68 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	5.48	**0.0620**	**0.250**	18.0	3.11
CADMIUM	0.381 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	4.58	6.37	**0.360**	0.158
CADMIUM	0.399 J	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	0.557	4.58	6.37	**0.360**	0.158
COPPER	53.0	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.19	3,100	47,000	**28.0**	7.79
LEAD	16.6	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	80.0	320	**11.0**	4.33
LEAD	16.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	2.23	80.0	320	**11.0**	4.33
LEAD	11.2	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	2.18	80.0	320	**11.0**	4.33

TABLE 4-4B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
LEAD	12.0 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	2.34	80.0	320	**11.0**	4.33
LEAD	40.7	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.19	80.0	320	**11.0**	4.33
MANGANESE	234	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	1,800	26,000	**220**	304
MANGANESE	224	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	1,800	26,000	**220**	304
MANGANESE	1,670 J	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	2.84	1,800	26,000	**220**	304
MANGANESE	842	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	1,800	26,000	**220**	304
MANGANESE	312 J	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	2.81	1,800	26,000	**220**	304
MANGANESE	287 J	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	2.74	1,800	26,000	**220**	304
MANGANESE	343 J	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	2.82	1,800	26,000	**220**	304
MANGANESE	231 J	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	2.73	1,800	26,000	**220**	304
MANGANESE	446	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	2.92	1,800	26,000	**220**	304
MANGANESE	256 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.74	1,800	26,000	**220**	304
MERCURY	0.254 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.108	23.0	350	**0.100**	NC
VANADIUM	44.7	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	390	5,800	**7.80**	96.4
VANADIUM	48.8	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	43.9	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	54.5	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	390	5,800	**7.80**	96.4
VANADIUM	27.3	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	27.8	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	57.3	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	390	5,800	**7.80**	96.4
VANADIUM	20.6	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	0.537	390	5,800	**7.80**	96.4
VANADIUM	27.9	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	390	5,800	**7.80**	96.4
VANADIUM	67.1	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	0.589	390	5,800	**7.80**	96.4
VANADIUM	27.7	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	43.3	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	1.08	390	5,800	**7.80**	96.4
VANADIUM	27.5	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	38.3	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	42.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	52.8	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	1.09	390	5,800	**7.80**	96.4

TABLE 4-4B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	51.3	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	40.3	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	73.2	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	1.23	390	5,800	**7.80**	96.4
VANADIUM	52.4	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	37.5	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	43.3	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	1.19	390	5,800	**7.80**	96.4
VANADIUM	25.0	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	1.10	390	5,800	**7.80**	96.4
ZINC	360	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	2.71	23,000	350,000	**46.0**	50.1
ZINC	56.0	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	2.64	23,000	350,000	**46.0**	50.1
ZINC	73.5	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	100	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	2.62	23,000	350,000	**46.0**	50.1
ZINC	69.0	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	2.84	23,000	350,000	**46.0**	50.1
ZINC	69.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	11.1	23,000	350,000	**46.0**	50.1
ZINC	50.1	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	92.9	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	50.2	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	11.5	23,000	350,000	**46.0**	50.1
ZINC	269	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	11.0	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.904	BS1-TP1	010BS-TP01	0.00 - 0.50	01/12/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.63	BS1-TP2	010BS-TP03	0.00 - 0.50	01/12/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.71	BS1-TP2	010BS-TP04	2.00 - 4.00	01/12/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.892	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.39	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.59	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.609	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.351	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	0.0	4.90	22.0	**0.200**	NC

TABLE 4-4B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 4 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID	Identification
J	Estimated value
mg/kg	Milligrams per kilogram
ng/kg	Nanograms per kilogram
TEQ	Toxicity equivalence quotient

SECTION 4.4 PHOTOGRAPHS

SECTION 4.4 – EXPOSURE UNIT 4 PHOTOGRAPHIC LOG

Photograph 4.4-1
Burn Slit/Trench 1 Test Pit 1 Looking North

Photograph 4.4-2
Burn Slit/Trench 1 Test Pit 2 Looking South

SECTION 4.4 – EXPOSURE UNIT 4 PHOTOGRAPHIC LOG

Photograph 4.4-3
View South Along Burn Slit/Trench 1

Photograph 4.4-4
Burn Slit/Trench 1 MDAS Incendiary Bomb and Fuse Components

Photograph 4.4-5
Burn Barrel Excavations

Photograph 4.4-6
Burn Barrel 2 Excavation

Photograph 4.4-7
Former Trailer
Soils Sample Location

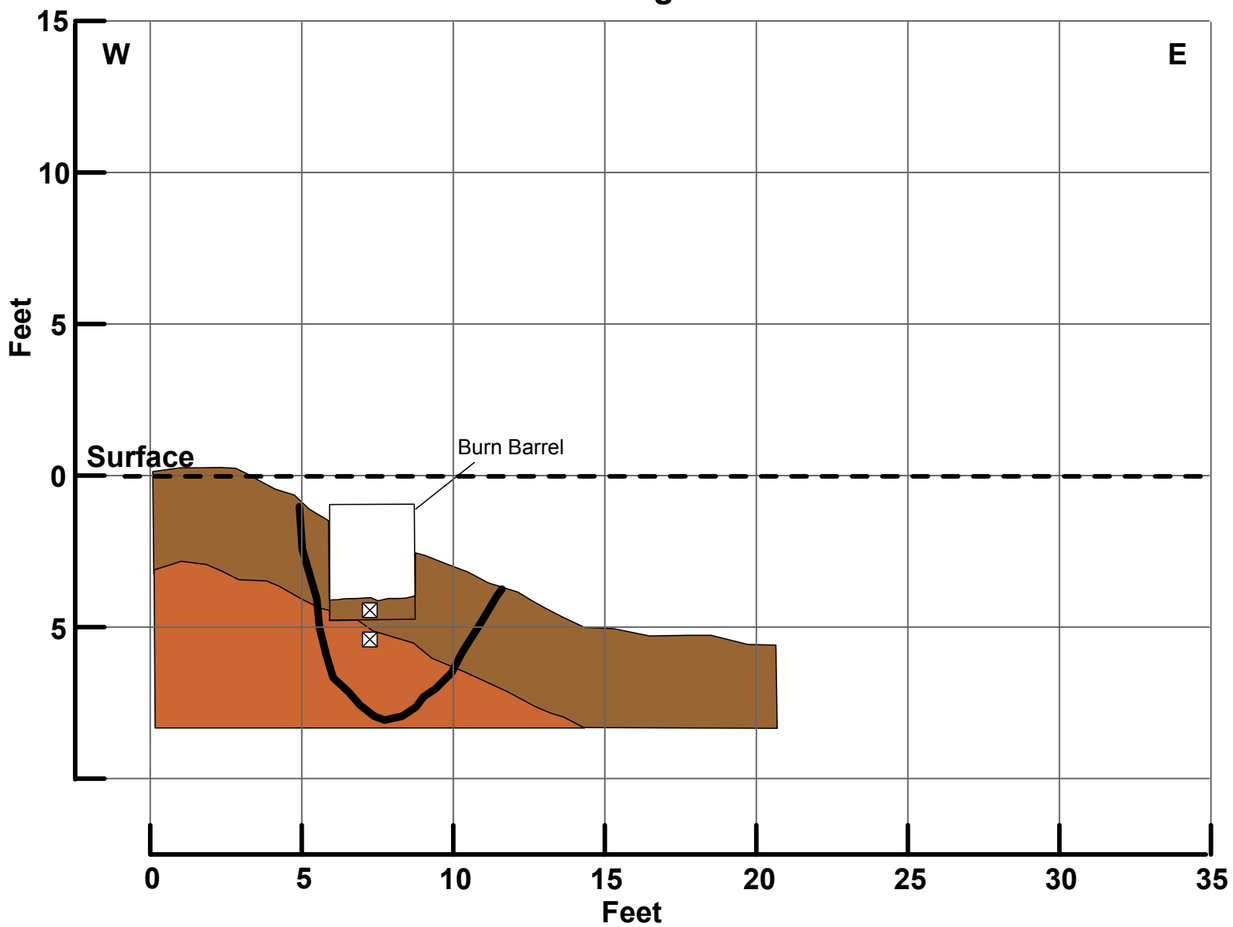
Photograph 4.4-8
Southern Portion of Pilgrim Creek Looking South

Photograph 4.4-9
Installing Temporary Well PC-MW2

Photograph 4.4-10
Pilgrim Creek Soil Sampling PC-SB04

SECTION 4.4 TEST PIT LOGS

Trench Profile BB1-E1
View Looking North



Debris Content

MDAS Small arms casings, igniters [100%] (75 lbs)

Total Depth

8 feet below adjacent grade
6 feet below lowest surface grade

Samples

010MBDA-BB01
(4.0-4.5 ft bgs)

010MDBA-BB02
(6.0-6.5 ft bgs)

Date Excavated:	5 February 2015	**Trench No.:**	BB1-E1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Barrel 1	**Project No:**	103G1959010

Topsoil/Fill
Medium bown silty sand, moist, loose

Weathered Bedrock
Light red brown to yellow brown, some mottling

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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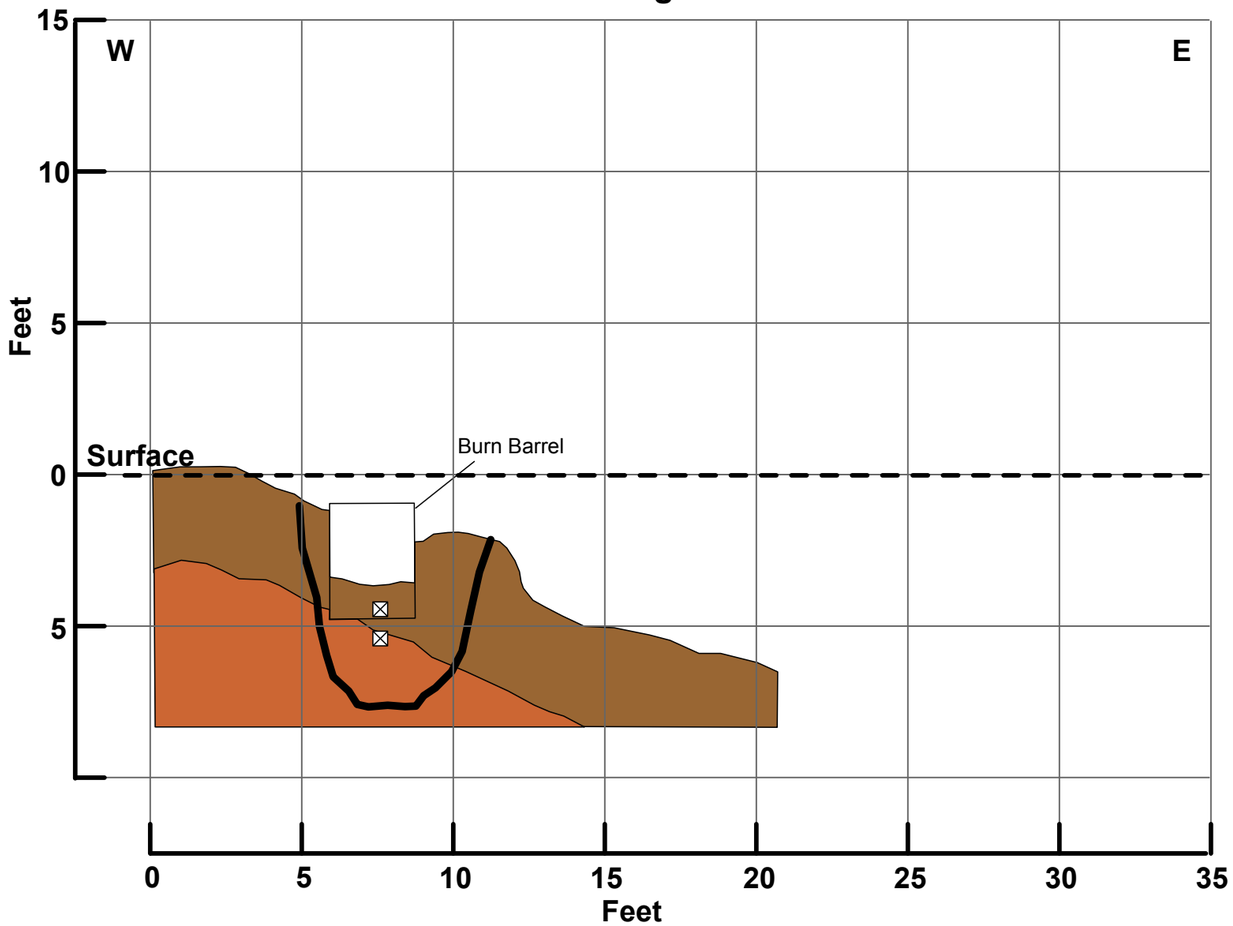
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BB1-E1 TRENCH LOG

Trench Profile BB2-E1
View Looking North



Samples

010MBDA-BB03
(4.0-4.5 ft bgs)

010MDBA-BB04
(6.0-6.5 ft bgs)

Debris Content

MDAS Small arms casings, igniters [100%] (100 lbs)

Total Depth

7 feet below adjacent grade
6 feet below lowest surface grade

Date Excavated:	5 February 2015	**Trench No.:**	BB2-E1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Barrel 2	**Project No:**	103G1959010

Topsoil/Fill
Medium bown silty sand, moist, loose

Weathered Bedrock
Light red brown to yellow brown, some mottling

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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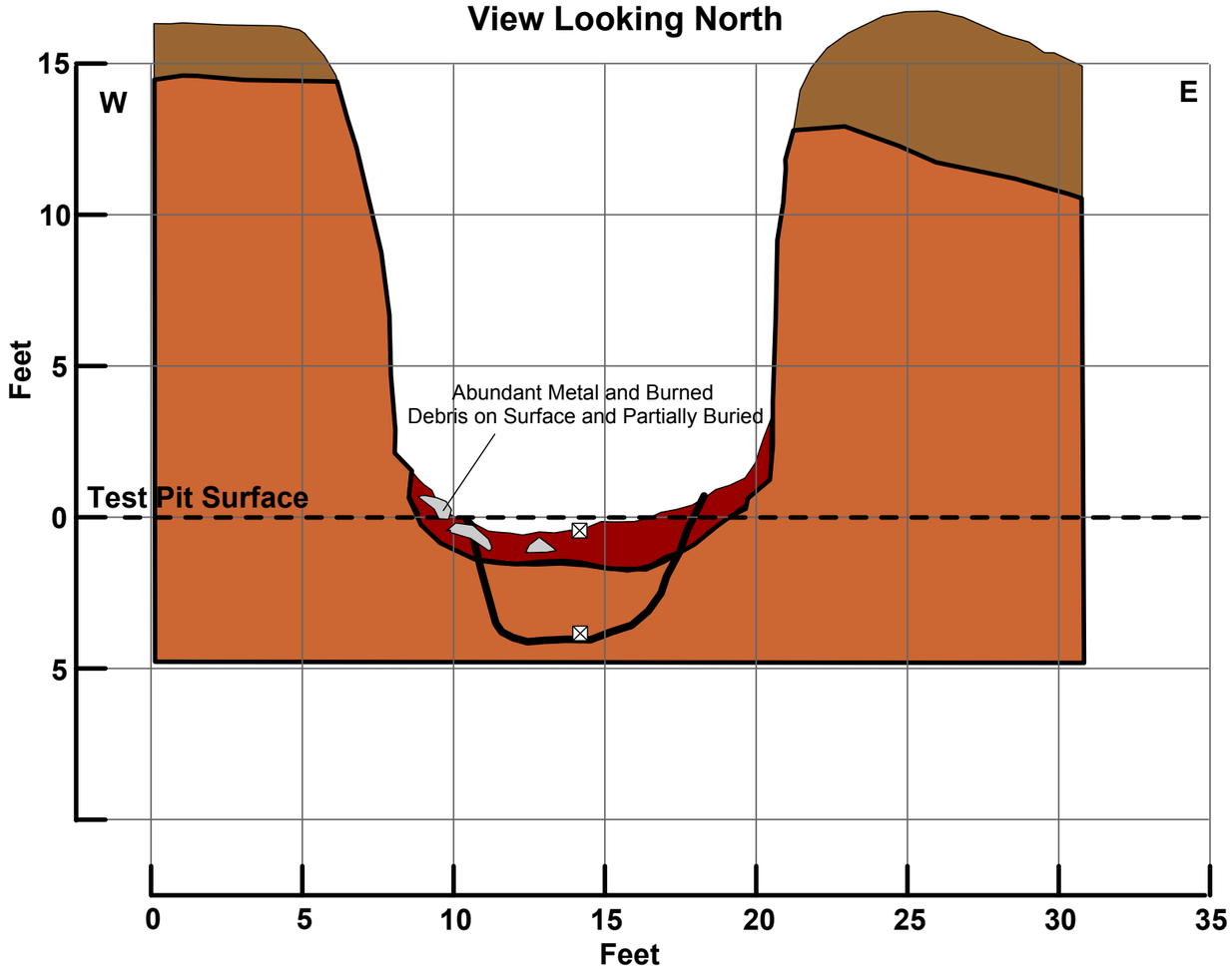
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BB2-E1 TRENCH LOG

Trench Profile BS1-TP1
View Looking North



Debris Content

MDAS	Incendiary bomb components, fuze components, munitions debris (no explosive compounds) [10-15%] (80 lbs)
Scrap	Scrap metal on surface and partially buried [20-25%] (100 lbs)
Other	Wood [< 5%] (10 lbs)

Total Depth

20 feet below adjacent grade
4 feet below lowest surface grade

Samples

010BS-TP01
(0.0-0.5 ft bgs)

010BS-TP02
(2.0-4.0 ft bgs)

Date Excavated:	13 January 2015	**Trench No.:**	BS1-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 1	**Project No:**	103G1959010

Topsoil
Dark to medium brown silty sand, moist, loose

Topsoil/Slough
Light to medium brown silty sand, moist to dry, loose, some organices (roots), some metal debris

Weathered Bedrock
Light red-tan granite, equigranular, slightly weathered

Large Debris
Abundant metal and burned debris on surface and partially buried

Limits of Excavation

Geologic Contact (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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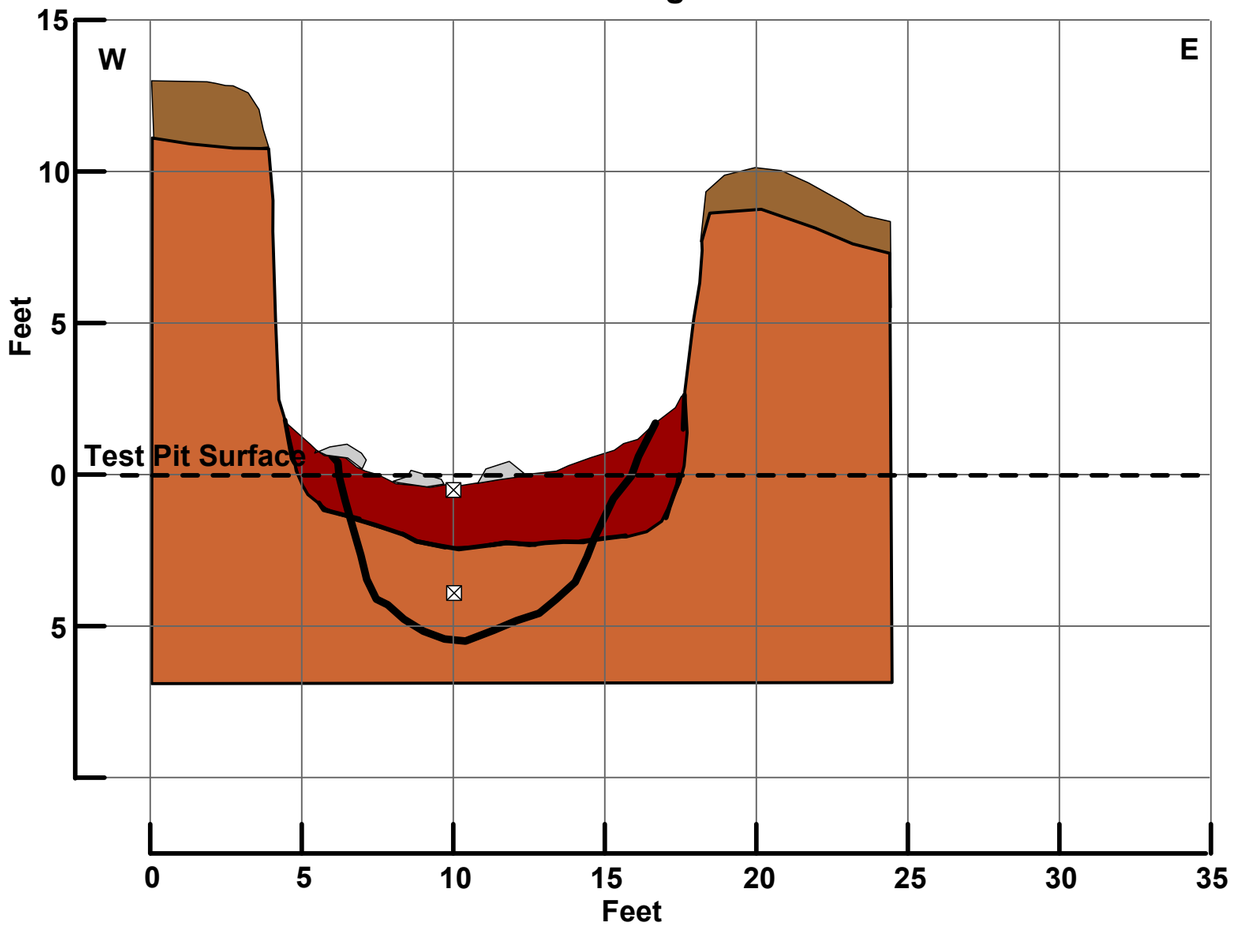
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS1-TP1 TRENCH LOG

Trench Profile BS1-TP2
View Looking North



Debris Content

MDAS Incendiary bomb components, fuze components, munitions debris (no explosive compounds) [5-10%] (60 lbs)

Scrap Scrap metal, straps, and metal plates [5-10%] (20 lbs)

Total Depth

16 feet below adjacent grade
4 feet below lowest surface grade

Samples

010BS-TP03
(0.0-0.5 ft bgs)

010BS-TP04
(2.0-4.0 ft bgs)

Date Excavated:	13 January 2015	**Trench No.:**	BS1-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 1	**Project No:**	103G1959010

Topsoil
Dark to medium brown silty sand, moist to dry, loose

Topsoil/Slough
Dark brown silty sand, damp, loose, abundant organics (roots), minor metal debris

Weathered Bedrock
Light red-tan granite, equigranular (2 to 4 mm), slightly weathered

Large Debris
Some metal debris, MDAS, and scrap on surface

Limits of Excavation

Geologic Contact (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS1-TP2 TRENCH LOG

4.5 NATURE AND EXTENT OF CONTAMINATION FOR EU 5

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs.

4.5.1 Investigation Results and Discussion at EU 5

EU 5 incorporates the Firing line area, the Central Firing Range Floor, and the Target Berm. Three buried Disposal Trenches (DT9 through DT11) and one suspected Disposal Trench (SD2) were also tentatively identified within this area (Figure 4-5). Several surface structures (used and unused metal targets, concrete and metal blast observation booths, Keyport lockers [2], and concrete debris bins) are also located within this EU. Two geophysical surveys (Marrs 2007; ChaduxTt 2010) were conducted in the range floor area to identify OB/OD trenches that anecdotal evidence suggested were present (Malcolm Pirnie 2006). Sampling within the area during the SI included the completion of three soil borings located within the limits of Disposal Trench 9 and two soil borings within Disposal Trench 10. The borings were advanced to depths ranging from two to six feet bgs. Samples were collected at 0 to 0.5 foot bgs and from the bottom of the borings (if refusal was encountered before the depth of six feet). The samples were analyzed for VOCs, SVOCs, metals, dioxins, and explosives. Also, during the SI, a total of 16 surface composite samples (5 aliquots each) were also collected in the firing line area (3 samples), near the front of small arms targets, where suspect MPPEH items and MDAS were observed (8 samples), and in front of the Metal Target Berm (5 samples). These samples were analyzed for metals and explosives.

Sampling during the RI included the completion of two test pits at the suspect buried Disposal Trench 9 location (Test Pit Logs 4-5). The trench was tentatively identified in historical aerial photographs and during the 2007 geophysical survey conducted by Marrs. The trench is one of the longest OB/OD trenches within the site, measuring approximately 390 feet in length. The western portion of the trench is evidenced by settlement of the fill resulting in a 20-foot wide linear depression in the range floor. Two test pits were excavated during this RI on this Disposal Trench. Debris fill was observed in Test Pit DT9-TP1 to a depth of 9 feet bgs and a maximum width at the surface of 16 feet and a width at the bottom of the debris of 13 feet. An upper layer of fill was observed in this test pit that appeared to contain significantly more debris than the lower debris fill. In Test Pit DT9-TP2, the fill was observed to a depth of approximately six feet bgs and a width of 23 feet at the surface and approximately 18 feet at the bottom of the debris. The debris fill contained a variety of MDAS, scrap metal, wood, and other burned debris/burn ash comprising approximately 25 percent of the fill volume in the upper layer and 15 percent in the lower zone. For Test Pits DT9-TP1 and TP-2, samples were collected at the surface (0 – 0.5 foot bgs), within the central portion of the debris fill (four to six feet bgs), at the fill to native contact (four to five and nine to ten feet bgs, respectively) and at least two feet below that in native undisturbed bedrock (eight to nine and 11 to 12 ft. bgs, respectively). The surface samples were analyzed for metals, explosives, PCP, perchlorate, dioxin, white phosphorous, and hydrazine. The debris and native contact sample in DT9-TP1 included the same analytical suite and was also analyzed for TPH-d.

Suspected Disposal Trench 10 was an irregular elongated feature located south of Disposal Trench 9. Test Pit DT10-TP1 was excavated in the eastern portion of the suspect feature; however, there fill or debris were not observed within the test pit. Soil samples were collected at the surface (0 to 0.5 foot bgs) and the bottom of the test pit (2.5 to 3.0 feet bgs). However, Test Pit DT10-TP2 did encounter debris to a depth of approximately 4 feet bgs, at a length of 13 feet within the test pit. The debris comprised less than 15 percent of the fill and contained some MDAS, scrap metal, wood, plastic, and minor burn ash. It appears the eastern portion of the suspect trench may have been a result of a geologic feature (shallow drainage channel). Samples were collected at the surface (0 – 0.5 foot bgs), within the central portion of the debris fill (two to four feet bgs), at the fill to native contact (5 – 5.5 ft. bgs), and approximately one foot below that in native undisturbed bedrock (5.5 – 6.0 ft. bgs). The samples were analyzed for metals, explosives, PCP, perchlorate, dioxin, white phosphorous, and hydrazine. The deepest sample in DT10-TP2 was also analyzed for TPH-d. Dioxin and white phosphorous were not included in the analytical suite for the lower bedrock samples.

Suspected Disposal Trench 11 was identified as a possible feature during the geophysical survey conducted during the SI. The trench is located south of Disposal Trench 10. Two surficial soil samples were collected from this area during the SI. During this RI, Test Pit DT11-TP1 was excavated to a depth of five feet bgs and a length of 18 feet in the central portion of the feature; however, no fill or debris was observed in this test pit. Soil samples were collected at depths of 0 – 0.5 foot bgs and four to five feet bgs and analyzed for metals, explosives, PCP, perchlorate, dioxin, white phosphorous, and hydrazine. The deepest sample was also analyzed for TPH-d.

Surface Disturbance 2 was identified as a surface disturbance during the SI from historical photographs of the site taken in 1974. Two test pits were excavated across the suspect features alignment during this RI. Debris fill was encountered within Test Pit SD2-TP-1 to a depth of 3.5 feet bgs with a width of approximately 16 feet. The fill contained burned wood, burn ash and scrap metal (metal drum lid). Samples were collected at the surface (0 – 0.5 foot bgs), in the debris (two to three feet bgs), just above the native contact, and in the bedrock (three feet bgs). The surface and debris fill samples were analyzed for metals, explosives, PCP, perchlorate, dioxin, white phosphorous, and hydrazine. The underlying bedrock samples were analyzed for the same suite of analyses with the exception of dioxin and white phosphorous. In Test Pit SD2-TP1, weathered bedrock was observed at a depth of 1.5 to 2.5 feet bgs with no evidence of debris or other fill observed. Samples were collected from this test pit at depths of 0 – 0.5 foot bgs and three to four feet bgs and analyzed for metals, explosives, PCP, TPH-d, perchlorate, dioxin, white phosphorous, and hydrazine.

The metal target and earthen Target Berm are located in the southern portion of EU 5. Based on penetrations in the current metal plate, it appears that 20 to 40-mm rounds were common ammunition used at the range. Three test pits were excavated in the earthen berm located behind the metal plate. The test pits were completed in the upper portion of the metal target and extended above the top of the plate to evaluate for the possible presence of UXO that may have missed the target or penetrated the target and not detonated. The test pits were excavated to a depth of approximately five feet into the face of the berm. The material from the test pits were spread out adjacent to the berm and inspected by the UXO technicians prior to collecting the samples.

Samples from the surface (0 – 0.5 foot bgs) and the lower/interior portion of the test pit (2 to 4 feet bgs) were analyzed for metals, explosives, perchlorate, white phosphorous, and hydrazine.

Area groundwater well AGW-MW3 was planned to be installed within EU 5 as part of the bedrock aquifer evaluation. A boring was advanced to a depth of approximately 47 feet bgs (until drill refusal was met); however, no groundwater was encountered. Soil samples were collected at depths of 0 – 0.5, 5, 10, and 30 feet bgs. The surface sample was analyzed for metals and dioxins; the 5, 10, and 30 foot samples were analyzed for metals, with the 30 foot sample also analyzed for explosives, VOCs, SVOCs, perchlorate, dioxins, and hydrazine.

4.5.2 Extent of MPPEH and MC at EU 5

A total of nine MDAS items previously identified as MPPEH during the SI were removed from the surface within EU 5 during the initial site clearance sweep. The MPPEH item discovered during the RI included a 4.5-inch barrage rocket casing removed from Test Pit 2 in Disposal Trench 10. Analytical results indicated that arsenic exceeded human health screening levels in all sample locations with results ranging from 0.769J to 3.15 mg/kg. The dioxin concentration exceeds the human health screening level (4.90 ng/kg) in the sample from Disposal Trench 9 TP-1 at a depth of three to four feet bgs with a result of 102 ng/kg. Sample UXO1-SB06 collected during the previous SI also yielded a concentration greater than the screening level with 11.2 ng/kg.

There were no explosives, VOCs, SVOCs, perchlorate, PCP, and hydrazine concentrations detected or, if detected, above associated screening levels.

Data from samples collected in the bedrock soils below the debris fill indicate that there has not been vertical migration of COPCs from the disposal trenches. A summary of soil analytical results compared with screening criteria and exceedances for EU 5 are provided at the end of this section, respectively (Tables 4-5A and 4-5B).

4.5.3 Human Health Risk Assessment Findings

4.5.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 2E-09 for both federal toxicity criteria and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.00008 for federal toxicity values and 0.00001 for State of California toxicity values. The maximum detected concentrations of lead in surface soil at EU 5 is 16.4 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 5.

4.5.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 1E-07 for both federal and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.01 for federal

toxicity values and 0.03 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 5 is 16.4 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified in surface soil for the future industrial worker at EU 5.

The estimated cancer risk from exposure to subsurface soil is 4E-06 for both federal and State of California toxicity values. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxin** in subsurface soil. The noncancer HI from exposure to subsurface soil is 0.1 for federal toxicity criteria and 0.03 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 5 is 22.9 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. **Dioxins** are COCs in subsurface soil at EU.

4.5.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 5E-07 for both federal and State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.4 for federal toxicity criteria and 0.05 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 5 is 22.9 mg/kg. This concentration is below the risk-based screening level of 39 mg/kg for the future construction worker. No chemical risk drivers were identified in subsurface soil for the future construction worker at EU 5.

4.5.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 4E-07 for both federal and State of California toxicity criteria. The noncancer HIs from exposure to surface soil for the future residential scenario are based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.4 for federal toxicity values and 0.06 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 5 is 16.4 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. No chemical risk drivers were identified in surface soil for the future resident at EU 5.

The estimated cancer risk from exposure to subsurface soil is 1E-05 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in subsurface soil. The estimated HI for subsurface soil is 2 for federal toxicity criteria and 0.2 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 5 is 22.9 mg/kg. This concentration is below the risk-based screening level of 80 mg/kg for residential soil. **Dioxins** are COCs in subsurface soil at EU 5.

The maximum detected concentrations of lead in surface and subsurface soil at EU 5 is 16.4 mg/kg and 22.9 mg/kg, respectively. These concentrations are below the risk-based screening levels of 80 mg/kg for residential soil and 320 mg/kg for industrial soil. Based on these comparisons, lead is below a level of concern in both surface and subsurface soil at EU 5.

The following provide a summary of the human health risk assessment findings for EU 5:

SUMMARY OF INCREMENTAL RISK DRIVERS							
Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
5	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Dioxins	--	Dioxins

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.5.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 5 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.5.4.1 Results of the Step 2 SLERA for EU 5

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 5:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 5	COPECs without Benchmarks or TRVs
Plants	chromium, copper, manganese, vanadium	strontium, dioxins, perchlorate
Invertebrates	chromium	cobalt, molybdenum, silver, thallium, vanadium, dioxins, perchlorate
Birds	chromium, copper, lead, zinc	antimony, beryllium, thallium, perchlorate
Non-Burrowing Mammals	cadmium, copper, lead, selenium, vanadium, zinc	perchlorate
Burrowing Mammals	dioxins	perchlorate

In summary, the SLERA indicates that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.5.4.2 Results of the Step 3a Risk Refinement for EU 5

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) supports an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, no COECs were identified for EU 5.

4.5.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 5:

- All previously identified MDAS items at the surface were removed during the RI.

- MPPEH item discovered within the EU included a barrage rocket body recovered from TP1 in Disposal Trench 10.

- No UXO or MPPEH items were recovered from the three Target Berm test pits.

- MDAS identified in the area consisted of a 40-mm cartridge case, 20-mm casing, flare plates, and flare caps.

- Groundwater was not observed within the maximum explored depth of 47 feet bgs in AGM-MW3, so a monitoring well was not installed at this location.

- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, present at concentrations that exceed initial screening levels.

- The HHRA indicates that dioxins are risk drivers in subsurface soil for future industrial workers and future residents. The human health risks fall within the range of risk management decision. No further action is recommended with regard to human health risk based upon the following:

    - The planned future use will remain secured open space with existing land use controls in-place.

    - This EU is infrequently visited by Navy workers or contractors,

    - The calculated risk for industrial or construction workers are generally conservative.

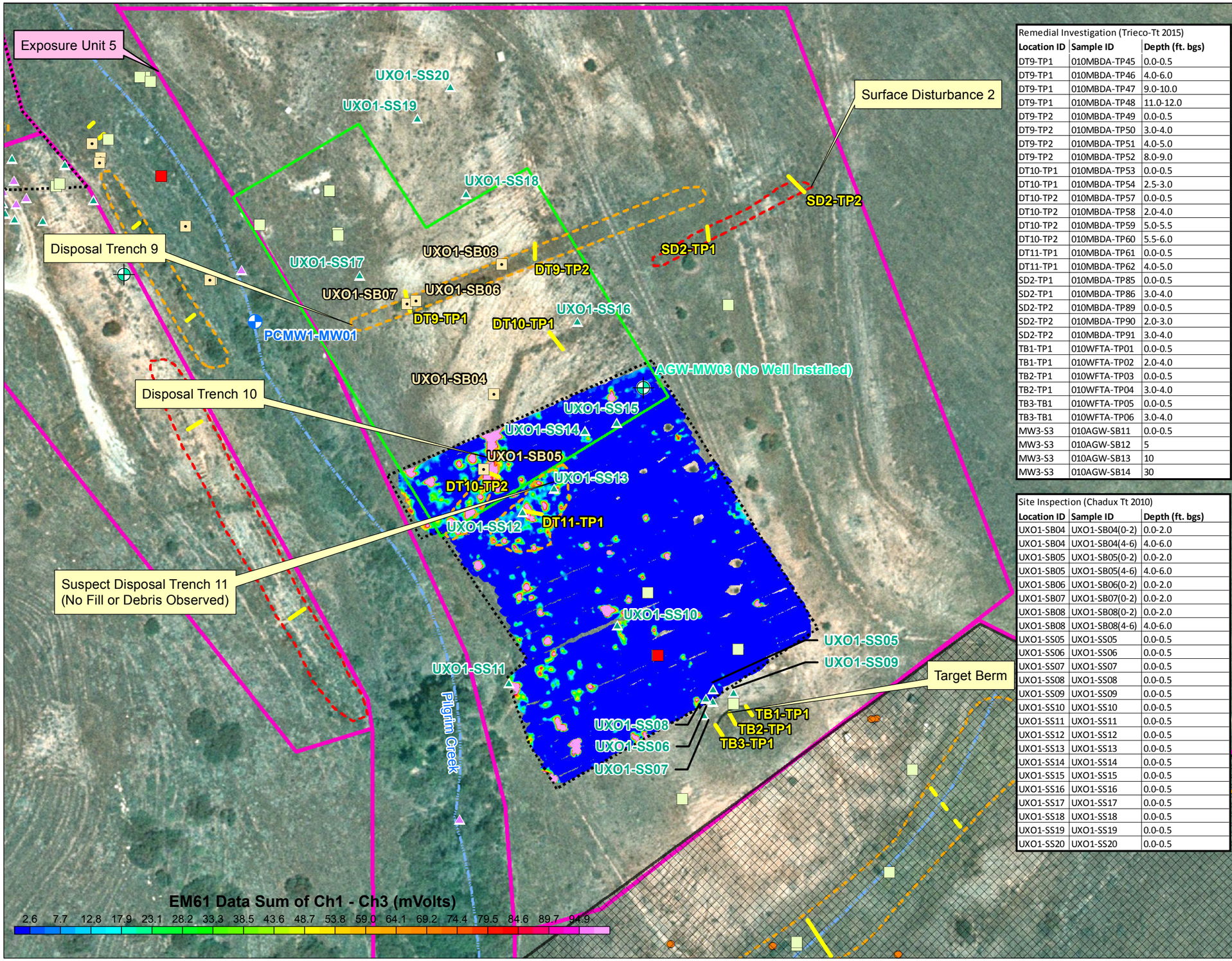
    - Workers allowed access this EU will be briefed to reduce their potential exposure to the contaminants at the site.

- The ERA Step 3a refinement indicates there are no COECs identified for this EU.

- Analytical data indicates that COCs identified in the central range floor disposal trenches are not migrating vertically into the underlying bedrock material.

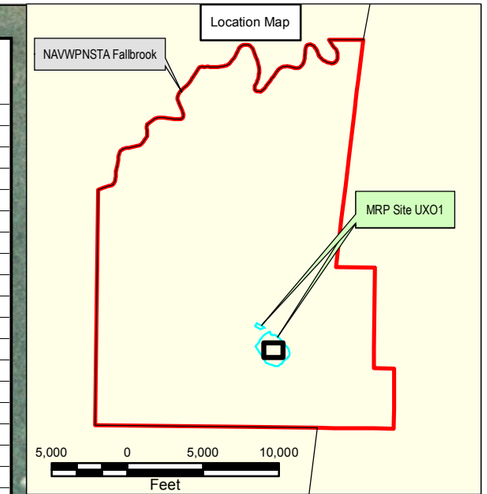
- Further response actions should be considered in the FS due to the possible presence of MEC/MPPEH within Disposal Trenches 9 and 10, the eastern portion of Surface Disturbance 2 and the earthen Target Berm.

SECTION 4.5 FIGURES



Remedial Investigation (Trieco-Tt 2015)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
DT9-TP1	010MBDA-TP45	0.0-0.5
DT9-TP1	010MBDA-TP46	4.0-6.0
DT9-TP1	010MBDA-TP47	9.0-10.0
DT9-TP1	010MBDA-TP48	11.0-12.0
DT9-TP2	010MBDA-TP49	0.0-0.5
DT9-TP2	010MBDA-TP50	3.0-4.0
DT9-TP2	010MBDA-TP51	4.0-5.0
DT9-TP2	010MBDA-TP52	8.0-9.0
DT10-TP1	010MBDA-TP53	0.0-0.5
DT10-TP1	010MBDA-TP54	2.5-3.0
DT10-TP2	010MBDA-TP57	0.0-0.5
DT10-TP2	010MBDA-TP58	2.0-4.0
DT10-TP2	010MBDA-TP59	5.0-5.5
DT10-TP2	010MBDA-TP60	5.5-6.0
DT11-TP1	010MBDA-TP61	0.0-0.5
DT11-TP1	010MBDA-TP62	4.0-5.0
SD2-TP1	010MBDA-TP85	0.0-0.5
SD2-TP1	010MBDA-TP86	3.0-4.0
SD2-TP2	010MBDA-TP89	0.0-0.5
SD2-TP2	010MBDA-TP90	2.0-3.0
SD2-TP2	010MBDA-TP91	3.0-4.0
TB1-TP1	010WFTA-TP01	0.0-0.5
TB1-TP1	010WFTA-TP02	2.0-4.0
TB2-TP1	010WFTA-TP03	0.0-0.5
TB2-TP1	010WFTA-TP04	3.0-4.0
TB3-TB1	010WFTA-TP05	0.0-0.5
TB3-TB1	010WFTA-TP06	3.0-4.0
MW3-S3	010AGW-SB11	0.0-0.5
MW3-S3	010AGW-SB12	5
MW3-S3	010AGW-SB13	10
MW3-S3	010AGW-SB14	30

Site Inspection (Chadux Tt 2010)		
Location ID	**Sample ID**	**Depth (ft. bgs)**
UXO1-SB04	UXO1-SB04(0-2)	0.0-2.0
UXO1-SB04	UXO1-SB04(4-6)	4.0-6.0
UXO1-SB05	UXO1-SB05(0-2)	0.0-2.0
UXO1-SB05	UXO1-SB05(4-6)	4.0-6.0
UXO1-SB06	UXO1-SB06(0-2)	0.0-2.0
UXO1-SB07	UXO1-SB07(0-2)	0.0-2.0
UXO1-SB08	UXO1-SB08(0-2)	0.0-2.0
UXO1-SB08	UXO1-SB08(4-6)	4.0-6.0
UXO1-SS05	UXO1-SS05	0.0-0.5
UXO1-SS06	UXO1-SS06	0.0-0.5
UXO1-SS07	UXO1-SS07	0.0-0.5
UXO1-SS08	UXO1-SS08	0.0-0.5
UXO1-SS09	UXO1-SS09	0.0-0.5
UXO1-SS10	UXO1-SS10	0.0-0.5
UXO1-SS11	UXO1-SS11	0.0-0.5
UXO1-SS12	UXO1-SS12	0.0-0.5
UXO1-SS13	UXO1-SS13	0.0-0.5
UXO1-SS14	UXO1-SS14	0.0-0.5
UXO1-SS15	UXO1-SS15	0.0-0.5
UXO1-SS16	UXO1-SS16	0.0-0.5
UXO1-SS17	UXO1-SS17	0.0-0.5
UXO1-SS18	UXO1-SS18	0.0-0.5
UXO1-SS19	UXO1-SS19	0.0-0.5
UXO1-SS20	UXO1-SS20	0.0-0.5



- Drainage Channel (Approximate)
- Range Fencing
- Exposure Unit Boundaries
- 2010 SI Geophysical Survey Area (ChaduxTt)
- 2015 Geophysical Survey Area (TriEco-Tt)
- Previous Magnetometer Geophysical Survey Limits (Marrs 2007)
- Surface Disturbance (From Historical Aerial Photo)
- Disposal Trench Limits (Approximate)
- MDAS (Removed)
- MPPEH (Removed)
- Metal Debris (Removed)
- RI Soil Sample Location (2015)
- SI Soil Sample Location (2010)
- SI Soil Boring Sample Location (2010)
- Shallow Monitoring Well
- Area Monitoring Well
- Test Pit

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

N

50 0 50 100
Feet

TriEco A Joint Venture

NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

Figure 4-5
Exposure Unit 5 Features and Sample Locations
MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_5_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.5 TABLES

TABLE 4-5A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 5

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 9	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
DIESEL RANGE ORGANICS	1/5	8.60 J	8.60 J	DT9-TP1	4.00 - 6.00	--	--	--	0	0	--	--	96	440	--	--
MOTOR OIL RANGE ORGANICS	1/5	23.0 J	23.0 J	DT9-TP1	4.00 - 6.00	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 8	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	52/52	18,400 J	5,080	DT11-TP1	4.00 - 5.00	11,586	12,069	12,146	0	0	52	7	77,000	1,100,000	50 +	14,710
ANTIMONY	19/52	1.95 J	0.108 J	DT9-TP1	4.00 - 6.00	0.15	0.247	0.244	0	0	3	--	31	470	0.27	--
ARSENIC	52/52	3.82 J	0.769 J	UXO1-SB08	4.00 - 6.00	1.482	1.533	1.591	52	52	0	2	0.062	0.25 #	18	3.105
BARIUM	52/52	316	62.0	UXO1-SB08	4.00 - 6.00	111.4	124.8	126.1	0	0	0	3	15,000	220,000	330	200.5
BERYLLIUM	52/52	0.449 J	0.0690 J	UXO1-SB08	4.00 - 6.00	0.228	0.238	0.239	0	0	0	1	15.2	183 #	21	0.359
CADMIUM	45/52	0.608	0.0966 J	UXO1-SB08	0.00 - 2.00	0.179	0.184	0.212	0	0	1	20	4.58	6.37 #	0.36	0.158
CALCIUM	52/52	5,250	769 J	UXO1-SS17	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	52/52	41.3 J	7.76	DT9-TP2	8.00 - 9.00	12.49	13.74	14.73	0	0	2	3	100,000	100,000 *	26	20.3
COBALT	52/52	11.1	3.16	UXO1-SB08	4.00 - 6.00	6.887	6.861	6.913	0	0	0	3	23	350	13	9.39
COPPER	52/52	154 J	4.23 J	UXO1-SB08	0.00 - 2.00	15	24.88	24.13	0	0	2	15	3,100	47,000	28	7.785
IRON	52/52	33,500 J	9,700 J	DT9-TP2	8.00 - 9.00	17,512	18,231	18,991	0	0	--	3	55,000	100,000 *	--	27,350
LEAD	52/52	22.9 J	2.07 J	UXO1-SB08	0.00 - 2.00	6.62	6.462	6.334	0	0	3	20	80	320 #	11	4.328
MAGNESIUM	52/52	7,210	1,880 J	DT9-TP1	9.00 - 10.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	52/52	425 J	107	DT10-TP2	2.00 - 4.00	273.3	266.7	264.7	0	0	38	8	1,800	26,000	220	304
MOLYBDENUM	27/28	0.494 J	0.121 J	MW3-S3	30.00 - 30.00	0.272	0.243	0.242	0	0	0	0	390	5,800	2 +	0.524
NICKEL	52/52	8.19	3.12	UXO1-SB08	4.00 - 6.00	4.318	4.671	4.673	0	0	0	8	1,500	22,000	38	5.15
POTASSIUM	52/52	5,880	1,400	MW3-S3	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-5A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
SELENIUM	31/52	0.169 J	0.0570 J	UXO1-SS15	0.00 - 0.50	0.132	0.124	0.124	0	0	0	--	390	5,800	0.52	--
SILVER	7/52	0.895	0.0527 J	UXO1-SB08	0.00 - 2.00	--	0.109	0.108	0	0	0	--	390	4,700	4.2	--
SODIUM	51/52	620	71.4 J	DT11-TP1	4.00 - 5.00	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	8/8	17.9	7.63 J	UXO1-SB08	4.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	39/52	0.702	0.169 J	DT9-TP1	9.00 - 10.00	0.315	0.31	0.322	0	0	0	2	0.78	12	1 +	0.552
VANADIUM	52/52	129	27.2	DT9-TP2	8.00 - 9.00	48.49	49.81	53.6	0	0	52	2	390	5,800	7.8	96.4
ZINC	52/52	69.0 J	16.9	UXO1-SB07	0.00 - 2.00	31.68	33.77	33.75	0	0	6	4	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	12/17	3,920	0.891 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	10/17	807	1.66 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	6/17	54.9	0.141 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	5/17	10.4	0.0308 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	9/17	18.4 J	0.0366 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	12/17	85.7	0.0841 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	7/17	17.5	0.120 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	8/17	39.8	0.123 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	5/17	9.29	0.0442 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	4/17	4.98	0.173 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	2/17	2.53 J	0.212 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	10/17	51.1	0.0308 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	3/17	18.4	0.299 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	1/17	0.614	0.614	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	1/17	0.203 J	0.203 J	DT9-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDD	15/17	61,600	3.14 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDF	15/17	3,820	0.157 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-DIOXINS	2/2	900	26.3	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-FURANS	2/2	396	9.64	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-5A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HEXA-DIOXINS	2/2	58.7	3.04	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-FURANS	2/2	105	4.11	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	14/15	10,000	0.461 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	11/15	3,380	0.108 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	11/15	1,990	0.113 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	10/15	1,050	0.0370 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	3/15	252	0.117 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	5/15	279	0.143 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-DIOXINS	1/2	2.30	2.30	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	2/2	8.24	1.32	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	2/15	427	0.870 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	4/17	351	0.652	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	16/17	102	0.0826	DT9-TP2	3.00 - 4.00	--	70.631	70.63	2	1	13	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	16/17	58.4	0.101	DT9-TP2	3.00 - 4.00	--	40.393	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	34/51	0.00920 J	0.000330	UXO1-SS08	0.00 - 0.50	0.0028	0.00219	0.0022	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
HYDRAZINE	2/28	0.000690	0.000600	DT9-TP1	9.00 - 10.00	--	--	--	0	0	--	--	0.23	1.1	--	--
Percent Moisture (%)																
PERCENT MOISTURE	52/52	25.8	1.90	UXO1-SS17	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-5A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 5

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-5A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 5

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	16,200	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,600	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,560 J	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,600 J	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400 J	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500 J	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,940 J	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	18,400 J	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,200 J	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,820 J	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,100 J	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,700 J	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300 J	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,300 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,800 J	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100 J	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,040	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	100	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100 J	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,900 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300 J	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,800 J	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,100 J	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,500	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,200	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,400	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,900 J	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	114	77,000	1,100,000	**50.0**	14,700

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	8,650 J	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	120	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,080	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	125	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	118	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,120	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,000	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,200 J	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,000 J	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,500 J	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,400 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,000 J	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,170 J	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,500 J	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,850 J	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,380 J	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	116	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,020	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,960	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,530	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,460	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,900	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,830	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	113	77,000	1,100,000	**50.0**	14,700
ANTIMONY	1.95 J	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.320 J	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	31.0	470	**0.270**	NC
ANTIMONY	0.319 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	31.0	470	**0.270**	NC
ARSENIC	1.43	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.995	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	**0.0620**	**0.250**	18.0	3.11

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.16	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.32	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.948	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.04	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.68	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.04	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.15	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.31	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.43	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.29	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.22	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.41	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.31	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.64	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.78	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.45	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.52	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.45	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.993 J	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.769 J	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	6.02	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.07 J	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.62 J	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	5.46	**0.0620**	**0.250**	18.0	3.11

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.84 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	6.23	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.50 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	5.88	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.35 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	5.66	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.82 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	5.70	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.83 J	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.43 J	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38 J	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.74 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20 J	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	5.76	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20 J	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	5.67	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.949 J	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	5.78	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.18 J	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82 J	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	5.74	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.00 J	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	5.56	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.19 J	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	5.83	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.70 J	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	5.71	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.39 J	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	5.73	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.87 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	5.64	**0.0620**	**0.250**	18.0	3.11
CADMIUM	0.608	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	0.566	4.58	6.37	**0.360**	0.158
CHROMIUM	41.3 J	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	100,000	100,000	**26.0**	20.3
CHROMIUM	34.3	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	100,000	100,000	**26.0**	20.3
COPPER	154 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	2.26	3,100	47,000	**28.0**	7.79
COPPER	32.6 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	2.25	3,100	47,000	**28.0**	7.79
LEAD	12.2 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	2.35	80.0	320	**11.0**	4.33
LEAD	22.9 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	2.26	80.0	320	**11.0**	4.33
LEAD	16.4 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	2.25	80.0	320	**11.0**	4.33
MANGANESE	225 J	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	1,800	26,000	**220**	304

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	314 J	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	1,800	26,000	**220**	304
MANGANESE	290 J	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	1,800	26,000	**220**	304
MANGANESE	425 J	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	1,800	26,000	**220**	304
MANGANESE	285 J	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	1,800	26,000	**220**	304
MANGANESE	229 J	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	1,800	26,000	**220**	304
MANGANESE	290 J	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	1,800	26,000	**220**	304
MANGANESE	314 J	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	1,800	26,000	**220**	304
MANGANESE	238	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	1,800	26,000	**220**	304
MANGANESE	277	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	1,800	26,000	**220**	304
MANGANESE	255 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	1,800	26,000	**220**	304
MANGANESE	248 J	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	1,800	26,000	**220**	304
MANGANESE	253 J	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	1,800	26,000	**220**	304
MANGANESE	230 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	1,800	26,000	**220**	304
MANGANESE	225 J	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	1,800	26,000	**220**	304
MANGANESE	253 J	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	1,800	26,000	**220**	304
MANGANESE	268 J	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	1,800	26,000	**220**	304
MANGANESE	254 J	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	1,800	26,000	**220**	304
MANGANESE	263 J	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	1,800	26,000	**220**	304
MANGANESE	259 J	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	1,800	26,000	**220**	304
MANGANESE	257 J	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	1,800	26,000	**220**	304
MANGANESE	310	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	2.84	1,800	26,000	**220**	304
MANGANESE	278 J	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	2.81	1,800	26,000	**220**	304
MANGANESE	257 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	3.12	1,800	26,000	**220**	304
MANGANESE	311 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	2.85	1,800	26,000	**220**	304
MANGANESE	299	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	234	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	234	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	239	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	224	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	341	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	2.88	1,800	26,000	**220**	304
MANGANESE	271	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	334	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	2.83	1,800	26,000	**220**	304
MANGANESE	247	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	2.89	1,800	26,000	**220**	304
MANGANESE	296 J	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	2.87	1,800	26,000	**220**	304
MANGANESE	276 J	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	2.78	1,800	26,000	**220**	304
MANGANESE	233 J	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	2.86	1,800	26,000	**220**	304
MANGANESE	404 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	2.82	1,800	26,000	**220**	304
VANADIUM	45.9	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	42.5	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	28.8	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	390	5,800	**7.80**	96.4
VANADIUM	33.6	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	390	5,800	**7.80**	96.4
VANADIUM	42.2	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	390	5,800	**7.80**	96.4
VANADIUM	33.2	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	390	5,800	**7.80**	96.4
VANADIUM	30.6	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	63.3	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	390	5,800	**7.80**	96.4
VANADIUM	45.6	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	34.2	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	97.0	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	81.8	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	49.6	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	390	5,800	**7.80**	96.4
VANADIUM	55.0	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	390	5,800	**7.80**	96.4
VANADIUM	59.3	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	0.542	390	5,800	**7.80**	96.4
VANADIUM	129	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	390	5,800	**7.80**	96.4
VANADIUM	62.4	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	390	5,800	**7.80**	96.4
VANADIUM	47.5	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	390	5,800	**7.80**	96.4
VANADIUM	55.1 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	47.3	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	67.1	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	0.526	390	5,800	**7.80**	96.4

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	83.0	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	61.0	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	390	5,800	**7.80**	96.4
VANADIUM	59.6	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	56.1	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	56.7	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	390	5,800	**7.80**	96.4
VANADIUM	58.7	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	390	5,800	**7.80**	96.4
VANADIUM	55.4	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	30.0	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	27.9	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	1.20	390	5,800	**7.80**	96.4
VANADIUM	27.2	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	50.3	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	1.09	390	5,800	**7.80**	96.4
VANADIUM	53.3	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	1.25	390	5,800	**7.80**	96.4
VANADIUM	48.1	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	1.18	390	5,800	**7.80**	96.4
VANADIUM	31.6	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	64.2	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	57.5	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	46.4	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	44.2	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	59.2	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	47.8	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	42.6	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	48.9	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	34.1	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	28.3	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	1.16	390	5,800	**7.80**	96.4
VANADIUM	33.6	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	53.9	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	28.7	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	32.0	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	53.8	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	1.14	390	5,800	**7.80**	96.4

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	39.1	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	50.1	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	1.13	390	5,800	**7.80**	96.4
ZINC	46.3	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	51.8	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	2.71	23,000	350,000	**46.0**	50.1
ZINC	55.0 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	12.5	23,000	350,000	**46.0**	50.1
ZINC	69.0 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	11.8	23,000	350,000	**46.0**	50.1
ZINC	66.5 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	11.3	23,000	350,000	**46.0**	50.1
ZINC	46.3 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	11.4	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.540	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.368	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.303	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.327	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.367	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.302 U	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.406	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.396	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.19	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	102	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.236	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.683	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.607	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	11.7	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	0.0	**4.90**	22.0	**0.200**	NC

TABLE 4-5B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 5 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID	Identification
J	Estimated value
mg/kg	Milligrams per kilogram
ng/kg	Nanograms per kilogram
TEQ	Toxicity equivalence quotient
U	Nondetected

SECTION 4.5 PHOTOGRAPHS

SECTION 4.5 – EXPOSURE UNIT 5 PHOTOGRAPHIC LOG

Photograph 4.5-1
Disposal Trench 9 – Test Pit 1
Abundant Wood and other Burned Debris in Upper Zone

Photograph 4.5-2
Disposal Trench 10 – Test Pit 2
Burned Debris Layer at East Limit of Test Pit

SECTION 4.5 – EXPOSURE UNIT 5 PHOTOGRAPHIC LOG

Photograph 4.5-3
Disposal Trench 10 – Test Pit 2
Metal Pallet

Photograph 4.5-4
Excavator at Surface Disturbance 2 – Test Pit 1

Photograph 4.5-5
Surface Disturbance 2 – Test Pit 1
No Fill or Debris Observed

Photograph 4.5-6
View of Target Range From Firing Area
Excavator is Working at Target Berm

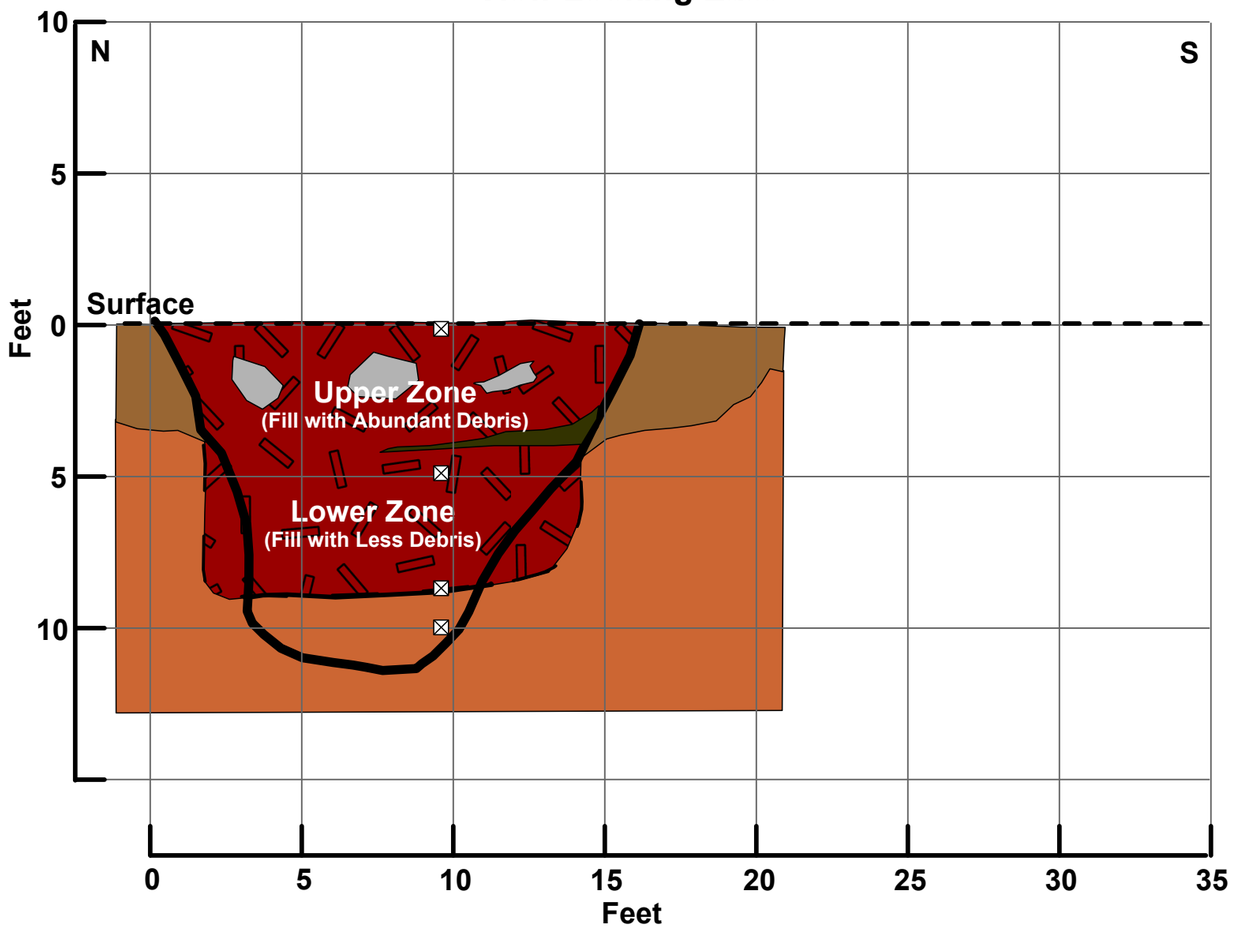
Photograph 4.5-7
View From Behind Target Berm
Test Pits in Foreground

Photograph 4.5-8
Target Berm Test Pit 1 in Foreground

Photograph 4.5-9
Target Berm Test Pit Sample Collection

SECTION 4.5 TEST PIT LOGS

Trench Profile DT9-TP1
View Looking East



Debris Content

MDAS 40-mm cartridge case [< 5%] (10 lbs)

Scrap Nails, other metal debris [upper zone 10-15%, lower zone 3 - 5%] (100 lbs total)

Other Wood, paper, styrofoam [upper zone 5%, lower zone <3%] (50 lbs total)

Total Depth

12 feet below adjacent grade
12 feet below lowest surface grade

Samples

010MBDA-TP45
(0.0-0.5 ft bgs)

010MBDA-TP46
(4.0-6.0 ft bgs)

010MBDA-TP47
(9.0-10.0 ft bgs)

010MBDA-TP48
(11.0-12.0 ft bgs)

Date Excavated:	13 January 2015	**Trench No.:**	DT9-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 9	**Project No:**	103G1959010

Topsoil
Dark brown silty sand with a trace of clay, damp, very loose

Debris Fill
Red brown to light redbrown silty sand, damp to dry, loose, with layer of burned material on south side, abundant debris with some wood, paper, and styrofoam

Weathered Bedrock (Granite)
Light grey brown granite, equigranular (2 to 3 mm) slightly weathered, moderately difficult to excavate

Debris
Abundant metal debris

Burn Ash

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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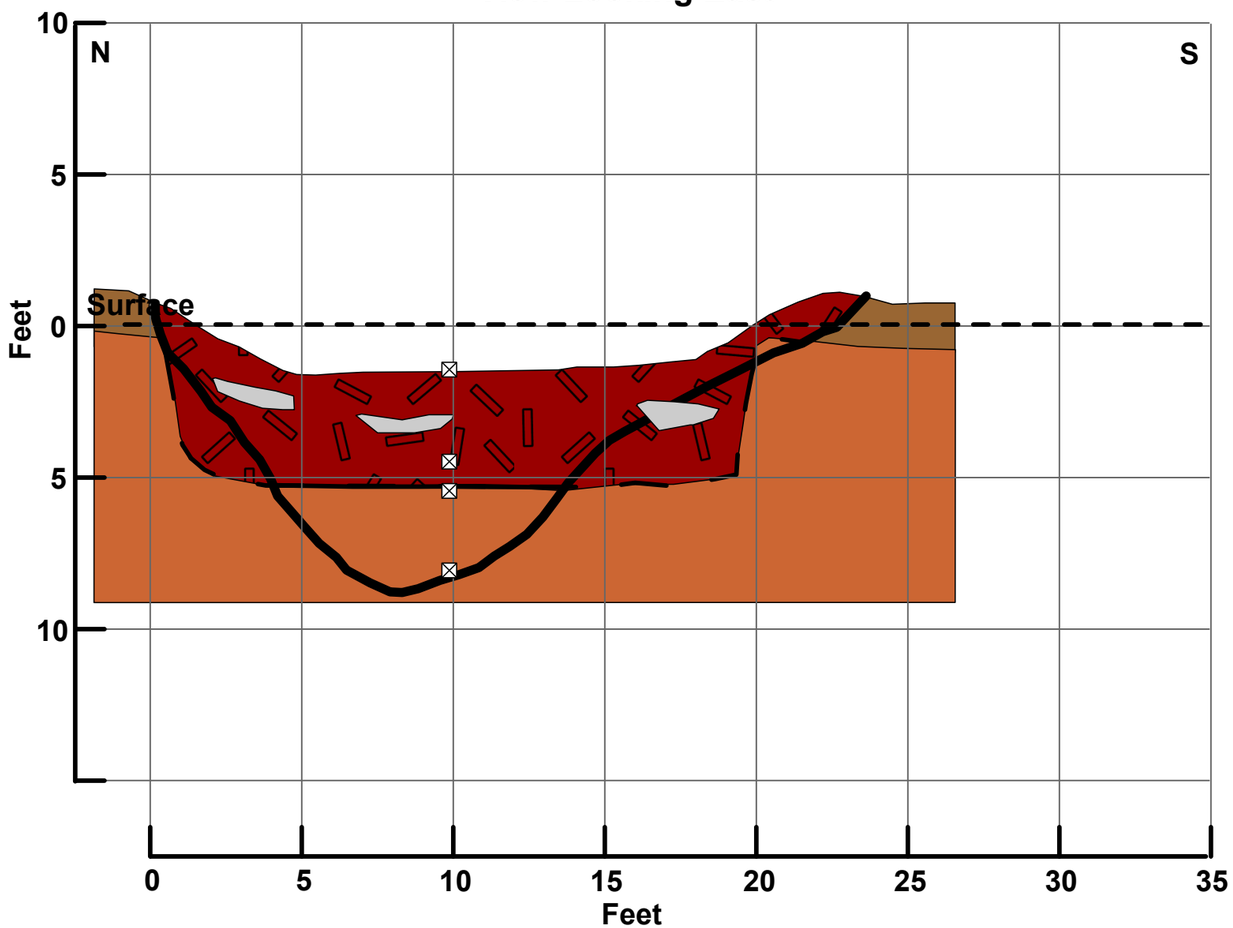
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT9-TP1 TRENCH LOG

Trench Profile DT9-TP2
View Looking East



Debris Content

MDAS 20-mm cartridge, flare plates and caps [<5%] (3 lbs)

Scrap Nails [<3%] (2 lbs)

Wood Wood boards, burned wood [25%] (50 lbs)

Total Depth

10 feet below adjacent grade
8 feet below lowest surface grade

Samples

010MBDA-TP49
(0.0-0.5 ft bgs)

010MBDA-TP50
(3.0-4.0 ft bgs)

010MBDA-TP51
(4.0-5.0 ft bgs)

010MBDA-TP52
(8.0-9.0 ft bgs)

Date Excavated:	28 January 2015	**Trench No.:**	DT9-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 9	**Project No:**	103G1959010

Topsoil
Medium red-brown silty SAND, moist, loose

Debris Fill
Dark red-brown silty SAND, moise, very loose, minor organics (rootlets), abundant wood (boards), burnt wood, layered and mixed, nails

Colluvium
Medium red-brown to grey silty SAND with traces of clay, mottled, dense, root casts, aporous

Debris
Layers of burned debris

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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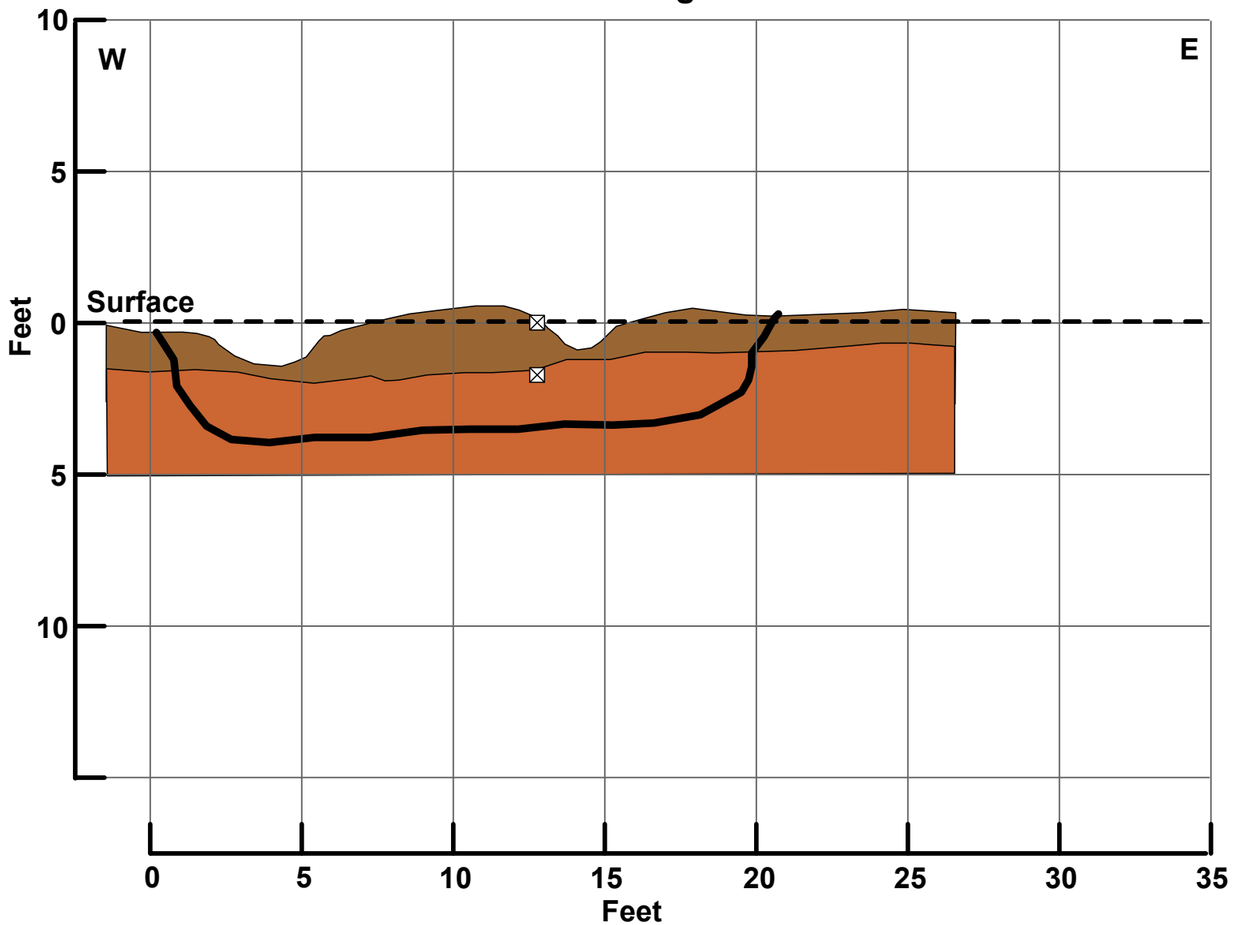
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT9-TP2 TRENCH LOG

Trench Profile DT10-TP1
View Looking North



Samples

010MBDA-TP53
(0.0-0.5 ft bgs)

010MBDA-TP54
(2.5-3.0 ft bgs)

Debris Content

N/A

Total Depth

3 feet below adjacent grade
2.5 feet below lowest surface grade

Date Excavated:	4 February 2015	**Trench No.:**	DT10-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 10	**Project No:**	103G1959010

Topsoil
Medium brown silty fine sand, moist, very loose, minor organics (rootlets)

Weathered Bedrock
Medium brown silty sand, with trace of clay, damp to dry, medium dense to very dense (where dry), mottled grey and red caliche stringers and blebs

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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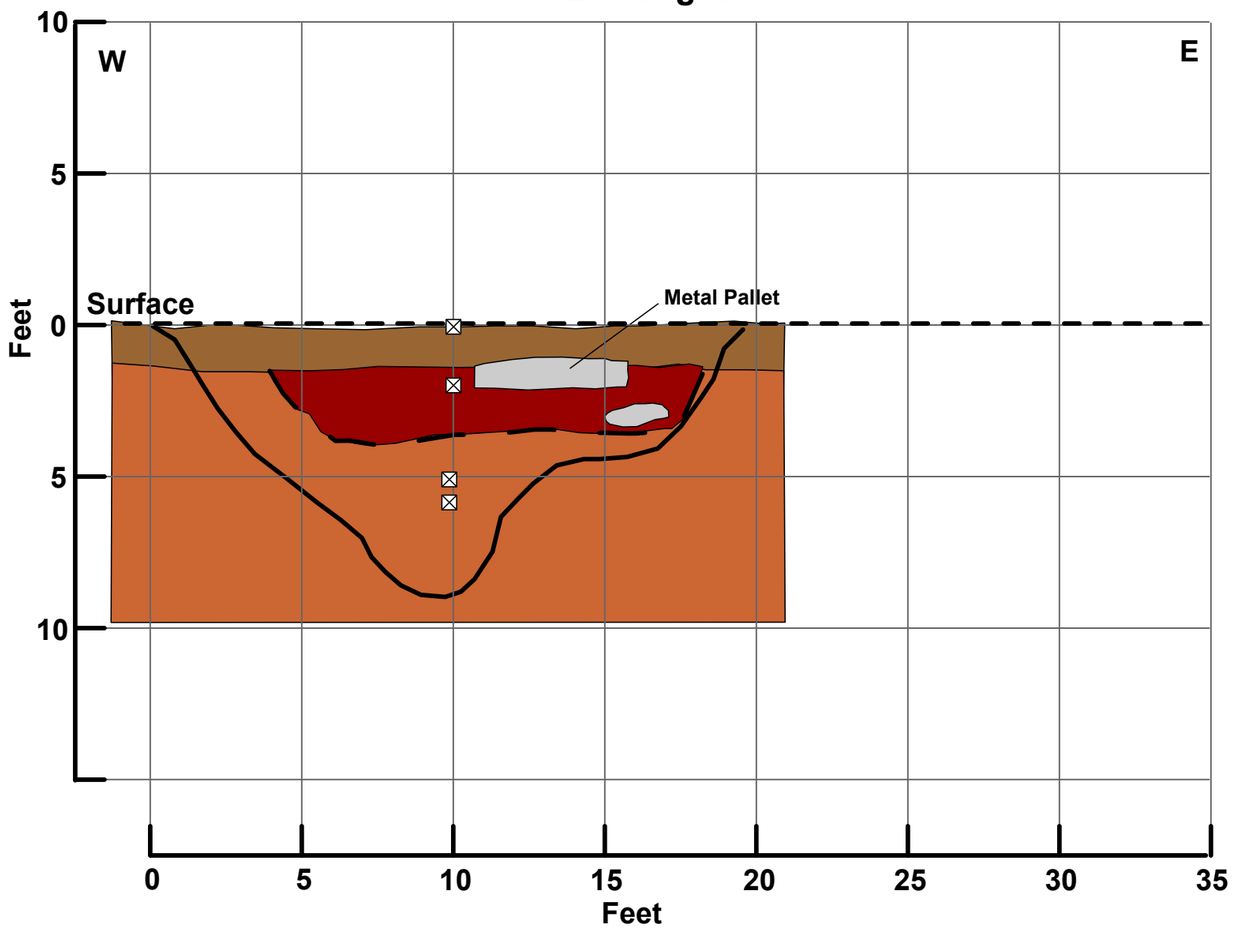
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT10-TP1 TRENCH LOG

Trench Profile DT10-TP2
View Looking North



Debris Content

MDAS Barrage rocket body, white phosphorus flare cap [5%] (15 lbs)

Scrap Metal pallet, nails, metal straps, scrap metal [25%] (150 lbs)

Other Wood, plastic [<3%] (10 lbs)

Total Depth

9 feet below adjacent grade
9 feet below lowest surface grade

Samples

010MBDA-TP57
(0.0-0.5 ft bgs)

010MBDA-TP58
(2.0-4.0 ft bgs)

010MBDA-TP59
(5.0-5.5 ft bgs)

010MBDA-TP60
(5.5-6.0 ft bgs)

Date Excavated:	28 January 2015	**Trench No.:**	DT10-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 10	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose

Debris Fill
Medium brown silty sand, damp, loose, contains 4' x 4' wire metal pallet, small metal straps (weathered bands), nails and wood, white phosphorus flare cap

Large Debris
Scrap metal, large pallet

Weathered Bedrock
Medium brown silty sand, with trace of clay, damp to dry, medium dense to very dense (where dry), mottled grey and red caliche stringers and blebs

Limits of Excavation

Inferred Limits of Disposal Trench

Soil Sample

0 5
Feet

One Inch = Five Feet

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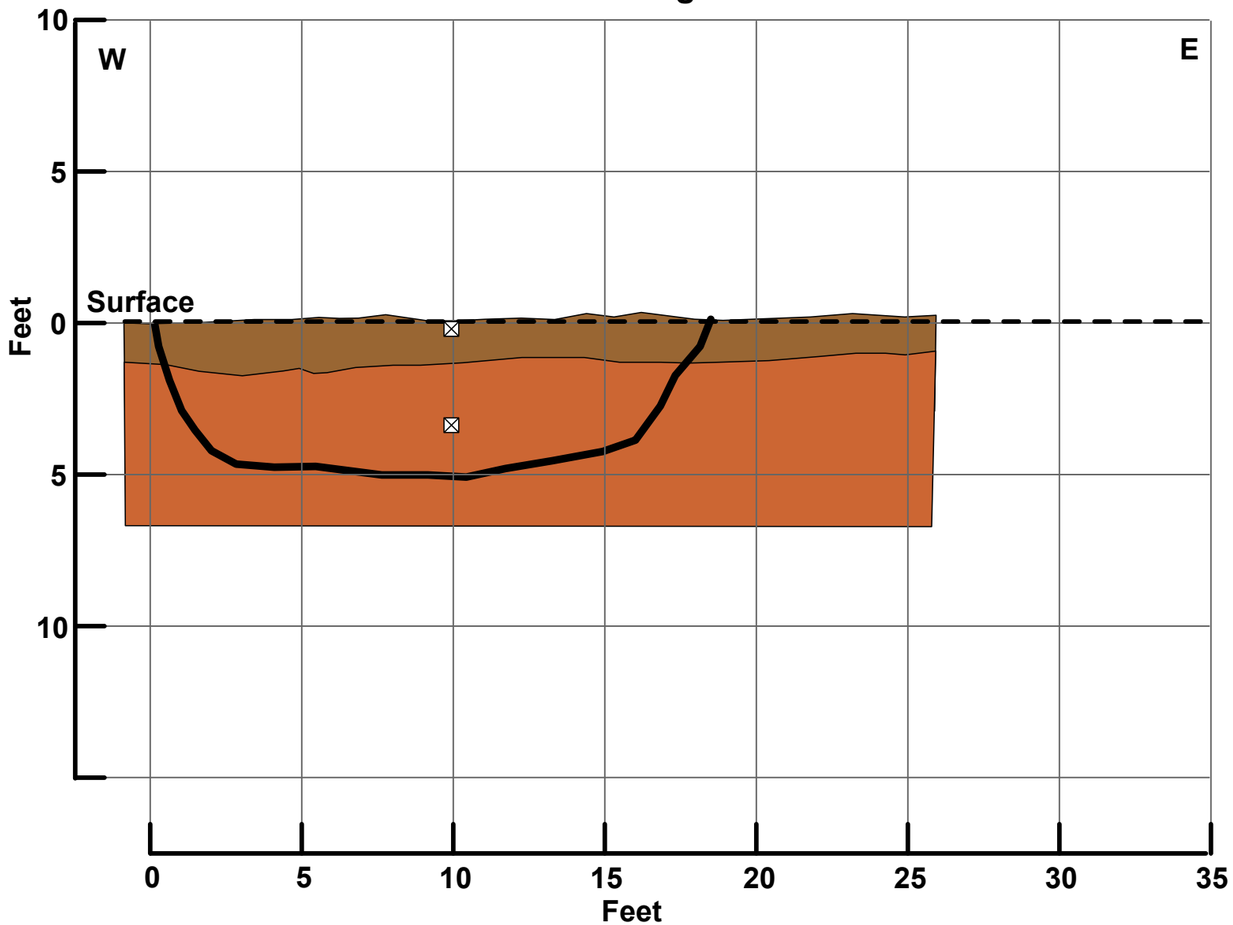
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT10-TP2 TRENCH LOG

Trench Profile DT11-TP1
View Looking North



Samples

010MBDA-TP61
(0.0-0.5 ft bgs)

010MBDA-TP62
(4.0-5.0 ft bgs)

Debris Content

N/A

Total Depth

5 feet below adjacent grade
5 feet below lowest surface grade

Date Excavated:	28 January 2015	**Trench No.:**	DT11-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 11	**Project No:**	103G1959010

Topsoil
Medium brown sandy silt, moist, very loose, some organics (rootlets)

Colluvium
Medium brown silty sand, damp to dry, medium dense where damp, some blocky fractures with root hairs, small vugs and some caliche, very difficult to excavate

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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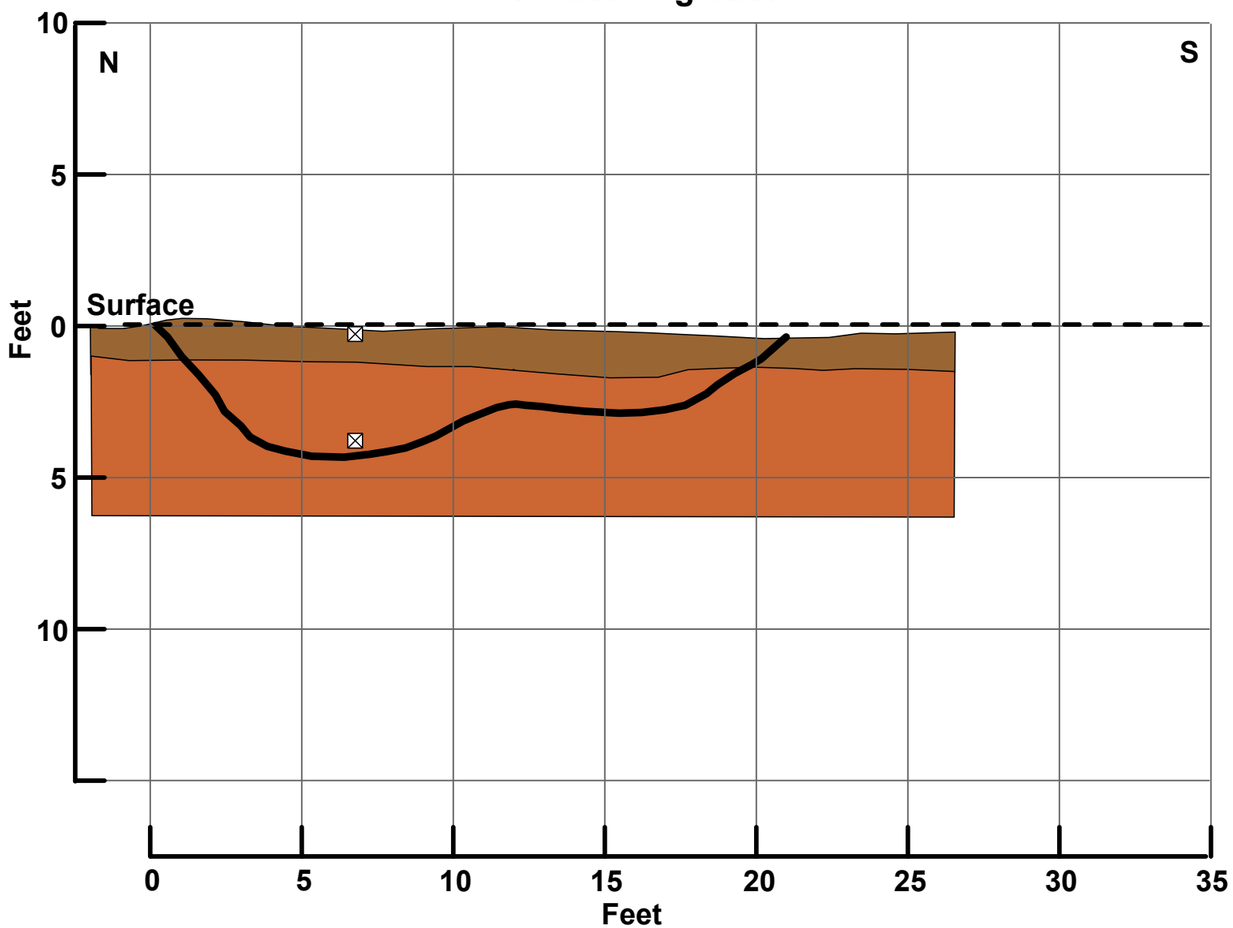
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT11-TP1 TRENCH LOG

Trench Profile SD2-TP1
View Looking East



Debris Content

N/A

Total Depth

4.0 feet below adjacent grade
4.0 feet below lowest surface grade

Samples

010MBDA-TP85
(0.0-0.5 ft bgs)

010MBDA-TP86
(3.0-4.0 ft bgs)

Date Excavated:	28 January 2015	**Trench No.:**	SD2-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Surface Disturbance 2	**Project No:**	103G1959010

Topsoil
Mmedium red brown sandy silt, moist, very loose, minor organics (roots/rootlets)

Colluvium
Medium to light red brown silty sand, damp to dry, medium dense where damp, mottled, some manganese staining (natural), very hard where dry, some vugs (excavator refusal)

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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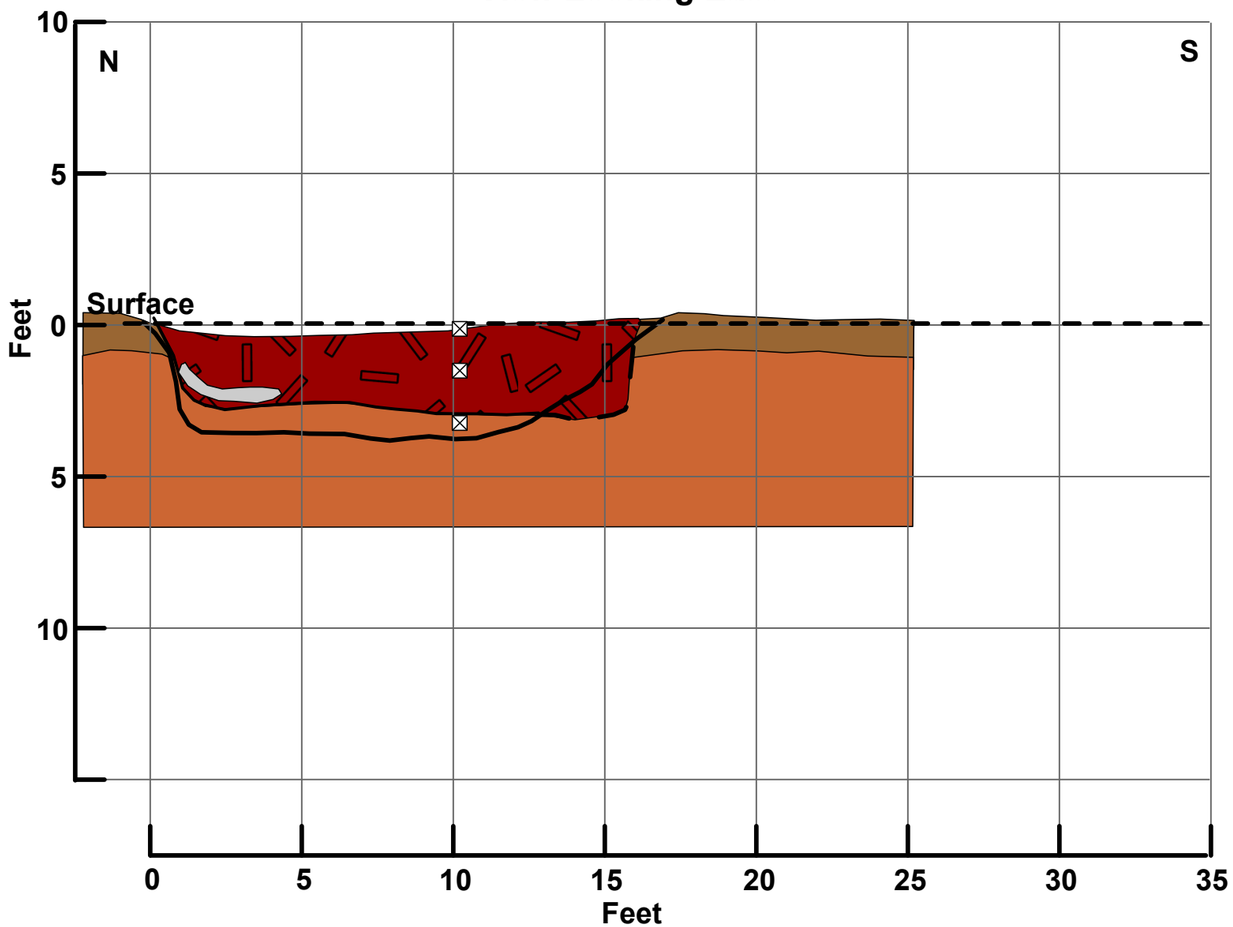
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

SD2-TP1 TRENCH LOG

Trench Profile SD2-TP2
View Looking East



Samples

010MBDA-TP89
(0.0-0.5 ft bgs)

010MBDA-TP90
(2.0-3.0 ft bgs)

010MBDA-TP91
(3.0-4.0 ft bgs)

Date Excavated: 28 January 2015
Elevation (Ft. MSL):
Excavation Method: CAT 330B Excavator
Location: Surface Disturbance 2
Trench No.: SD2-TP2
Logged by: S. Bradley
Project: Fallbrook UXO1
Project No: 103G1959010

Topsoil
Mmedium red brown sandy silt, moist, very loose, minor organics (roots/rootlets)

Debris Fill
Medium to dark brown silty sand, damp, loose, some debris

Large Debris
Burned wood debris

Weathered Bedrock
Light brown granite, dry, very dense

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
A Joint Venture

Debris Content

Scrap 55-gallon drum lid at surface [5%] (15 lbs)

Other Burned wood [<2%] (10 lbs)

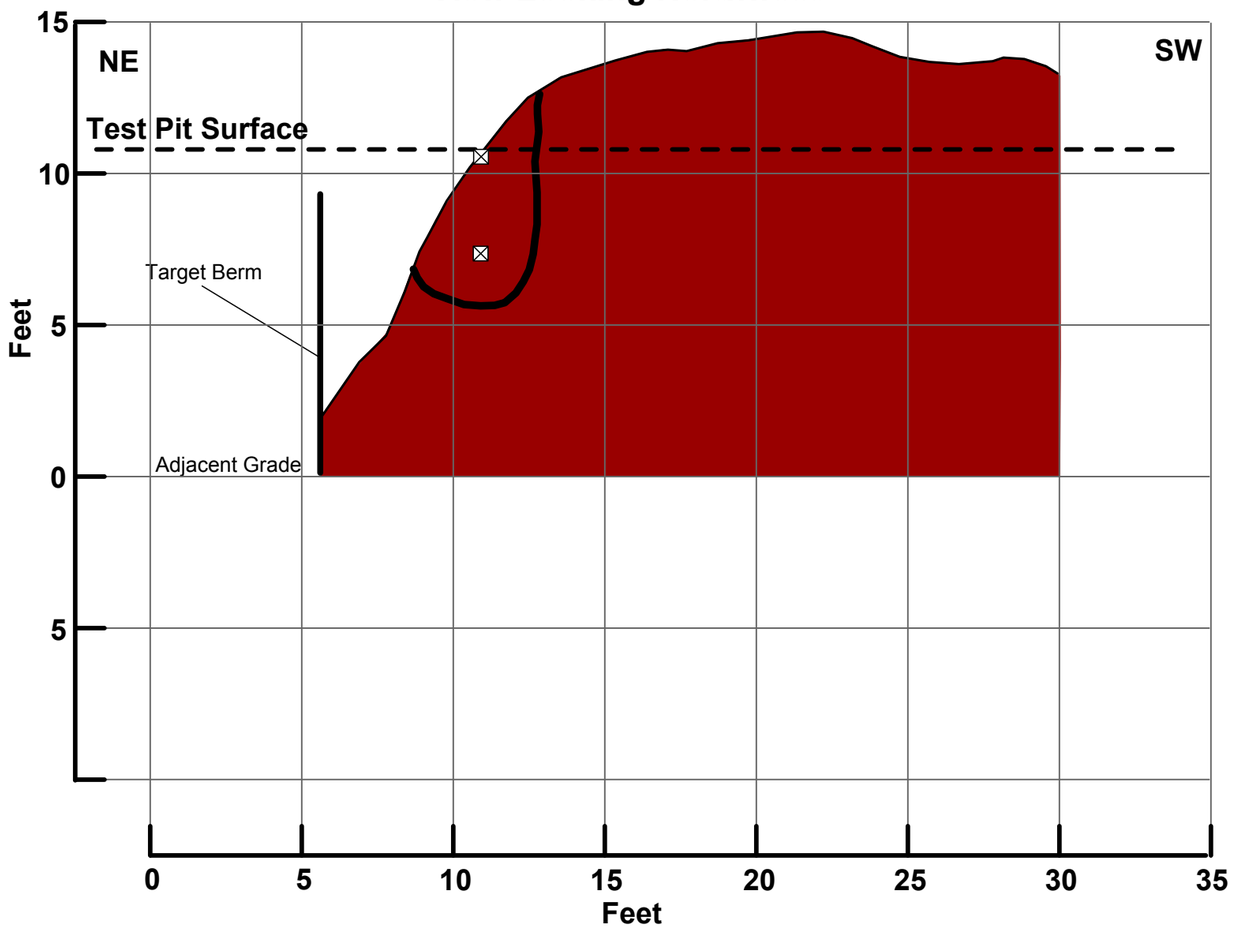
Total Depth

4.0 feet below adjacent grade
4.0 feet below lowest surface grade

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

SD2-TP2 TRENCH LOG

Trench Profile TB1-TP1
View Looking Northwest



Debris Content

N/A

Total Depth

6 feet above adjacent grade
6 feet below lowest surface grade

Samples

010WFTA-TP01
(0.0-0.5 ft bgs)

010WFTA-TP02
(2.0-4.0 ft bgs)

Date Excavated:	5 February 2015	**Trench No.:**	TB1-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Target Berm 1	**Project No:**	103G1959010

Artificial Fill
Medium bown silty sand, moist, loose

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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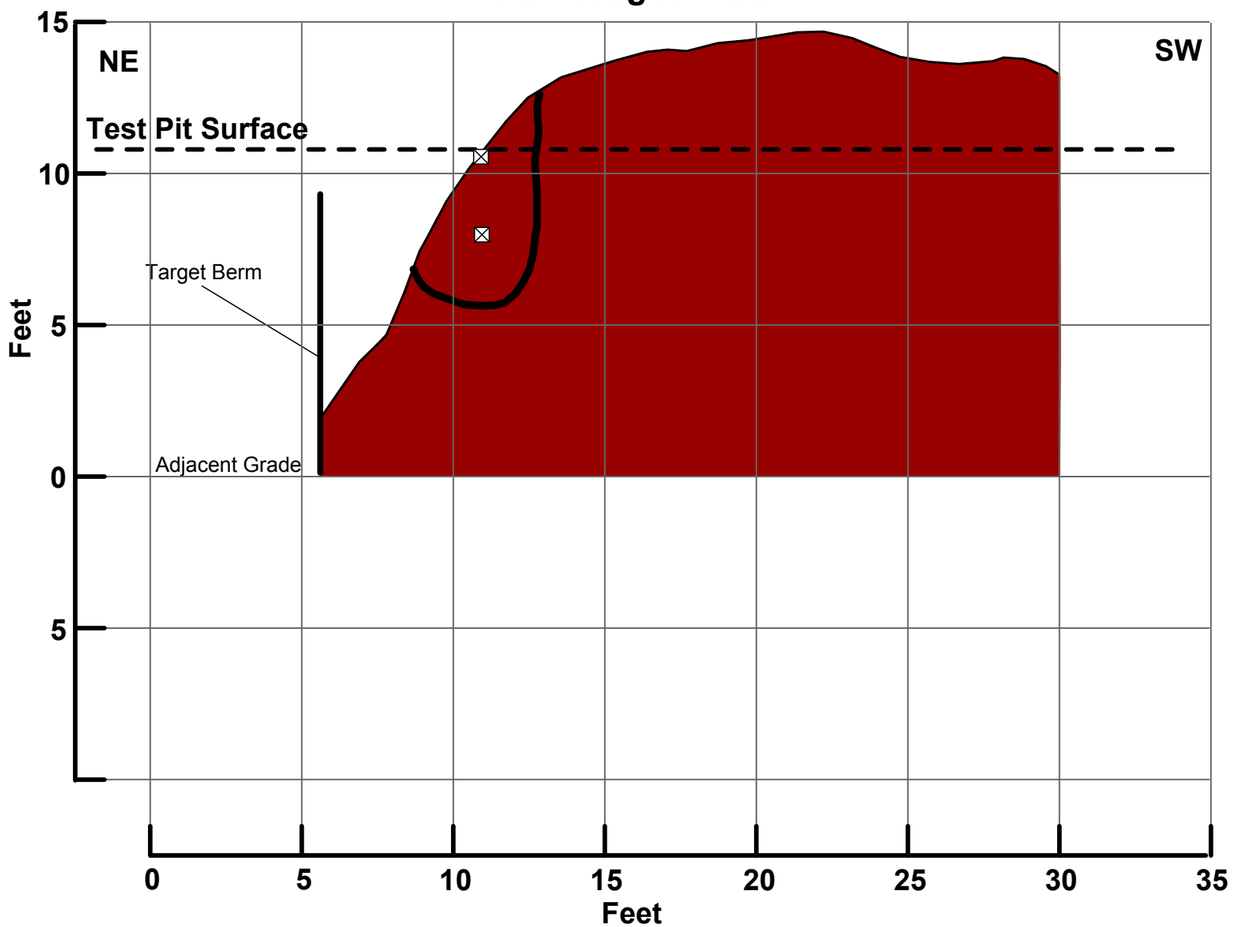
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

TB1-TP1 TRENCH LOG

Trench Profile TB2-TP1
View Looking Northwest



Debris Content

N/A

Total Depth

6 feet above adjacent grade
6 feet below lowest surface grade

Samples

010WFTA-TP03
(0.0-0.5 ft bgs)

010WFTA-TP04
(3.0-4.0 ft bgs)

Date Excavated:	5 February 2015	**Trench No.:**	TB2-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Target Berm 2	**Project No:**	103G1959010

Artificial Fill
Medium bown silty sand, moist, loose

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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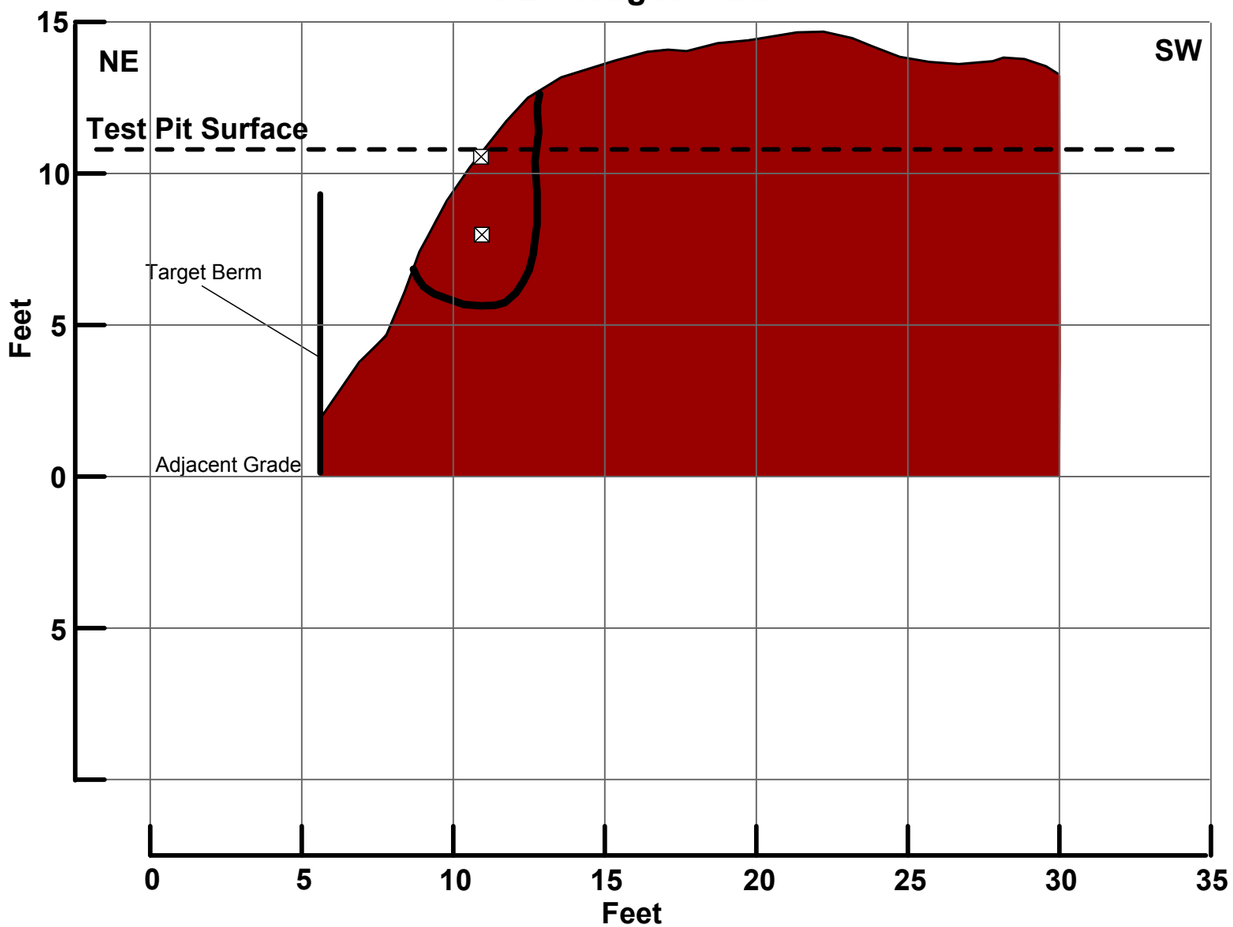
MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

TB2-TP1 TRENCH LOG

Trench Profile TB3-TP1
View Looking Northwest



Debris Content

N/A

Total Depth

6 feet above adjacent grade
6 feet below lowest surface grade

Samples

010WFTA-TP05
(0.0-0.5 ft bgs)

010WFTA-TP06
(3.0-4.0 ft bgs)

Date Excavated:	5 February 2015	**Trench No.:**	TB3-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Target Berm 3	**Project No:**	103G1959010

Artificial Fill
Medium bown silty sand, moist, loose

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
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MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

TB3-TP1 TRENCH LOG

4.6 NATURE AND EXTENT OF CONTAMINATION FOR EU 6

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs.

4.6.1 Investigation Results and Discussion at EU 6

EU 6 incorporates the Range Impact Area and suspected Disposal Trench 12 (Figure 4-6). The site is characterized by generally level ground in the vicinity of the target berm with a west flowing drainage south of the berm. The drainage coincides with the roughly east – west alignment of Disposal Trench 12 that drains into Pilgrim Creek near the location of temporary well PC-MW3. The remaining southern portion of the EU slopes gradually to the north towards Disposal Trench 12 and the former target berm. As such, it is considered to be the potential Range Impact Area should fired munitions have overshot the target. A DGM survey was conducted at this 14-acre area at the outset of the RI fieldwork, as discussed previously in this report (Figure 3-4). Data from the survey is provided in Appendix E. Area groundwater well AGW-MW2 is also located in the southwestern portion of EU 6. Groundwater was observed within this well at a depth of approximately 22 feet bgs.

The two primary investigation activities included the completion of three test pits extending across suspected Disposal Trench 12 (Test Pit Logs 4-6) and the geophysical survey of the Range Impact Area. This was followed with investigation of a subset of the anomalies by the UXO technicians. Suspected Disposal Trench 12 was initially identified during the previous SI by the geophysical and UXO team due to the strong signal responses received from the handheld detectors used during the anomaly avoidance operations. An abundance of possible munition-related debris, as well as scrap metal, was observed at the surface in the area. Settlement of the ground surface in a linear fashion also provided a strong indication that a disposal trench may exist. Although no sampling was conducted in this EU during the SI, numerous MPPEH, MDAS, and scrap metal items were identified by the investigation team. These items were subsequently relocated and removed during this RI.

Disposal Trench 12 was identified in two of the three test pits excavated in this area. Test Pit DT12-TP1 was located in the west portion of the suspect trench footprint; however, there was no debris fill identified in the test pit. Debris was observed in the alluvial soils exposed in the test pit walls (Photographs 4-6). Logging of the trench indicated that the alluvium extends approximately four feet below the channel bottom and consists of a silty sand that is dry and very loose in consistency. The debris observed within the alluvium consisted of Styrofoam, hard rubber, and what appeared to be a couple of rusted base plates for a slap flare. The second Test Pit, DT12-TP2, encountered a significant amount of debris fill that appears to be, for the most part, unrelated to activities associated with the MRP Site UXO1 operations. The debris was observed to a depth of approximately 10 feet bgs over a distance of 40 feet. A majority of the debris encountered included wood boards, metal pipes, plastic sheeting, and metal plates that comprised up to 70 percent of the fill by volume. The third Test Pit, DT12-TP-3, traversed a relatively wide portion of the disposal trench. The test pit was completed in three sections across the debris fill area that was 50 feet wide with the debris fill extending to a depth of 12 feet bgs. The actual thickness of fill was

approximately 7 feet; however, there has been a significant amount of settlement this debris was buried. Material observed in the debris fill comprised nearly 70 percent of the fill by volume and was mostly rubber (possibly gaskets) and wood, with metal, concrete, and plastic also present. There were no munitions related items observed within the debris fill. There was, however, munition related debris identified in the detector aided sweep by the UXO technicians of the surficial soils throughout the DGM survey. The approximate footprint of the disposal trench is indicated on Figure 4-6. Based on information obtained from the geophysical survey, it appears the trench may extend to the east and then turn south. However, the southeastern extension of this feature may be a result of the geologic conditions (minor drainage channel) as opposed to debris related as seen in Disposal Trench 10.

4.6.2 Extent of MPPEH and MC at EU 6

MPPEH items identified within EU 6 during the DGM investigation included: one 105-mm flare, one 4 lb. incendiary bomb body, and two incendiary bomb components. These items were disposed of on-site during demolition operations.

There was no MDAS identified in the debris fill encountered in the three test pits excavated within the suspected limits of Disposal Trench 12 at EU 6. However, during the detector-aided intrusive investigation of the DGM survey area by the UXO team, MDAS items recovered included: three partial 120-mm mortars, three expended 40-mm smoke cartridges, one expended LAW rocket motor, two ballistic windshields, and one ballistic nose cone. Those items were placed in a secured container until transportation for demilitarization and recycling.

Analytical results showed that all arsenic results exceeded human health screening levels with concentrations ranging from 1.23 to 2.50 mg/kg. Lead was detected at concentrations of 157 mg/kg and 108 mg/kg in samples collected from the debris fill layer in DT12-TP2 and TP-3, respectively. These values exceed the residential screening goal of 80 mg/kg, but not the industrial goal of 320 mg.kg. Diesel range organics were detected in four out of the 43 samples with a high concentration of 49.0 mg/kg and motor oil in 2 sample with a high concentration of 430 mg/kg. Both of these maximum concentrations were located within the Disposal Trench 12 debris fill and are below screening levels of 96 mg/kg and 100,000 mg/kg respectively. Dioxin screening levels were exceeded for the surface samples at DT12-TP1 and TP2 and within the debris fill layer in TP2 and TP3. Concentrations ranged from 12.9 to 34.2 ng/kg. There were no exceedances of initial screening levels for explosives, VOCs, SVOCs, TPH-d, perchlorate, PCP, white phosphorous, or hydrazine. A summary of soil analytical results compared with screening criteria and exceedances for EU 6 are provided at the end of this section, respectively (Tables 4-6A and 4-6B).

4.6.3 Human Health Risk Assessment Findings

4.6.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 2E-08 for both federal toxicity criteria and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.0007

for federal toxicity values and 0.00009 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 6 is 16.5 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 6.

4.6.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 1E-06 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in surface soil. The noncancer HI from exposure to surface soil is 0.04 for federal toxicity values and 0.004 for State of California toxicity values. The maximum detected concentration of **lead** in surface soil at EU 6 is 16.5 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. **Dioxins** are identified as chemical risk drivers in surface soil for the future industrial worker at EU 6.

The estimated cancer risk from exposure to subsurface soil is 2E-06 for federal toxicity values and 3E-06 for State of California toxicity values. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **dioxins** in subsurface soil. The noncancer HI from exposure to subsurface soil is 0.2 for federal toxicity criteria and 0.1 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 6 is 157 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. **Dioxins** are COCs in subsurface soil at EU 6.

4.6.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 3E-07 for federal toxicity values and 4E-07 for State of California toxicity values. The noncancer HI from exposure to subsurface soil is 0.4 for both federal and State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 6 is 157 mg/kg. The mean lead concentration in subsurface soil at EU 6 is 107 mg/kg. This concentration is greater than the risk-based screening level of 39 mg/kg for the future construction worker. Lead is identified as a chemical risk driver identified in subsurface soil for the future construction worker at EU 6.

4.6.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 4E-06 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **dioxins** in surface soil. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The estimated HI for surface soil is 0.4 for federal toxicity values and 0.06 for State of California toxicity values. The maximum detected concentration of lead in surface soil at EU 6 is 16.5 mg/kg. This concentration is less than the risk-based screening level of 80 mg/kg for residential soil. **Dioxins** are COCs in surface soil at EU 6.

The estimated cancer risk from exposure to subsurface soil is 7E-06 for federal toxicity values and 9E-06 for State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **dioxins** in subsurface soil. **Arsenic** also contributes significantly to the estimated risk using State of California toxicity criteria. The estimated HI for subsurface soil is 2 for both federal and State of California toxicity values. The maximum detected concentration of **lead** in subsurface soil at EU 6 is 157 mg/kg. The mean concentration of **lead** in subsurface soil at is 107 mg/kg. This concentration is greater than the risk-based screening level of 80 mg/kg for residential soil. Arsenic, **lead**, and dioxins (State of California only) are COCs in surface and subsurface soil at EU 6 for the future resident.

The following table provides a summary of the risk assessment findings for EU 6:

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
6	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	Dioxins		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Dioxins	Lead	Arsenic [c] Diesel Range Organics [c] Dioxins Lead

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.

a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
c Based on State of California toxicity values only.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.6.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 6 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.6.4.1 Results of the Step 2 SLERA for EU 6

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low

and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 6:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 6	COPECs without Benchmarks or TRVs
Plants	antimony, chromium, lead, manganese, vanadium, zinc	dioxins
Invertebrates	chromium	cobalt, molybdenum, thallium, vanadium, dioxins
Birds	chromium, lead, zinc	antimony, beryllium, thallium
Non-Burrowing Mammals	antimony, cadmium, lead, nickel, vanadium, zinc, dioxins	none
Burrowing Mammals	cadmium, zinc, dioxins	none

In summary, the SLERA indicates that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.6.4.2 Results of the Step 3a Risk Refinement for EU 6

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COECs in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **supports** an acceptable risk determination, the site exits the ERA process.
- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, **no COECs** were identified for EU 6.

4.6.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 6:

- All previously identified MDAS items at the surface were removed during the RI.
- Ten previously unidentified MDAS items were removed from this area during the RI. The items included three 120-mm mortars (partial), three 40-mm smoke cartridges, one LAW rocket motor, two ballistic windshields, and one ballistic nose cone.

- MPPEH items discovered within the EU by the UXO team during the intrusive investigation of the down range area included four items (flare, incendiary bomb body, and two incendiary bomb components).

- The four MPPEH items represented 5 percent of the total target items recovered. MDAS and scrap metal comprised 13 percent 79 percent of the debris recovered, respectively.

- Disposal Trench 12 was primarily used for the burial of building related debris. No MPPEH or MDAS items were identified in the fill materials. However, MDAS was recovered from the surface of the disposal trench area.

- It is possible that additional MPPEH or MDAS exist within the footprint of EU 6 beyond the limits of the DGM survey area.

- Groundwater was observed at a depth of approximately 22 feet bgs in AGW-MW2.

- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, are present at concentrations that exceed initial screening levels.

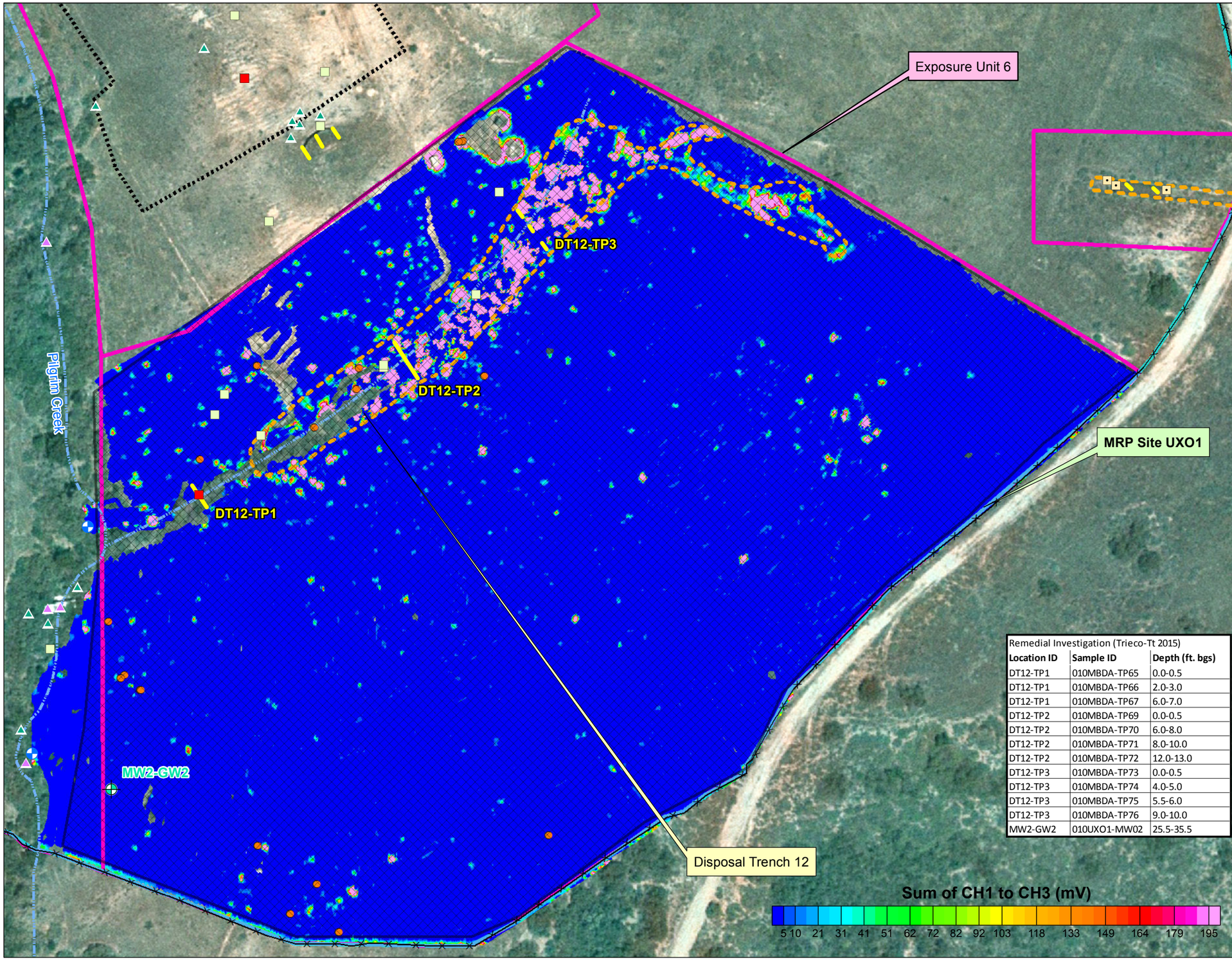
- The HHRA indicates that dioxins are risk drivers in surface and subsurface soils for future industrial workers and future residents. The mean lead concentration exceeds the RBSL and is a COC for the future construction worker. Arsenic, and lead are also COCs in subsurface soil for the future resident. The human health risk for dioxins fall within the range of risk management decision. Residential development is not considered a likely future use scenario for this EU.

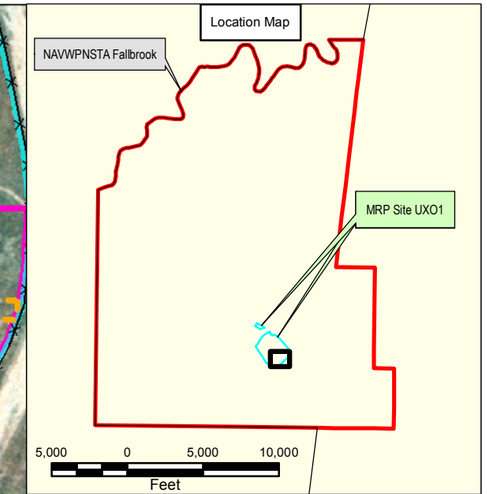
- The ERA Step 3a refinement indicates there are no COECs identified for this EU.

- Analytical data from soil samples obtained in native materials below the debris fill indicates that the COCs identified (arsenic, lead and dioxins) in Disposal Trench 12 are not migrating vertically from the fill into the underlying bedrock.

- Further response action should be considered in the FS due to the possible presence of MEC/MPPEH for the Range Impact Area and lead in the subsurface within EU 6.

SECTION 4.6 FIGURES





MRP Site UXO1 Boundary
Drainage Channel (Approximate)
Range Fencing
Exposure Unit Boundaries
2010 SI Geophysical Survey Area (ChaduxTt)
2015 Geophysical Survey Area (TriEco-Tt)
Disposal Trench Limits (Approximate)
MDAS (Removed)
MPPEH (Removed)
Metal Debris (Removed)
RI Soil Sample Location (2015)
SI Soil Sample Location (2010)
SI Soil Boring Sample Location (2010)
Shallow Monitoring Well
Area Monitoring Well
Test Pit

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

50 0 50 100
Feet

Remedial Investigation (Trieco-Tt 2015)

Location ID	Sample ID	Depth (ft. bgs)
DT12-TP1	010MBDA-TP65	0.0-0.5
DT12-TP1	010MBDA-TP66	2.0-3.0
DT12-TP1	010MBDA-TP67	6.0-7.0
DT12-TP2	010MBDA-TP69	0.0-0.5
DT12-TP2	010MBDA-TP70	6.0-8.0
DT12-TP2	010MBDA-TP71	8.0-10.0
DT12-TP2	010MBDA-TP72	12.0-13.0
DT12-TP3	010MBDA-TP73	0.0-0.5
DT12-TP3	010MBDA-TP74	4.0-5.0
DT12-TP3	010MBDA-TP75	5.5-6.0
DT12-TP3	010MBDA-TP76	9.0-10.0
MW2-GW2	010UXO1-MW02	25.5-35.5

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Fallbrook, California

Figure 4-6

Exposure Unit 6 Features and Sample Locations MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_6_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.6 TABLES

TABLE 4-6A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 6

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
None Detected	0/ 1	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
DIESEL RANGE ORGANICS	2/6	49.0	24.0	DT12-TP3	4.00 - 5.00	--	--	--	0	0	--	--	96	440	--	--
MOTOR OIL RANGE ORGANICS	2/6	430	210	DT12-TP2	5.00 - 6.00	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 1	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	12/12	15,500	10,200	DT12-TP1	2.00 - 3.00	--	--	12,814	0	0	12	1	77,000	1,100,000	50 +	14,710
ANTIMONY	10/12	10.6 J	0.127 J	DT12-TP2	5.00 - 6.00	--	--	9.103	0	0	7	--	31	470	0.27	--
ARSENIC	12/12	2.52	1.23	DT12-TP2	9.00 - 10.00	--	--	1.878	12	12	0	0	0.062	0.25 #	18	3.105
BARIUM	12/12	174	87.9	DT12-TP3	5.50 - 6.00	--	--	141.8	0	0	0	0	15,000	220,000	330	200.5
BERYLLIUM	12/12	0.285 J	0.104 J	DT12-TP1	2.00 - 3.00	--	--	0.214	0	0	0	0	15.2	183 #	21	0.359
CADMIUM	12/12	1.99	0.140 J	DT12-TP3	4.00 - 5.00	--	--	1.162	0	0	2	9	4.58	6.37 #	0.36	0.158
CALCIUM	12/12	3,740	1,130	DT12-TP3	4.00 - 5.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	12/12	33.7	12.0	MW2B-S2B	30.00 - 30.00	--	--	15.06	0	0	1	1	100,000	100,000 *	26	20.3
COBALT	12/12	8.64	5.45	DT12-TP2	9.00 - 10.00	--	--	6.975	0	0	0	0	23	350	13	9.39
COPPER	12/12	32.1 J	4.56 J	DT12-TP3	4.00 - 5.00	--	--	20.47	0	0	1	3	3,100	47,000	28	7.785
IRON	12/12	29,600	15,900	DT12-TP2	9.00 - 10.00	--	--	22,732	0	0	--	1	55,000	100,000 *	--	27,350
LEAD	12/12	157	2.02	DT12-TP2	5.00 - 6.00	--	--	107	2	0	4	7	80	320 #	11	4.328
MAGNESIUM	12/12	6,660	2,950	DT12-TP2	9.00 - 10.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	12/12	278	128	DT12-TP3	4.00 - 5.00	--	--	219.1	0	0	4	0	1,800	26,000	220	304
MERCURY	2/12	0.122	0.0214 J	DT12-TP2	5.00 - 6.00	--	--	--	0	0	1	--	23	350	0.1 +	--
MOLYBDENUM	12/12	0.674	0.139 J	DT12-TP2	0.00 - 0.50	--	--	0.43	0	0	0	2	390	5,800	2 +	0.524
NICKEL	12/12	6.37	3.48	DT12-TP2	5.00 - 6.00	--	--	5.14	0	0	0	2	1,500	22,000	38	5.15

TABLE 4-6A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 6 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
POTASSIUM	12/12	6,290	2,110	DT12-TP2	9.00 - 10.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	10/12	0.136 J	0.0535 J	DT12-TP2	5.00 - 6.00	--	--	0.0978	0	0	0	--	390	5,800	0.52	--
SILVER	2/12	0.0744 J	0.0692 J	DT12-TP3	4.00 - 5.00	--	--	--	0	0	0	--	390	4,700	4.2	--
SODIUM	12/12	482	72.2 J	MW2B-S2B	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	12/12	0.544	0.246 J	DT12-TP2	9.00 - 10.00	--	--	0.375	0	0	0	0	0.78	12	1 +	0.552
VANADIUM	12/12	92.1	41.6	DT12-TP2	9.00 - 10.00	--	--	65.32	0	0	12	0	390	5,800	7.8	96.4
ZINC	12/12	329	28.1	DT12-TP2	5.00 - 6.00	--	--	248.2	0	0	4	3	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	10/10	1,270	0.782 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	10/10	446	0.253 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	9/10	12.2	0.0965 J	DT12-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	8/10	3.14	0.0837 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	9/10	10.9	0.159 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	9/10	33.6	0.468 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	9/10	5.11	0.127 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	9/10	11.0	0.188 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	6/10	1.88 J	0.0715 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	8/10	1.96 J	0.0825 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	7/10	1.02 J	0.0909 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	9/10	9.66	0.149 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	7/10	1.24 J	0.127 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	5/10	0.263 J	0.0948 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	5/10	0.491 J	0.135 J	DT12-TP3	4.00 - 5.00	--	--	--	--	--	--	--	--	--	--	--
OCDD	9/10	21,900 J	85.8	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
OCDF	10/10	1,340	0.520 J	DT12-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	10/10	2,470	1.43 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	9/10	1,150	6.68	DT12-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-6A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 6 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HXCDD	9/10	400	2.22 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	9/10	376	3.11	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	9/10	35.1	0.143 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	8/10	42.9	0.406 J	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	6/10	2.30	0.113 J	DT12-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	9/10	5.12	0.117 J	DT12-TP3	4.00 - 5.00	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	10/10	34.2	0.275	DT12-TP2	5.00 - 6.00	--	--	--	4	1	10	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	10/10	16.4	0.345	DT12-TP2	5.00 - 6.00	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	3/12	0.00130 J	0.00129 J	DT12-TP1,	6.00 - 7.00	--	--	--	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
None Detected	0/ 12	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Percent Moisture (%)																
PERCENT MOISTURE	12/12	21.1	3.50	DT12-TP2	12.00 - 13.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-6A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 6

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-6A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 6

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-6B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 6

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	11,800	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,500	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,200	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,600	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,900	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,000	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,200	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	116	77,000	1,100,000	**50.0**	14,700
ANTIMONY	0.834 J	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	31.0	470	**0.270**	NC
ANTIMONY	10.6 J	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	31.0	470	**0.270**	NC
ANTIMONY	0.462 J	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.540 J	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	31.0	470	**0.270**	NC
ANTIMONY	6.25 J	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	31.0	470	**0.270**	NC
ANTIMONY	0.502 J	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	31.0	470	**0.270**	NC
ANTIMONY	0.906 J	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	31.0	470	**0.270**	NC
ARSENIC	1.29	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.538	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.547	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.23	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.556	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.40	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.52	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	0.516	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.27	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	**0.0620**	**0.250**	18.0	3.11

TABLE 4-6B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 6 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.37	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.23	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	**0.0620**	**0.250**	18.0	3.11
CADMIUM	0.377 J	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	4.58	6.37	**0.360**	0.158
CADMIUM	1.99	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	4.58	6.37	**0.360**	0.158
CHROMIUM	33.7	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	100,000	100,000	**26.0**	20.3
COPPER	32.1 J	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	3,100	47,000	**28.0**	7.79
LEAD	16.5	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	80.0	320	**11.0**	4.33
LEAD	157	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	**80.0**	320	**11.0**	4.33
LEAD	108	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	**80.0**	320	**11.0**	4.33
LEAD	11.6	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	80.0	320	**11.0**	4.33
MANGANESE	248	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	1,800	26,000	**220**	304
MANGANESE	226	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	1,800	26,000	**220**	304
MANGANESE	278	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	1,800	26,000	**220**	304
MANGANESE	254	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	1,800	26,000	**220**	304
MERCURY	0.122	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.107	23.0	350	**0.100**	NC
VANADIUM	47.8	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.538	390	5,800	**7.80**	96.4
VANADIUM	62.0	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.547	390	5,800	**7.80**	96.4
VANADIUM	50.5	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.556	390	5,800	**7.80**	96.4
VANADIUM	43.5	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	390	5,800	**7.80**	96.4
VANADIUM	47.9	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	92.1	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	70.8	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	0.516	390	5,800	**7.80**	96.4
VANADIUM	43.0	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	41.6	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	390	5,800	**7.80**	96.4
VANADIUM	66.1	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	390	5,800	**7.80**	96.4
VANADIUM	66.9	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	61.8	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	390	5,800	**7.80**	96.4
ZINC	46.1	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	2.56	23,000	350,000	**46.0**	50.1
ZINC	329	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	2.63	23,000	350,000	**46.0**	50.1

TABLE 4-6B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 6 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ZINC	54.1	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	2.59	23,000	350,000	**46.0**	50.1
ZINC	283	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	2.78	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	20.2	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.477	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.449	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.99	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	34.2	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.809	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.80	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	12.9	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.452	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.275	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.0	4.90	22.0	**0.200**	NC

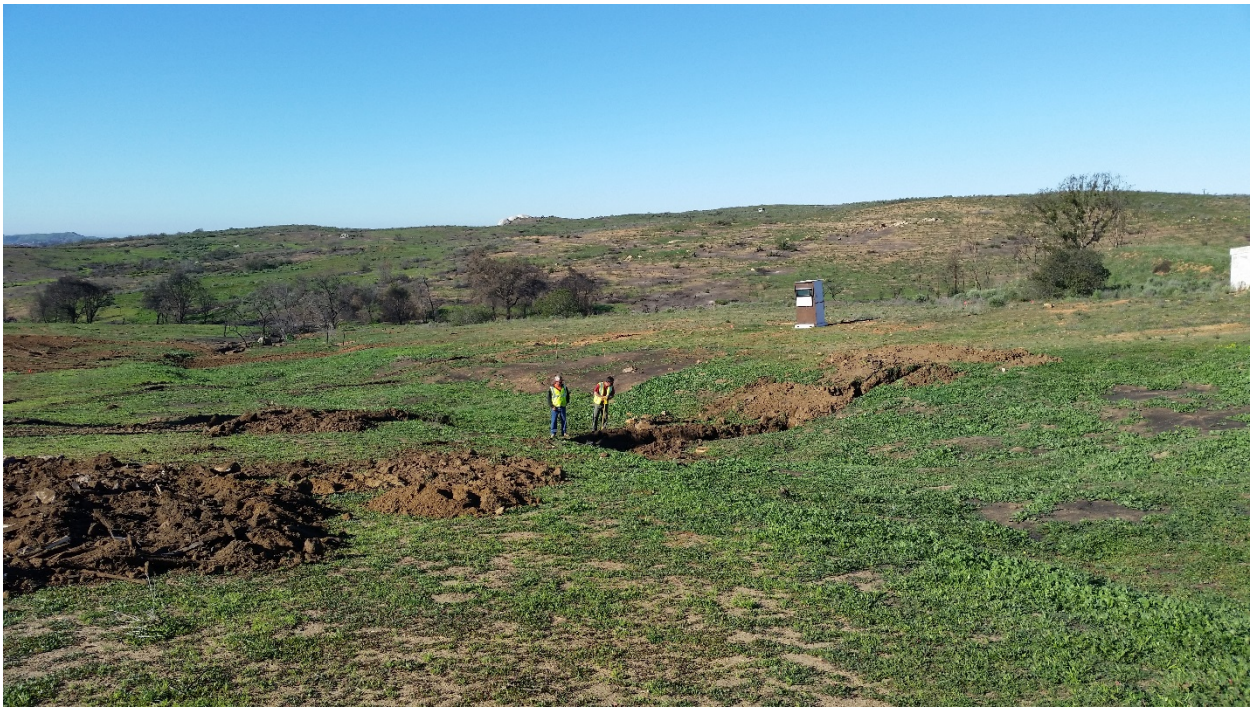
Notes:
1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID Identification
J Estimated value
mg/kg Milligrams per kilogram
ng/kg Nanograms per kilogram
TEQ Toxicity equivalence quotient

SECTION 4.6 PHOTOGRAPHS

SECTION 4.6 – EXPOSURE UNIT 6 PHOTOGRAPHIC LOG

Photograph 4.6-1
Drainage Swale West (down gradient) of
Disposal Trench 12 with Scrap Metal Debris



Photograph 4.6-2
Disposal Trench 12 – Test Pit 2

Photograph 4.6-3
Disposal Trench 12 – Test Pit 2
Primarily Wood Debris in East Sidewall

Photograph 4.6-4
Disposal Trench 12 – Test Pit 2
Debris Spread for UXO Clearance

Photograph 4.6-5
Disposal Trench 12 – Test Pit 2
Close-up of Construction Debris Fill

Photograph 4.6-6
Disposal Trench 12 – Test Pit 2
Scrap Metal Debris

Photograph 4.6-7
Disposal Trench 12 – Test Pit 2 Scrap Metal Debris
Scrap Metal Piping, strap and Porcelain Sink Debris

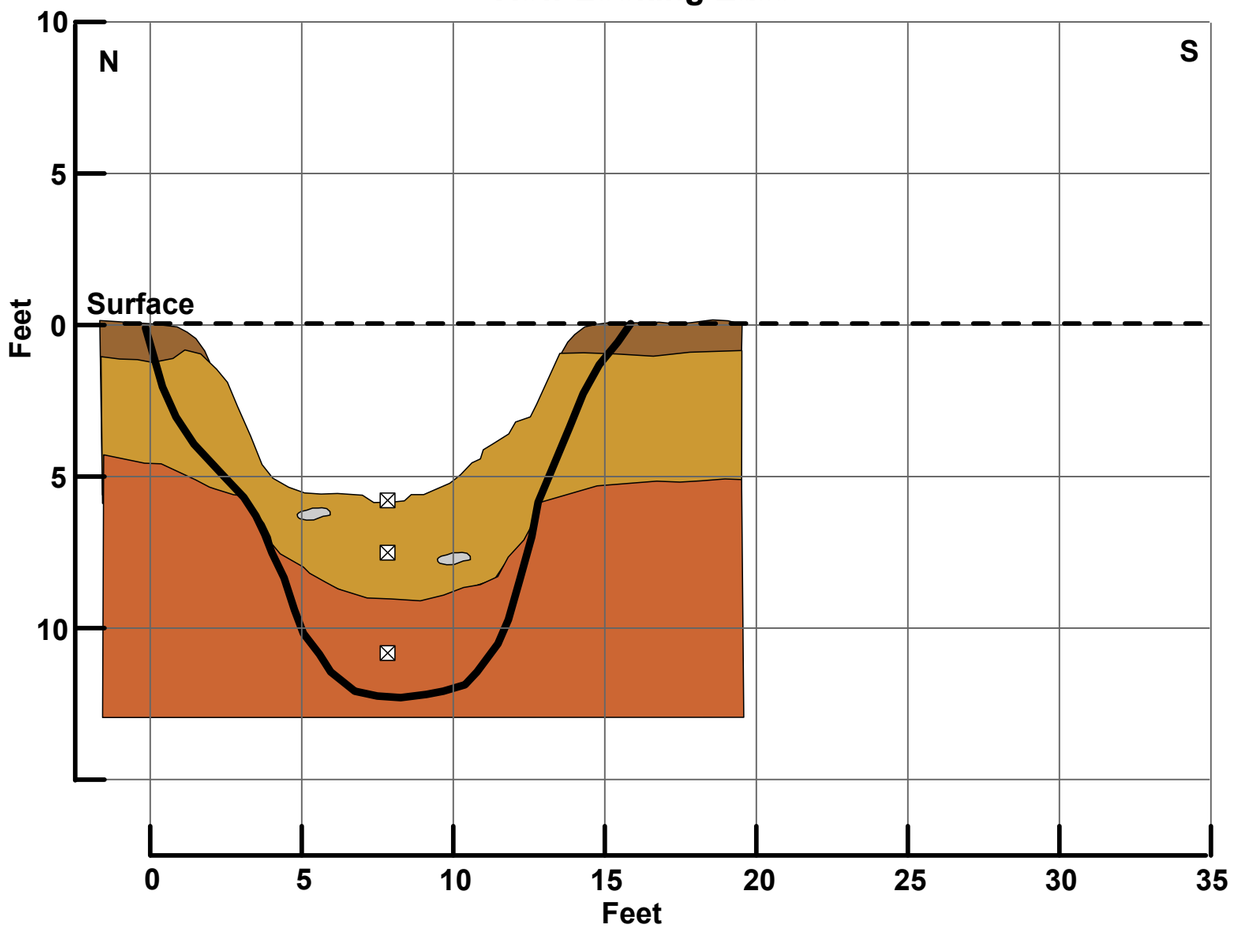
Photograph 4.6-8
Disposal Trench 12 – Test Pit 3
View North

Photograph 4.6-9
Disposal Trench 12 – Test Pit 3
Debris in South Portion of Trench

Photograph 4.6-10
Disposal Trench 12 – Test Pit 3
Debris in Central Portion of Trench

SECTION 4.6 TEST PIT LOGS

Trench Profile DT12-TP1
View Looking East



Debris Content

MDAS Base plate [<5%] (5 lbs)

Other Two round base plates (rusted), rubber box, styrofoam [<5%] (5 lbs)

Total Depth

12 feet below adjacent grade
7 feet below lowest surface grade

Samples

010MBDA-TP65
(0.0-0.5 ft bgs)

010MBDA-TP66
(2.0-3.0 ft bgs)

010MBDA-TP67
(6.0-7.0 ft bgs)

Date Excavated:	5 February 2015	**Trench No.:**	DT12-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 12	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, some organics (roots and rootlets)

Debris
Two round base plates (rusted), rubber box, Styrofoam

Alluvium
medium brown silty sand, moist to dry, loose, some debris

Colluvium
Medium grey brown silty sand with trace of clay, damp to dry, mottled red brown to grey, some vugs, caliche, trace of organics, roots and carbon, medium dense

Limits of Excavation

Soil Sample

0 5
Feet

One Inch = Five Feet

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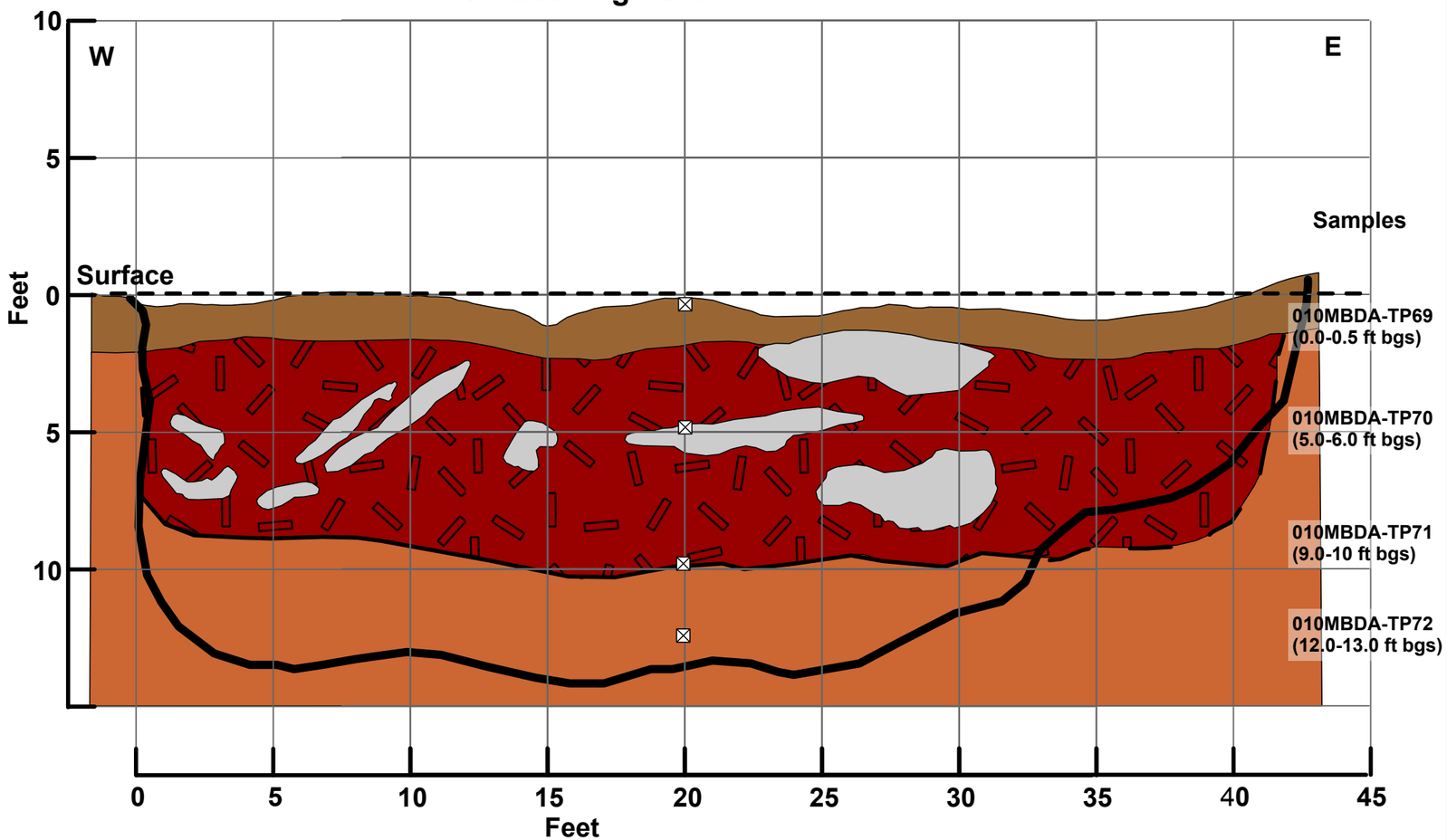
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

DT12-TP1 TRENCH LOG

Trench Profile DT12-TP2
View Looking North



Debris Content

Scrap Steel plates, metal pipes, straps, sheeting, [15%-20%] (200 lbs)

Other Wood debris, plastic, paper [40-50%] (100 lbs)

Total Depth

13 feet below adjacent grade
13 feet below lowest surface grade

Date Excavated:	5 February 2015	**Trench No.:**	DT12-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 12	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, some organics (roots and rootlets)

Large Debris
Large pockets of wood debris

Debris Fill
Medium brown silty sand, damp to dry, very loose (caving), abundant debris

Weathered Bedrock
Light red brown granite grades to light grey/green granite, dry to damp, medium dense to dense

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

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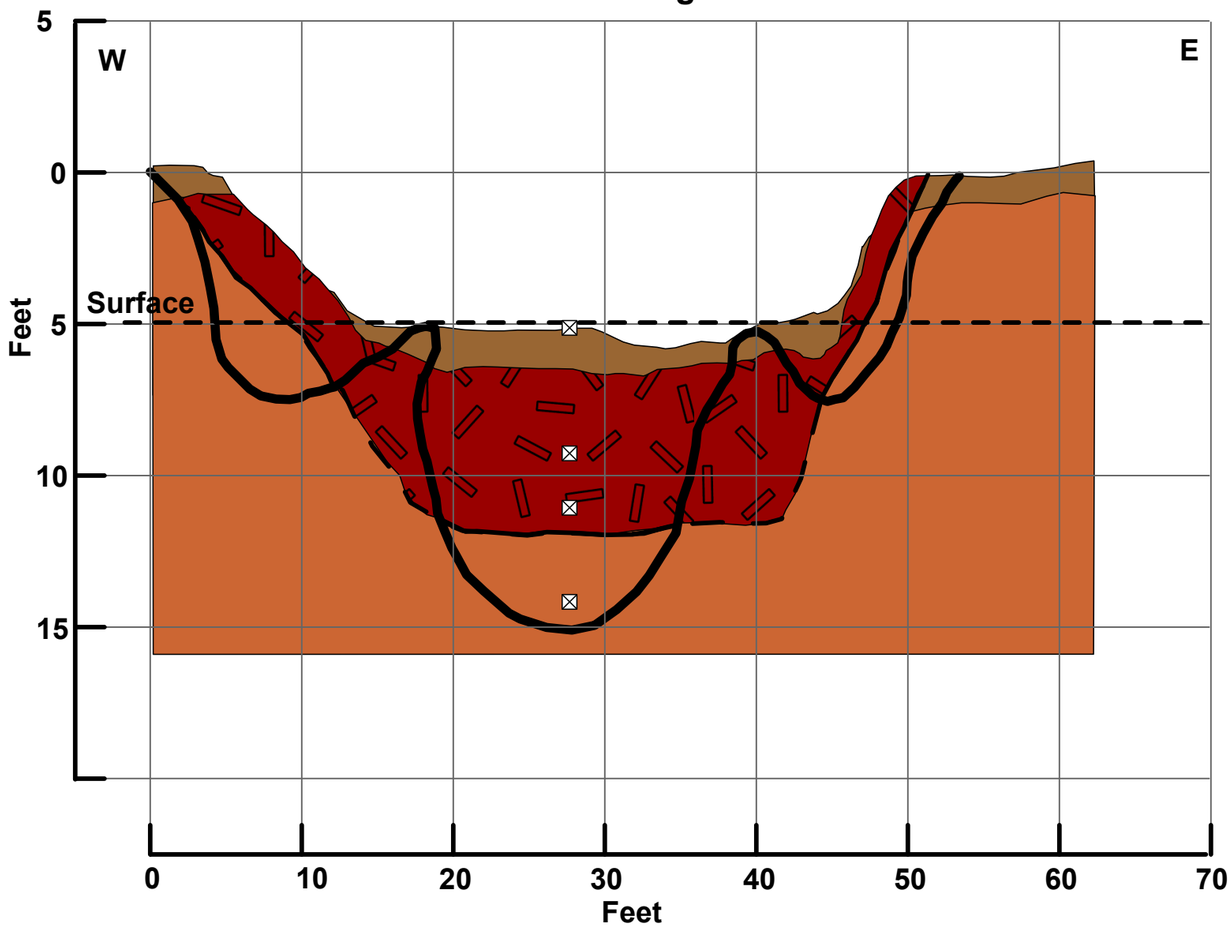
Fallbrook, California

DT12-TP2 TRENCH LOG

Trench Profile DT12-TP3
View Looking North



Debris Content

Scrap Metal strap, nails, bolts [20-25%] (200 lbs)

Other Rubber, wood, plastic, concrete [45-50%] (100 lbs)

Total Depth

15 feet below adjacent grade
10 feet below lowest surface grade

Samples

010MBDA-TP73
(0.0-0.5 ft bgs)

010MBDA-TP74
(4.0-5.0 ft bgs)

010MBDA-TP75
(5.5-6.0 ft bgs)

010MBDA-TP76
(9.0-10.0 ft bgs)

Date Excavated:	6 February 2015	**Trench No.:**	DT12-TP3
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Disposal Trench 12	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, very loose, some organics (roots and rootlets)

Building Debris Fill
Rubber, wood, metal, plastic, and concrete 70% by volume

Alluvium
medium brown silty sand, moist to dry, loose, some debris

Colluvium
Medium brown to red brown silty sand, damp to dry, loose to lightly weathered light grey granite, damp to moist, dense

Limits of Excavation

Limits of Disposal Trench (Dashed Where Inferred)

Soil Sample

Horizontal Scale
0 — 10 Feet
One Inch = Ten Feet

Vertical Scale
0 — 5 Feet
One Inch = Five Feet

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Remedial Investigation
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DT12-TP3 TRENCH LOG

4.7 NATURE AND EXTENT OF CONTAMINATION FOR EU 7

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs.

4.7.1 Investigation Results and Discussion at EU 7

EU 7 is located along the southeastern portion of MRP Site UXO1 and incorporates only one feature (Burn Slit/Trench 2). This trench, like the others, was reportedly used for burning of rocket fuel. The trench is approximately 80 feet long, 15 feet wide, and approximately 12 feet deep. The central portion of the trench had a corrugated metal cover, which was removed during this RI to facilitate sampling. Three locations (UXO1-SB01 through UXO1-SB03) were sampled just outside the metal covered area during the previous SI. Each location consisted of a surface sample (0 to 0.5 foot bgs) and a sample at a depth of two to three feet bgs. The samples were analyzed for metals, explosives, VOCs, SVOCs, TPH-d, and dioxins. During this RI, samples were collected using the excavator at two locations (BST3-TP1 and BST3-TP2) within the central portion of the trench (Test Pit Logs 4-7). Samples were collected at the surface (0 to 0.5 foot bgs) in what was classified as slough with burned debris and in the underlying bedrock at a depth of two to four feet bgs in BST2-TP1 and at three to four feet bgs in BST2-TP2. The slough/debris fill within the trench was approximately two feet thick, but contained an abundant amount of burned debris, metal, slag, MDAS (expended 35-mm slap flares and 40-mm illumination flare components), and MPPEH (Photographs 4-7). The two surface (slough/debris) samples were analyzed for TPH-d, perchlorate, dioxins, and hydrazine. The deepest samples collected from the underlying bedrock also included analysis for SVOCs.

4.7.2 Extent of MPPEH and MC at EU 7

MPPEH identified with Burn Slit/Trench 3 included the following: expended smoke grenades (2), candle mix (pyrotechnic) (1), and expended flare components (150). MDAS included numerous 35-mm slap flare components and 40-mm illumination flare components. These items were identified within the limits of the Burn Slit/Trench. No MPPEH or MDAS was observed outside the trench limits.

Analytical results indicated that arsenic exceeds initial human health screening values for all soil samples. Results ranged from 0.944J to 2.45J mg/kg. Thallium was also detected in the previous SI sample UXO1-SB02, (0 to 2 feet. bgs), outside the central portion of the trench, at a concentration of 0.843 mg/kg that exceeds the human health screening level of 0.780 mg/kg. Barium was also detected in this same SI sample at a concentration of 3,170 mg/kg, which also exceeds screening levels. The presence of barium is not surprising since barium is used as a coloring agent for smoke grenades or flares. Although the VOCs Tetrachloroethene and Trichlorofluormethane we detected in one sample from Burn Slit/Trench 2 (EU 2) (BST2-TP2 at 0 – 0.5 ft bgs) the results (0.00068 and 0.00230J mg/kg) are well below residential screening levels of 0.480 and 730 mg/kg. The dioxin TEQ human health screening level (4.90 ng/kg) was also exceeded for the BS2-TP2 surface sample with a result of 74.6 ng/kg. There were either no detections or no exceedances of screening levels for explosives, SVOCs, TPH-d, perchlorate,

pentachlorophenol, white phosphorous or hydrazine. A summary of soil analytical results compared with screening criteria and exceedances for EU 7 are provided at the end of this section, respectively (Tables 4-7A and 4-7B).

4.7.3 Human Health Risk Assessment Findings

4.7.3.1 Current/Future Natural Resources Worker

The estimated cancer risk from exposure to surface soil is 8E-08 for both federal toxicity criteria and State of California toxicity criteria. The noncancer HI from exposure to surface soil is 0.002 for federal toxicity values and 0.0002 for State of California toxicity values. The maximum detected concentrations of lead in soil at EU 7 is 40.8 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. No chemical risk drivers were identified for the current/future natural resources worker at EU 7.

4.7.3.2 Future Industrial Worker

The estimated cancer risk from exposure to surface soil is 4E-06 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of, and dermal contact with, **dioxins** in surface soil. The noncancer HI from exposure to surface soil is 0.1 for federal toxicity values and 0.009 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 7 is 40.8 mg/kg. This concentration is less than the risk-based screening level of 320 mg/kg for industrial soil. **Dioxins** are identified as a chemical risk driver in surface soil for the future industrial worker at EU 6.

The estimated cancer risk from exposure to subsurface soil is 4E-06 for federal toxicity criteria and 6E-06 for State of California toxicity values. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **dioxins** in subsurface soil. **Arsenic** also contributes significantly to the estimated risk using State of California toxicity criteria. The noncancer HI from exposure to subsurface soil is 0.2 for federal toxicity criteria and 0.3 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 7 is 40.8 mg/kg. This concentration is below the risk-based screening level of 320 mg/kg for industrial soil. **Dioxins** and **arsenic** (State of California only) are COCs in subsurface soil at EU 7 for the future industrial worker.

4.7.3.3 Future Construction Worker

The estimated cancer risk from exposure to subsurface soil is 6E-07 for the federal toxicity values and 9E-07 for State of California toxicity values. The noncancer HI from exposure to subsurface soil is 2 for both federal and State of California toxicity values. The maximum detected concentrations of lead in subsurface soil at EU 7 is 40.8 mg/kg. This concentration is greater than the risk-based screening level of 39 mg/kg for the future construction worker. The mean lead concentration in subsurface soil at EU 4, however, is 37.4 mg/kg. This concentration is below the risk-based screening level of 39 mg/kg for the future construction worker. **Barium** is identified as a chemical risk driver in subsurface soil for the future construction worker at EU 7.

4.7.3.4 Future Adult/Child Resident

The estimated cancer risks for the future residential exposure scenario are based on the aggregate risks for child and adult residents. The estimated cancer risk from exposure to surface soil is 2E-05 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **dioxins** in surface soil. The noncancer HI from exposure to surface soil for the future residential scenario is based on the total HI estimated for the child resident. The HI for surface soil is 1 for federal toxicity values and 0.1 for State of California toxicity values. **Dioxins** is identified as a chemical risk driver in surface soil for the future resident at EU 7.

The estimated cancer risk from exposure to subsurface soil is 2E-05 for both federal and State of California toxicity criteria. Most of the estimated cancer risk is associated with incidental ingestion of and dermal contact with **arsenic** and **dioxins** in subsurface soil. The HI for subsurface soil is 2 for federal toxicity criteria and 3 for State of California toxicity values. The maximum detected concentration of lead in subsurface soil at EU 7 is 40.8 mg/kg. This concentration is less than the risk-based screening level of 80 mg/kg for residential soil. **Arsenic** and **dioxins** are COCs in subsurface soil at EU 7.

The following table provides a summary of the human health risk assessment findings for EU 7:

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
7	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	Dioxins		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Arsenic [c] Dioxins	Barium	Arsenic Dioxins

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
c Based on State of California toxicity values only.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.7.4 Ecological Risk Assessment Findings

A SLERA and Step 3a risk refinement were conducted for EU 7 to assess potential risks to terrestrial receptors associated with exposure to COPECs. The following sections discuss the results of each evaluation.

4.7.4.1 Results of the Step 2 SLERA for EU 7

Preliminary risk drivers — COPECs with HQs greater than 1 using the high TRV, and COPECs posing potential risk (HQs greater than 1 using the low TRV for birds and mammals, or by direct comparison to plant and invertebrate toxicity benchmarks) — were identified in Step 2 of the

Navy's seven-step process for ERA. In addition, chemicals without toxicity information were identified as COPECs by default at the conclusion of Step 2.

The CSM described and presented in Appendix G identifies a complete exposure pathway from soils to plants via direct contact, invertebrates via direct contact and ingestion, and to birds and mammals via ingestion and bioaccumulation through the food chain. Plants and invertebrates were evaluated by comparing maximum site concentrations with plant and invertebrate toxicity benchmarks. Estimated daily doses of COPECs for birds and mammals were compared with low and high TRVs by calculating an HQ using a FCM. Calculations are presented in their entirety in Appendix G. The table below summarizes the results of Step 2 of the SLERA for EU 7:

Assessment Endpoint	COPECs based on HQs > 1.0 for EU 7	COPECs without Benchmarks or TRVs
Plants	barium, chromium, manganese, vanadium, zinc	strontium, dioxins, perchlorate, PCE, trichlorofluoromethane
Invertebrates	barium, chromium, zinc	cobalt, silver, strontium, thallium, vanadium, dioxins, perchlorate, PCE, trichlorofluoromethane
Birds	cadmium*, chromium, copper, lead, nickel, zinc*	antimony, beryllium, strontium, thallium, perchlorate
Non-Burrowing Mammals	antimony, barium*, cadmium, copper, lead, nickel, selenium, vanadium, zinc, dioxins	perchlorate
Burrowing Mammals	barium*, cadmium, zinc, dioxins	perchlorate

Note:

* Indicates COPEC is a risk driver (has an HQ greater than 1 using the high TRV).

In summary, the SLERA indicates that maximum concentrations of several metals pose potential or potentially significant risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA.

4.7.4.2 Results of the Step 3a Risk Refinement for EU 7

The results of the Step 3a risk refinement were used to assess whether there is a need for further evaluation of specific COEC in a BERA. The exit criteria for Step 3a are as follows (Navy 2004):

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **supports** an acceptable risk determination, the site exits the ERA process.

- If the reevaluation of the Tier 1 SLERA conservative assumptions (including consideration of background, detection frequency, and other factors) **does not support** an acceptable risk determination, the site continues in the Tier 2 BERA process, or is considered in planning for a remedial action.

Based on the results of the SLERA and the Step 3a risk refinement, barium and zinc were identified as posing risk to plants and invertebrates, and zinc was also identified as posing risk to non-burrowing mammals. Therefore, chemicals in soil at EU 7 may pose an unacceptable risk to ecological receptors and warrant further evaluation. The table below presents a summary of the ERA results:

Exposure Unit	Chemicals of Ecological Concern Identified after the Step 3a Risk Refinement				
	Receptor Group and Depth Interval				
	Plants	Invertebrates	Birds	Non-Burrowing Mammals	Burrowing Mammals
	(0-6 feet bgs)	(0-0.5 feet bgs)*	(0-0.5 feet bgs)*	(0-0.5 feet bgs)*	(0-6 feet bgs)
7	barium, zinc	barium, zinc	--	zinc	--

Notes:

-- No chemicals require further evaluation for the receptor group

* Invertebrates, birds, and non-burrowing mammals were evaluated using data from 0 to 2 feet bgs because data from 0 to 0.5 foot bgs were not available.

bgs Below ground surface

4.7.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from test locations within EU 7:

- Debris fill/slough is contained within the central portion of Burn Slit/Trench 2. This material is approximately two feet thick and contains a significant amount of MPPEH, MDAS, metal slag, and ash.

- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, were present at concentrations that exceed initial screening levels.

- There was evidence of kick-out, slag or munitions related debris observed at the surface adjacent to the Burn Slit/Trench.

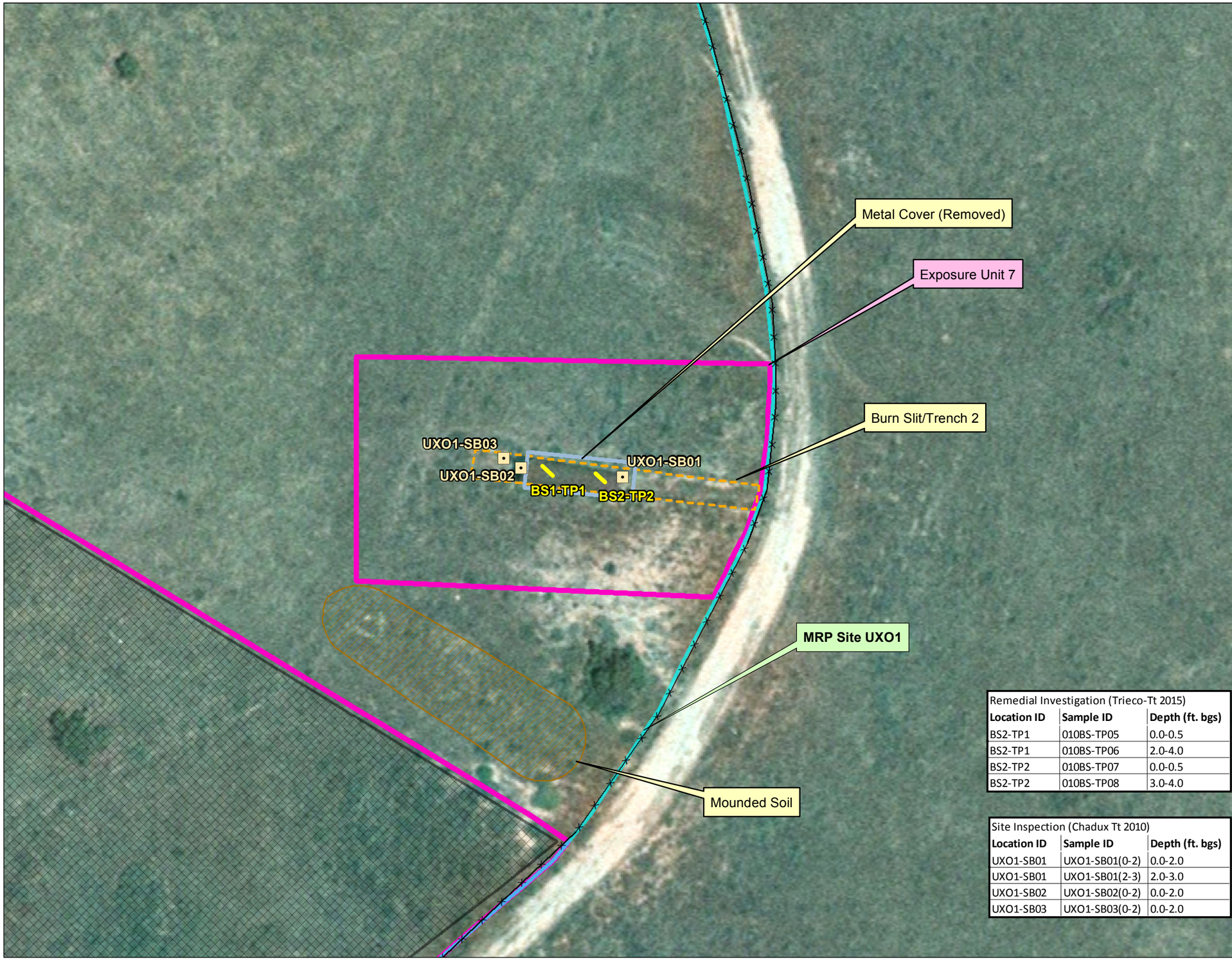
- The HHRA indicates that the dioxins are risk drivers for surface and subsurface soils located within the Burn Slit/Trench for future industrial worker and future residents. Arsenic is also a risk driver in subsurface soil within the Burn Slit/Trench for the future industrial worker and the future resident. Barium is a risk driver for construction workers in subsurface soils located within the Burn Slit/Trench.

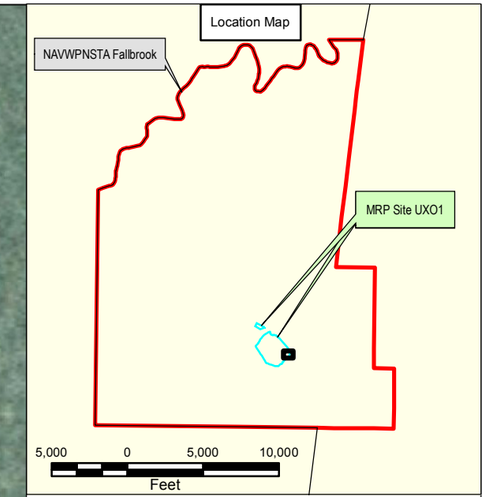
- The ERA Step 3a refinement indicates that barium and zinc are COECs for plants (0 to 6 foot bgs) and invertebrates (0 to 0.5 foot bgs) and zinc is a COEC for non-burrowing animals at 0 – 0.5 foot bgs.

- Analytical data from soil samples collected in bedrock soils below the debris fill in the Burn Slit/Trench indicate that COCs of COECs identified are not migrating vertically into the underlying bedrock materials.

- Further response action should be considered in the FS due to the possible presence of MEC/MPPEH, barium and ecological risks related to barium and zinc in the fill/slough contained within Burn Slit/Trench 2.

SECTION 4.7 FIGURES





MRP Site UXO1 Boundary
Range Fencing
Exposure Unit Boundaries
Burn Slit/Trench Limits (Approximate)
2015 Geophysical Survey Area (TriEco-Tt)
Metal Cover (Removed)
Mounded Soil
SI Soil Boring Sample Location (2010)

bgs below ground surface
ft feet

Note: 100% detector-aided visual survey was conducted over the geophysical survey areas during SI. EM61 data was collected along survey lines nominally spaced 5 feet apart over accessible portions of the geophysical survey areas during SI.

25 0 25 50
Feet

Remedial Investigation (Trieco-Tt 2015)

Location ID	Sample ID	Depth (ft. bgs)
BS2-TP1	010BS-TP05	0.0-0.5
BS2-TP1	010BS-TP06	2.0-4.0
BS2-TP2	010BS-TP07	0.0-0.5
BS2-TP2	010BS-TP08	3.0-4.0

Site Inspection (Chadux Tt 2010)

Location ID	Sample ID	Depth (ft. bgs)
UXO1-SB01	UXO1-SB01(0-2)	0.0-2.0
UXO1-SB01	UXO1-SB01(2-3)	2.0-3.0
UXO1-SB02	UXO1-SB02(0-2)	0.0-2.0
UXO1-SB03	UXO1-SB03(0-2)	0.0-2.0

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Figure 4-7
Exposure Unit 7 Features and Sample Locations
MRP Site UXO1 RI

6/16/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_4_7_Exposure_UnitBoundaries.mxd Tt-SD Mario

SECTION 4.7 TABLES

TABLE 4-7A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 7

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
TETRACHLOROETHENE	1/8	0.000680	0.000680	BS2-TP2	0.00 - 0.50	--	--	--	0	0	--	--	0.48	1.3 #	--	--
TRICHLOROFLUOROMETHANE	1/4	0.00230 J	0.00230 J	BS2-TP2	0.00 - 0.50	--	--	--	0	0	--	--	730	3,100	--	--
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
MOTOR OIL RANGE ORGANICS	1/4	14.0 J	14.0 J	BS2-TP2	0.00 - 0.50	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 4	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	4/4	15,300 J	7,660	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	4	1	77,000	1,100,000	50 +	14,710
ANTIMONY	1/4	1.22 J	1.22 J	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	1	--	31	470	0.27	--
ARSENIC	4/4	2.45 J	0.944 J	UXO1-SB02	0.00 - 2.00	--	--	--	4	4	0	0	0.062	0.25 #	18	3.105
BARIUM	4/4	3,170	166	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	1	3	15,000	220,000	330	200.5
BERYLLIUM	2/4	0.312 J	0.178 J	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	0	0	15.2	183 #	21	0.359
CADMIUM	3/4	1.42	0.173 J	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	1	3	4.58	6.37 #	0.36	0.158
CALCIUM	4/4	1,380	967	UXO1-SB01	2.00 - 3.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	4/4	14.7	10.3	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	0	0	100,000	100,000 *	26	20.3
COBALT	4/4	9.30	6.69	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	0	0	23	350	13	9.39
COPPER	4/4	34.6 J	5.44	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	1	2	3,100	47,000	28	7.785
IRON	4/4	24,200 J	14,600	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	--	0	55,000	100,000 *	--	27,350
LEAD	4/4	40.8 J	7.32	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	3	4	80	320 #	11	4.328
MAGNESIUM	4/4	7,680 J	4,630	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	4/4	326	210	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	3	1	1,800	26,000	220	304
NICKEL	4/4	9.48	4.65	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	0	3	1,500	22,000	38	5.15
POTASSIUM	4/4	5,990	4,810	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	2/4	0.291 J	0.258 J	UXO1-SB03	0.00 - 2.00	--	--	--	0	0	0	--	390	5,800	0.52	--

TABLE 4-7A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 7 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
SILVER	1/4	0.137 J	0.137 J	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	0	--	390	4,700	4.2	--
SODIUM	4/4	204	62.9 J	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	4/4	95.9 J	10.6 J	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	4/4	0.843	0.372 J	UXO1-SB02	0.00 - 2.00	--	--	--	1	0	0	1	0.78	12	1 +	0.552
VANADIUM	4/4	49.7	34.7	UXO1-SB02,	0.00 - 2.00	--	--	--	0	0	4	0	390	5,800	7.8	96.4
ZINC	4/4	702	39.1	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	3	3	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	4/5	77.5 J	2.47 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	5/5	141 J	1.02 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	5/5	16.3	0.131 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	4/5	6.20	0.194 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	5/5	41.4	0.275 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	5/5	12.2	0.403 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	5/5	49.6	0.329 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	5/5	9.85	0.271 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	4/5	17.9	0.178 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	4/5	10.6	0.294 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	5/5	40.9	0.246 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	5/5	82.7	0.365 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	5/5	91.6	0.488 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	3/5	4.51	0.199 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	4/5	63.5	0.467 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDD	3/5	229 J	9.40	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDF	5/5	55.6 J	0.369 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-DIOXINS	1/1	10.1	10.1	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-FURANS	1/1	10.6	10.6	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-DIOXINS	1/1	1.97	1.97	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-7A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 7 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HEXA-FURANS	1/1	13.0	13.0	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	4/4	172 J	5.34	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	4/4	233 J	0.396 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	4/4	237	4.70 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	4/4	534	1.98 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	4/4	178	2.19 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	4/4	963	2.48 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	1/1	8.41	8.41	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	3/4	175	1.94 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	5/5	1,700	4.72	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	5/5	74.6	1.14	BS2-TP2	0.00 - 0.50	--	--	--	1	1	5	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	5/5	197	2.06	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
PERCHLORATE	7/8	0.304	0.00120 J	BS2-TP2	3.00 - 4.00	--	--	--	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
None Detected	0/ 4	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Percent Moisture (%)																
PERCENT MOISTURE	8/8	21.3	3.40	UXO1-SB01	2.00 - 3.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 4-7A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 7

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 4-7A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR EU 7

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 4-7B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 7

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	7,660	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,100	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	120	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,300 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	132	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ANTIMONY	1.22 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	1.32	31.0	470	**0.270**	NC
ARSENIC	0.944 J	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	5.85	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.07 J	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	6.01	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.45 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	6.58	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	5.65	**0.0620**	**0.250**	18.0	3.11
BARIUM	3,170	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	6.58	15,000	220,000	**330**	201
CADMIUM	1.42	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.658	4.58	6.37	**0.360**	0.158
COPPER	34.6 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	2.63	3,100	47,000	**28.0**	7.79
LEAD	13.9	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	2.34	80.0	320	**11.0**	4.33
LEAD	40.8 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	2.63	80.0	320	**11.0**	4.33
LEAD	20.7 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	2.26	80.0	320	**11.0**	4.33
MANGANESE	227	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	3.00	1,800	26,000	**220**	304
MANGANESE	326	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	3.29	1,800	26,000	**220**	304
MANGANESE	271	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	2.82	1,800	26,000	**220**	304
THALLIUM	0.843	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.658	**0.780**	12.0	1.00	0.552
VANADIUM	34.7	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	40.9	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	1.20	390	5,800	**7.80**	96.4
VANADIUM	49.7	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	1.32	390	5,800	**7.80**	96.4
VANADIUM	49.7	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	1.13	390	5,800	**7.80**	96.4
ZINC	78.2	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	702	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	13.2	23,000	350,000	**46.0**	50.1
ZINC	154	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	11.3	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	1.84	BS2-TP1	010BS-TP05	0.00 - 0.50	01/27/15	0.0	4.90	22.0	**0.200**	NC

TABLE 4-7B: SOIL ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA FOR EU 7 (Continued)

Remedial Investigation Report, Munitions Response Program Site UX01
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	2.05	BS2-TP1	010BS-TP06	3.00 - 3.50	01/27/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	74.6	BS2-TP2	010BS-TP07	0.00 - 0.50	01/27/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.43	BS2-TP2	010BS-TP08	3.00 - 4.00	01/27/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.14	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.0	4.90	22.0	**0.200**	NC

Notes:
1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID Identification
J Estimated value
mg/kg Milligrams per kilogram
ng/kg Nanograms per kilogram
TEQ Toxicity equivalence quotient

SECTION 4.7 PHOTOGRAPHS

SECTION 4.7 – EXPOSURE UNIT 7 PHOTOGRAPHIC LOG

Photograph 4.7-1
View Looking West at Burn Slit Trench 2
Prior to Remedial Investigation

Photograph 4.7-2
View Looking East at Blast Shield Set-up prior
to conducting Test Pits at Burn Slit/Trench2

Photograph 4.7-3
Burn Slit/Trench 2 – Test Pit 1

Photograph 4.7-4
Burn Slit/Trench 2 Test Pit 1
Close-up Photograph of Metal Slag in Upper Soil Layer

Photograph 4.7-5

Burn Slit/Trench 2 Test Pit 2

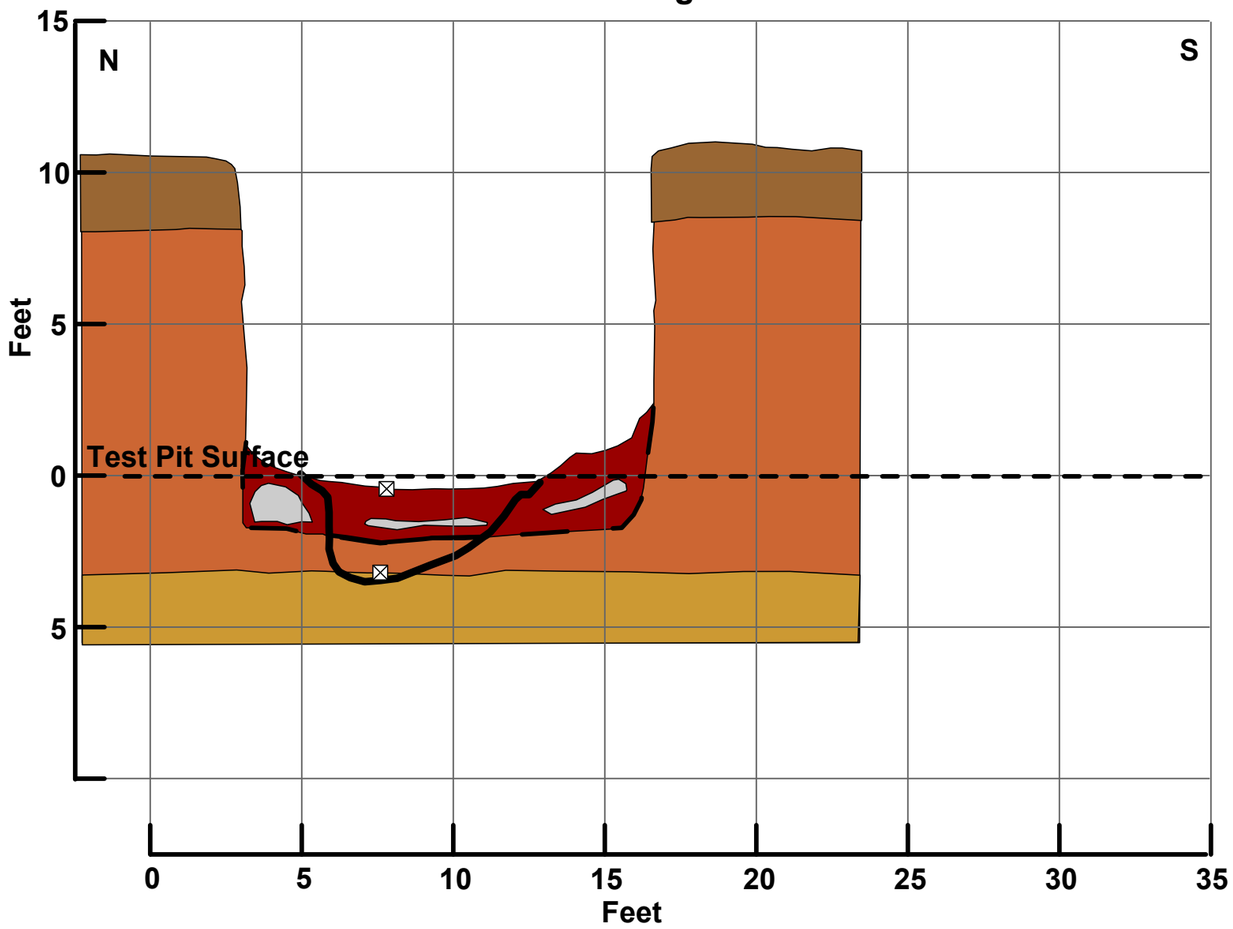
MDAS – 35-mm Slap Flares and 40-mm Illumination Flares

Photograph 4.7-6

Burn Slit/Trench 2 Fused Metal and Metal Slag Debris

SECTION 4.7 TEST PIT LOGS

Trench Profile BS2-TP1
View Looking East



Debris Content

MDAS Flare bases [15%] (25 lbs)

MPPEH 40-mm smoke grenade (MEC) [<5%] (10 lbs)

Scrap Fused metal (aluminum, carbon, lead), nails [25%] (200 lbs)

Other Partially burned wood pallet [<10%] (20 lbs)

Total Depth

14 feet below adjacent grade
3.5 feet below lowest surface grade

Samples

010BS-TP05
(0.0-0.5 ft bgs)

010BS-TP06
(2.0-4.0 ft bgs)

Date Excavated:	27 January 2015	**Trench No.:**	BS2-TP1
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 2	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, loose, moist

Topsoil/Slough
Dark brown silty sand, moist, very loose, burned debris, metal, metal slag (fused), some organics (roots), wood

Weathered Bedrock
Medium red brown granite, dense to very dense, moist to dry, medium to course grained

Debris
Metal slag, burned and munition debris

Limits of Excavation

Geologic Contact (Dashed Where Inferred)

Soil Sample

0 5
Feet

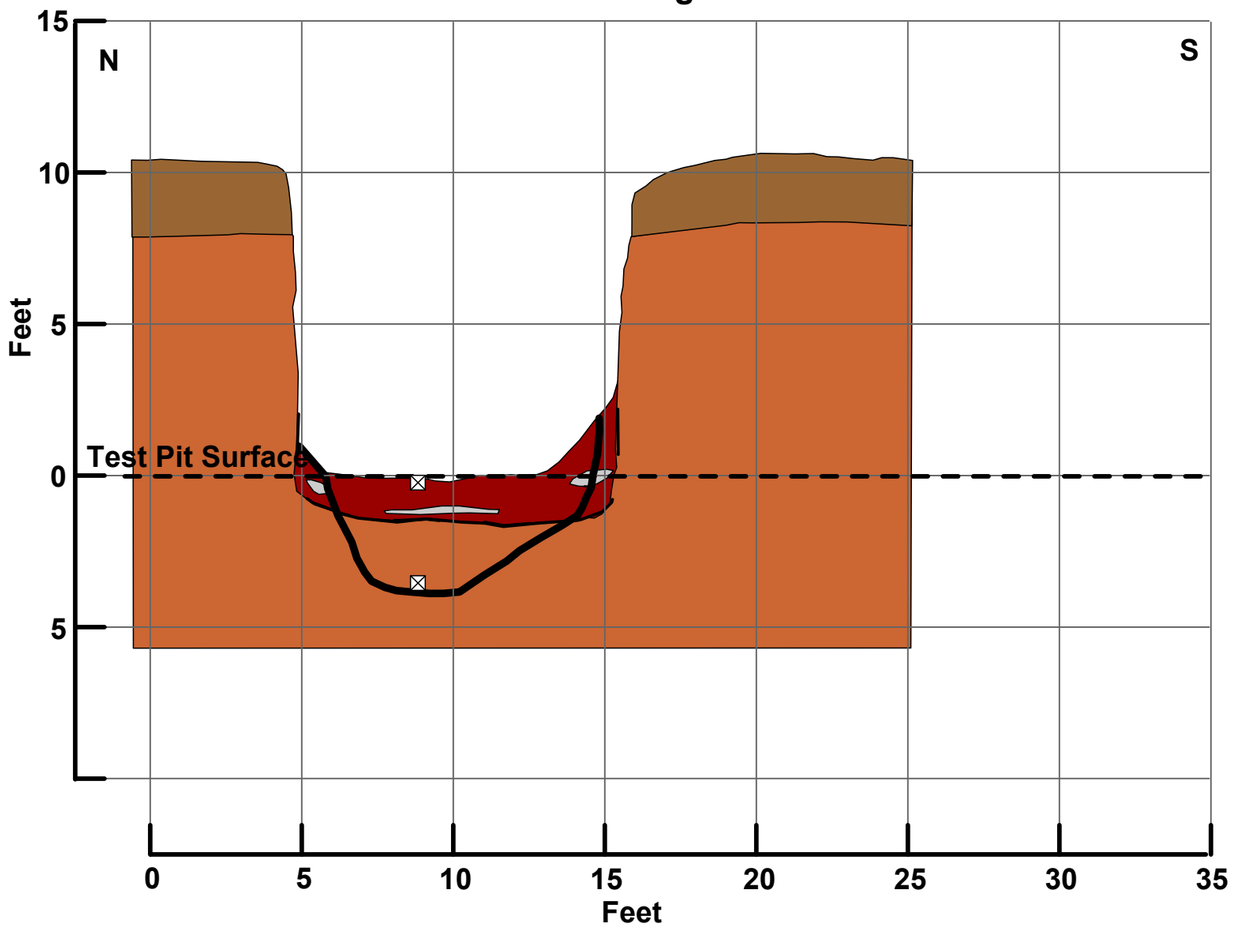
One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS2-TP1 TRENCH LOG

Trench Profile BS2-TP2
View Looking East



Debris Content

MDAS	35-mm slap flares, 40-mm smoke grenade [25%] (60 lbs)
Scrap	Nails, sheeting, aluminum, bolts, wire [20%] (40 lbs)
Other	Wood, burned wood [5%] (10 lbs)

Total Depth

14 feet below adjacent grade
4 feet below lowest surface grade

Samples

010BS-TP07
(0.0-0.5 ft bgs)

010BS-TP08
(3.0-4.0 ft bgs)

Date Excavated:	27 January 2015	**Trench No.:**	BS2-TP2
Elevation (Ft. MSL):		**Logged by:**	S. Bradley
Excavation Method:	CAT 330B Excavator	**Project:**	Fallbrook UXO1
Location:	Burn Slit Trench 2	**Project No:**	103G1959010

Topsoil
Medium brown silty sand, moist, loose

Topsoil/Slough
Medium brown silty sand, moist, very loose, abundant metal debris, burned ash, charcoal, wood, some roots

Weathered Bedrock
Light red brown granite, dry, dense to very dense, medium to coarse crystalline, near vertical fractures in trench sidewall

Limits of Excavation

Geologic Contact (Dashed Where Inferred)

Soil Sample

0 5
Feet

One Inch = Five Feet

TriEco
A Joint Venture

MRP SITE UXO1
Remedial Investigation
NAVWPNSTA Seal Beach Detachment Fallbrook
Fallbrook, California

BS2-TP2 TRENCH LOG

4.8 NATURE AND EXTENT OF CONTAMINATION FOR GROUNDWATER

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs and their possible impact on groundwater.

4.8.1 Investigation Results and Discussion of Groundwater

A total of six borings were completed to evaluate groundwater conditions within MRP Site UXO1 (Figure 2-2). Three groundwater monitoring wells were planned to be installed to evaluate area groundwater within the bedrock and two to evaluate possible "perched" groundwater conditions with Pilgrim Creek. The deep wells were drilled using a HSA drill rig. All borings encountered dense granodiorite bedrock immediately below the surficial topsoil horizon (Boring Logs 4-8). Monitoring well AGW-MW1, located in EU 3, was completed to a depth of 34.2 feet bgs, with a stabilized potentiometric surface of approximately 24.7 feet bgs. The second boring was completed to a depth of 36.2 feet bgs in the southern portion of the site (EU 6). The well was installed (AGW-MW2), with a potentiometric surface at 19.9 feet bgs. The third planned area monitoring well is located in the east central portion of the site, within EU 5. The well boring was advanced to a depth of 47 feet bgs; however, no water was present in the boring, so the well was not installed.

The second phase of the groundwater evaluation included the completion of two temporary shallow wells by hand auger drilling methods within the Pilgrim Creek drainage. The upgradient well PC-MW1 was completed to a depth of 17.2 feet bgs, with groundwater observed the following day at 16.4 feet bgs. The downgradient well PC-MW2 was completed to a depth of 10.6 feet bgs with groundwater observed at 8.6 feet bgs later the same day. A third temporary well (PC-MW3) was installed approximately 240 feet upgradient of PC-MW2. This well was completed to a depth of 7.5 feet bgs where hand auger refusal was met. No groundwater or moist soil conditions were observed in this well. Photographs of the borings and monitoring wells are provided following the text of this section (Photographs 4-8)

Based on the initial sampling program and associated well measurements, it appears that, in the upper portion of the drainage, area groundwater is recharging the "perched" groundwater zone. Evidence of this is provided by the potentiometric surface elevation of 632.8 msl in the bedrock well AGW-MW1 and the potentiometric surface elevation of 622.7 msl in the shallow Pilgrim Creek well PC-MW1. The implied direction of flow is to the east at a gradient of 0.069 ft/ft.

However, in the southern wells, the reverse groundwater condition appears to be occurring, where groundwater is flowing from the Pilgrim Creek well PC-MW2 to the bedrock well AGW-MW2. The potentiometric surface elevation in PC-MW2 is 585.3 msl while the potentiometric surface elevation in AGW-MW2 is584.4 msl. This indicates a flow direction to the east and south at a gradient of 0.010 ft/ft.

4.8.2 Groundwater Conditions

There was no detections of explosive compounds, TPH-d, SVOCs, or hydrazine in groundwater. The propellant perchlorate was detected in all three groundwater samples submitted (AGW-MW1, AGW-MW2, PC-MW2) with results ranging from 0.995 to 3.71 µg/L. These results are below the residential screening level of 14 µg/L. The VOC chloromethane was detected at a concentration of 160J µg/L in temporary well PC-MW1. The value is well below the residential screening level of 190 µg/L. A summary of groundwater analytical results compared with screening criteria and exceedances for groundwater are provided at the end of this section (Tables 4-8A and 4-8B).

Arsenic values ranged from non-detect to a maximum concentration of 5.68 ug/L which exceeds the MCL for domestic tap water screening values of 5.0 ug/L.

4.8.3 Human Health Risk Assessment Findings

Groundwater for MRP Site UXO1 was evaluated on a site-wide basis using the maximum detected concentrations of each detected chemical from four wells. Only one VOC (chloromethane) was detected in groundwater, and only in one well. The detected concentration (0.16 µg/L) of chloromethane is far below the screening concentration for the vapor intrusion pathway (260 µg/L) for a residential receptor (EPA 2014b). Thus, the vapor intrusion pathway was determined to be insignificant and not evaluated further.

4.8.3.1 Future Industrial Worker

Groundwater exposure for the future industrial worker is based on ingestion of groundwater used as drinking water in the future. Dermal contact with chemicals in groundwater were determined to be insignificant for the future industrial worker and are not evaluated quantitatively.

The estimated cancer risk from exposure to groundwater by a future industrial worker is 5E-05 using federal toxicity values and 3E-04 using State of California toxicity values. The estimated cancer risk is associated with ingestion of **arsenic**. The noncancer HI from ingestion of groundwater soil is 0.7 using federal toxicity values and 28 using State of California toxicity values. The noncancer hazard estimated using State of California toxicity values is attributable to **arsenic**. The maximum lead concentration in groundwater 2.61 µg/L was compared to the maximum contaminant level of 15 µg/L for drinking water, and lead was determined to be below the screening level. **Arsenic** is identified as a chemical risk driver in site-wide groundwater.

4.8.3.2 Future Adult/Child Resident

Groundwater exposure for the future resident worker is based on ingestion of, dermal contact with, and inhalation of vapors from groundwater used as drinking water in the future.

The estimated cancer risk from exposure to groundwater by a future resident is 1E-04 using federal toxicity values and 7E-04 using State of California toxicity values. The estimated cancer risk is associated with ingestion of **arsenic**. The noncancer HI from ingestion of groundwater soil is 2 using federal toxicity values and 82 using State of California toxicity values. The noncancer hazard is attributable to **arsenic**. The maximum lead concentration in groundwater 2.61 µg/L was compared to the maximum contaminant level of 15 µg/L for drinking water, and lead was determined to be below the screening level. **Arsenic** is identified as a chemical risk driver in site-wide groundwater.

The following table provides a summary of the HHRA findings for groundwater:

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
Site-wide	Groundwater	Groundwater	Domestic Use [b]		Arsenic		Arsenic

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.
a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.
b Groundwater exposure pathways evaluated for domestic use are ingestion, dermal contact, and inhalation during household use. Dermal pathway is insignificant for the industrial worker.
c Based on State of California toxicity values only.
Exposure pathway not evaluated for this receptor.
-- No risk drivers were identified for this exposure pathway for this receptor.
bgs Below ground surface

4.8.4 ERA Findings

Groundwater was not evaluated in the current ERA.

Surface water was not present during the investigation, so it was not evaluated during the ERA.

4.8.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from groundwater sampling within MRP Site UXO1:

- Groundwater is present locally in the bedrock at depths greater than 20 feet bgs.
- Groundwater was encountered Pilgrim Creek at depths of 16.5 and 8 feet bgs in wells PC-MW1 and PC-MW2, respectively. Groundwater was not observed in well PC-MW3, which is located between the two other wells.
- There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected in groundwater or, if detected, were at concentrations that exceed initial screening levels.

- The HHRA indicates that arsenic is a risk driver for domestic drinking water and for future industrial workers and future residents. The cancer risk is below the risk management range for current or future land use scenarios. It is believed that the arsenic is likely naturally occurring and that residential development or use of area groundwater for residential use is not considered a likely future use scenario.

- An ERA was not conducted since there is no exposure pathway for groundwater.

- Surface water was not present during the investigation, so samples could not be collected.

- Based on analytical data and there is no indication that area groundwater or perched water within Pilgrim Creek has been impacted by past operations within the site. Further evaluation of the groundwater regarding the need for further action or no further action should be included in the feasibility study phase of the project.

SECTION 4.8 TABLES

TABLE 4-8A: SUMMARY OF GROUNDWATER ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA

Remedial Investigation Report, Munitions Response Program

Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Risk-based Criteria	Number of Detections Above Residential Risk-based Criteria
Volatile Organic Compounds (µg/L)							
CHLOROMETHANE	1/4	0.160 J	0.160 J	PCMW1-GW1	1.00 - 1.00	190	0
Petroleum Hydrocarbons (mg/L)							
Diesel/Motor Oil Range (extractables)							
None Detected	0/ 3	ND	ND	-	-	-	-
Semivolatile Organic Compounds (µg/L)							
None Detected	0/ 3	ND	ND	-	-	-	-
Metals (µg/L)							
Unfiltered							
ALUMINUM	3/4	92.5 J	117	MW1-GW1	100 - 200	20,000	0
ANTIMONY	1/4	0.403 J	0.403 J	MW1-GW1	1.00 - 1.00	7.8	0
ARSENIC	3/4	3.10 J	5.42	MW1-GW1	1.00 - 10.0	0.0071	**3**
BARIUM	4/4	8.34	71.1	PCMW1-GW1	1.00 - 10.0	3,800	0
CALCIUM	4/4	11,000	29,200	PCMW1-GW1	100 - 1,000	NA	0
CHROMIUM	1/4	0.596 J	0.596 J	MW1-GW1	1.00 - 1.00	22,000	0
COBALT	1/4	0.174 J	0.174 J	MW1-GW1	1.00 - 1.00	6	0
COPPER	4/4	1.03	33.3	PCMW2-GW1	1.00 - 10.0	800	0
IRON	3/4	70.1 J	138	MW1-GW1	100 - 200	14,000	0
LEAD	3/4	0.244 J	2.61 J	PCMW1-GW1	1.00 - 10.0	15	0
MAGNESIUM	4/4	8,930	29,900	PCMW1-GW1	100 - 1,000	NA	0
MANGANESE	4/4	4.38 J	103	MW2-GW2	1.00 - 10.0	430	0
MOLYBDENUM	4/4	2.70 J	21.9	MW2-GW2	2.00 - 10.0	100	0
NICKEL	1/4	0.249 J	0.249 J	MW1-GW1	1.00 - 1.00	390	0
POTASSIUM	4/4	2,260	10,800	MW2-GW2	100 - 1,000	NA	0
SELENIUM	1/4	1.02	1.02	MW1-GW1	1.00 - 1.00	100	0
SODIUM	4/4	61,700	146,000	MW2-GW2	100 - 1,000	NA	0

TABLE 4-8A: SUMMARY OF GROUNDWATER ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA (Continued)

Remedial Investigation Report, Munitions Response Program

Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Risk-based Criteria	Number of Detections Above Residential Risk-based Criteria
Metals (µg/L)							
Unfiltered							
VANADIUM	4/4	9.90 J	20.5	MW1-GW1	1.00 - 10.0	86	0
ZINC	4/4	6.49 J	31.1	PCMW1-GW1	20.0 - 20.0	6,000	0
Explosives (µg/L)							
PERCHLORATE	3/3	0.995	3.65	MW1-GW1	0.500 - 0.500	14	0
Hydrazine (µg/L)							
None Detected	0/ 3	ND	ND	-	-	-	-

Notes:

1 Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.

2 Only chemicals that were detected are shown in Table 4; groundwater samples were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, perchlorate and hydrazine.

3 Sample were collected during the 2015 RI investigation.

4 RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.

- Not applicable
-- No screening criterion or ambient limit has been established
bgs below ground surface
J Estimated value
mg/L Milligrams per liter
ND None detected
RI Remedial investigation
SI Site investigation
µg/L Micrograms per liter

Source: EPA. 2012. "Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. RSL Table Update." November.

TABLE 4-8B: GROUNDWATER ANALYTICAL RESULTS EXCEEDING SCREENING CRITERIA

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Collection Date	Laboratory Reporting Limit	Residential Risk-based Criteria
Metals (µg/L)						
Unfiltered						
ARSENIC	5.42	MW1-GW1	010UXO1-MW01	01/27/15	1.00	0.00710
ARSENIC	3.19 J	MW2-GW2	010UXO1-MW02	01/29/15	10.0	0.00710
ARSENIC	3.10 J	PCMW1-GW1	010PC-MW01	02/06/15	10.0	0.00710

Notes:
1. Screening criteria sources are presented in Sections 6.2 (ecological).
2 Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID Identification
J Estimated value
µg/L Micrograms per liter

SECTION 4.8 PHOTOGRAPHS

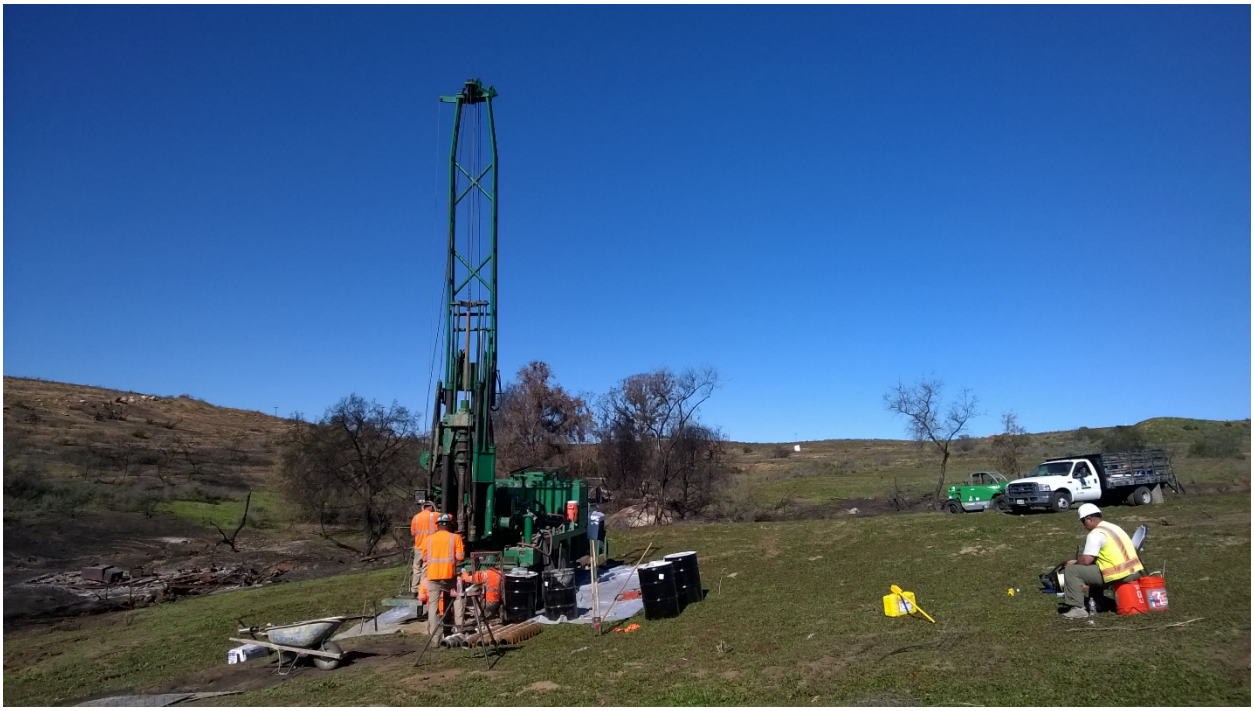
SECTION 4.8 – GROUNDWATER PHOTOGRAPHIC LOG

Photograph 4.8-1
Monitoring Well Location AGW-MW01
Hand Auguring and UXO Clearance

Photograph 4.8-1
Monitoring Well Location AGW-MW01
Soil Screening and Classification

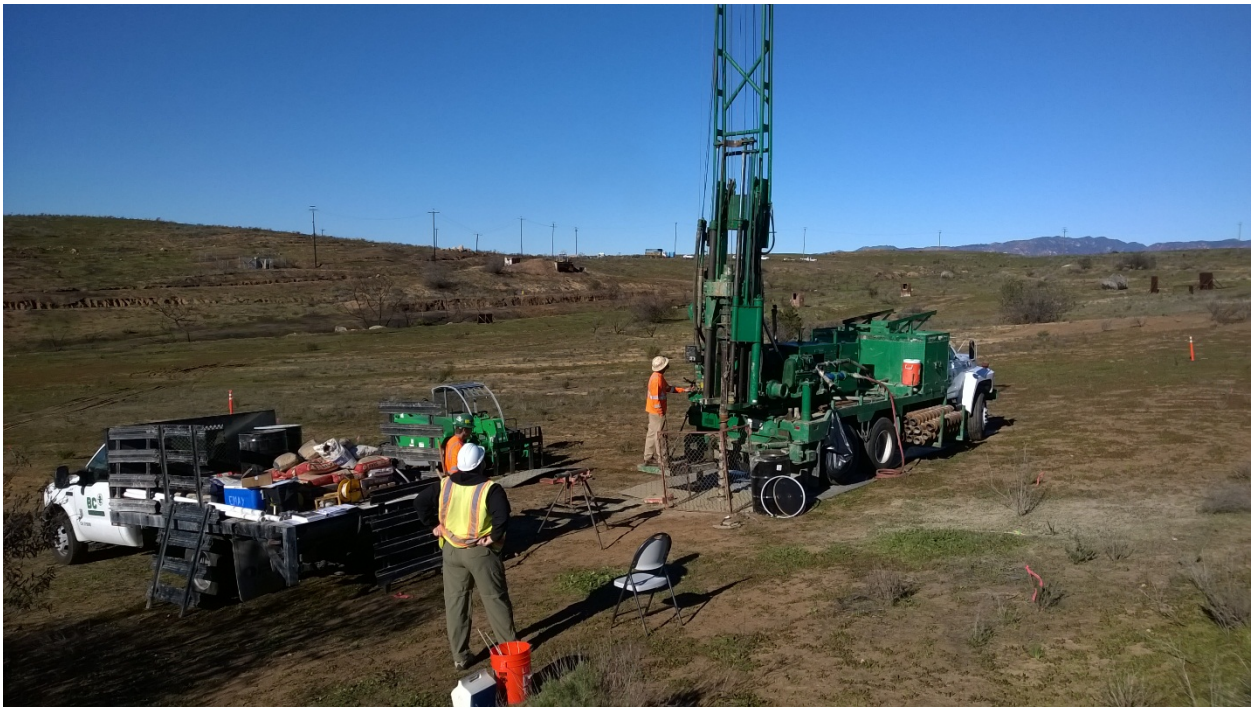
SECTION 4.8 – GROUNDWATER PHOTOGRAPHIC LOG

Photograph 4.8-1
Monitoring Well Location AGW-MW01
Core sample of colluvium/weathered granite bedrock contact



Photograph 4.8-1
Monitoring Well Location AGW-MW02
Hollow Stem Auger Drilling at Initial Boring Location;
Boring Subsequently Abandoned

Photograph 4.8-2
Monitoring Well Location AGW-MW02
Hollow Stem Auger Drilling at the Final Boring Location



Photograph 4.8-1
Monitoring Well Location AGW-MW03
Hollow Stem Auger Drilling; No Groundwater
Encountered and the Boring was Abandoned

SECTION 4.8 – GROUNDWATER PHOTOGRAPHIC LOG

Photograph 4.8-1
Installation of Temporary Well PC-MW02

Photograph 4.8-1
Temporary well PC-MW03

SECTION 4.8 BORING LOGS

TETRA TECH	**DATE:** 1/20/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-S1**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	15:02	X			0.0		SM	Topsoil/Alluvium: Fine to medium grained silty sand, very loose, moist, minor organics, roots, and some coarse gravel (weathered granite).	Sample ID: 010PC-SB01
1							SM	Clayey silt, dark brown (7.5YR 3/4), loose, moist, with some fine to coarse grained sand.	
2									
3	10:28	X			0.0				Sample ID: 010PC-SB02
								Silty sand, dark brown (7.5YR 4/6), loose, moist, with some fine to medium grained sand.	
4							SM		
								Total Depth 4.0 ft.	Boring Terminated @ 1040.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-S2**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	11:28	X			0.0		SM	Topsoil (2 inches): Fine to medium silty sand, reddish black (2.5YR 2/1), very loose, dry, graded, with organics and burned vegetation at surface.	Sample ID: 010PC-SB03
1							SM	Fine to medium grained silt, brown (10YR 4/3), non-plasticity, moist, with some fine to medium grained sand.	
2								Fine to medium grained sand with silt, strong brown (7.5YR 4/6), very loose, moist, with subangular medium to coarse gravel (weathered granite)	
3	11:56	X			0.0				Sample ID: 010PC-SB04
							SM	Alluvium: Silty sand, dark brown (7.5YR 4/6), loose, moist, fine grained poorly graded sand.	
4									Boring Terminated @ 1235

Total Depth 4.0 ft.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-S3**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	13:21	X			0.0		SM	Topsoil (2 inches): Fine to medium grained silty sand, reddish black (2.5YR 2/1), dry, very loose, with medium gravel (1 - 3-inch dia.), minor amount of organic material and burned vegetation.	Sample ID: 010PC-SB05
1							SM		
2							SM	Alluvium: Fine to medium grained silty sand, dark yellowish brown (10YR 3/4), very loose, moist, with some fine to medium subangular gravel (weathered granite).	
3	13:53	X			0.0			Silty sand, dark reddish brown (5YR 3/4), non-plastic, moist, loose, micaceous. Increasing grain size medium to coarse grained sand. Color reddens to 5YR 4/6.	Sample ID: 010PC-SB06
4								3.5 ft. - increasing silt content	Boring Terminated @ 1406

Total Depth 4.0 ft.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Chris Lynch	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-S4**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	14:30	X			0.0		SM	Alluvium: Fine grained silty sand, dark brown (7.5YR 3/4), moist, very loose, with roots and burned vegetation remnants at surface.	Sample ID: 010PC-SB07
1									
2							SM	Clayey silt, moist, loose, slightly plastic, cohesive with some coarse gravel (weathered granite).	
3	15:00	X			0.0				Sample ID: 010PC-SB08
4								**Total Depth 4.0 ft.**	Boring terminated @ 1625

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/22/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**DTT-SS1**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	9:40	X			0.0		SM	Topsoil: Fine to medium silty sand, dark reddish brown (5YR 3/3), slightly moist to moist, loose	Sample ID: 010DTT-SS01
1							SC	Colluvium: Fine to medium grained sandy clay with silt, reddish brown (5YR 4/4), moist, soft, low plasticity	
2							SM	Fine to medium grained silty sand, yellowish red (5YR 5/6), moist, loose	
3	10:00	X			0.0				Sample ID: 010DTT-SS02
4								Total Depth 4.0 ft.	Boring Terminated.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/22/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**DTT-SS2**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	10:12	X			0.0		SM	Topsoil: Fine to medium silty sand, dark reddish brown (5YR 3/3), slightly moist to moist, loose	Sample ID: 010DTT-SS03
1							SC	Colluvium: Fine to medium sandy, silty clay, yellowish-red (5YR 4/6), moist, soft, low plasticity.	
2									
3	10:20	X			0.0		SM	Fine to medium grained silty sand, yellowish red (5YR 5/6), moist, loose	Sample ID: 010DTT-SS04
4								Total Depth 4.0 ft.	Boring Terminated.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/22/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**DTT-SS3**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	10:44	X			0.0		SM	Topsoil: Fine to medium silty sand, dark reddish brown (5YR 3/3), slightly moist to moist, loose	Sample ID: 010DTT-SS05
1							SC	Colluvium: Fine to medium sandy, silty clay, reddish brown (5YR 4/4), moist, soft, low plasticity.	Surface is graded roadbed.
2									
3	11:33	X			0.0			Fine to coarse grained silty sand, yellowish red (5YR 5/6), moist, loose, medium density	Sample ID: 010DTT-SS06
4								Total Depth 4.0 ft.	Boring Terminated.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:**	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**DTT-SS4**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	12:55	X			0.0		SM	Topsoil: Fine to medium silty sand, dark reddish brown (5YR 3/3), slightly moist to moist, loose	Sample ID: 010DTT-SS07 Surface is graded roadbed.
1								Fine to medium grained silty sand, dark reddish brown (5YR 3/3)	
2							SC	Colluvium: Silty clay, reddish brown (5YR 4/4)	
3	13:17	X			0.0		SM	Fine to medium grained silty sand, yellowish red (5YR 5/6), moist, loose	Sample ID: 010DTT-SS08
4								Total Depth 4.0 ft.	Boring Terminated.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/13/15 - 1/14/15	**BORING**
	LOGGED BY: Nic Macario	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-MW1**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0							SM	Topsoil (2 inches): Fine to medium silty sand, reddish black (2.5YR 2/1), loose, dry, graded, with organics and burn ash.	Installed 2-inch diameter PVC well casing from 17 to 12 feet bgs. Backfilled annulus with #2 sand to 10 feet bgs, then hydrated bentonite to surface
							SM		
1							SM	Alluvium: Fine to medium grained silt, brown (10YR 4/3), loose, moist, with some fine to medium grained sand.	
2								Fine to medium grained silt, strong brown (7.5YR 4/6), non-plasticity, moist, with subangular weathered granite. Fine grained sand with weathered granite and gravel 6mm to 20mm	
3								Silty sand, dark brown (7.5YR 4/6), non-plastic, moist, with some fine grained sand.	
							SM		
4							SW		
5								Well graded sand, medium brown, dry, coarse angular grains (granite),medium dense.	
6							SW	Weathered Bedrock: Light grey brown well graded sand, damp, medium dense to dense, angular, coarse grained sand grains (weathered granite).	
7									
8									
9									
10							SW	Light grey brown, coarse grained, mottled light brown, micaceous, dense, homogeneous, dry	
11									
12									
13									
14									
15								16.0 ft. damp	
16									
17									
								Total Depth 17.2 ft.	

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-MW2**
PROJECT NAME: Remedial Investiagtion for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0					0.0			Alluvium: Fine grained silty sand, dark brown (7.5YR 3/4), moist, loose, with roots and burn ash and organics.	Installed 2-inch diameter PVC well casing from 10.5 to 5.5 feet bgs. Backfilled annulus with #2 sand to 5 feet bgs, then hydrated bentonite to
1									
2								Clayey silt, moist, plastic, cohesive with some coarse spcks of weathered granite.	
3									
4								Weathered Bedrock: Fine grained sand with silt, dark yellowish brown (10YR 3/4), moist, medium dense, slightly cohesive, some fine and medium grained weathered granite rock.	
5									
6								Increasing grain size, moisture content increasing, more difficult to drill with hand auger	
7									
8								Becomes very moist at 8.0 ft.	
9									
10								Difficult Drilling at 9.0 feet, hand auger refusal at 10.5 feet	
11								**Total Depth 10.5 ft.**	
12									
13									
14									
15									
16									
17									

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**PC-MW3**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** N/A	
	DRILL BIT SIZE: 3-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Grab from Auger	**COORDINATES:**
	SAMPLER TYPE: Glass Container	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0					0.0			Alluvium: Fine grained silty sand, dark brown (7.5YR 3/4), moist, loose, with roots and burn ash and organics.	Installed 2-inch diameter PVC well casing from 7.5 to 2.5 feet bgs. Backfilled annulus with #2 sand to 2.5 feet bgs, then hydrated bentonite to
1									
2								Clayey silt, moist, plastic, cohesive with some coarse spcks of weathered granite.	
3									
4								Weathered Bedrock: Fine grained sand with silt, dark yellowish brown (10YR 3/4), moist, low plasticity, cohesive, some fine and medium grained weathered granite.	
5									
6								Fine grained sand with silt increasing grain size, moisture and weathered granite content with depth.	More difficult to drill with hand auger.
7								**Total Depth 7.5 ft.**	Boring Terminated @ 09:00. Hand auger refusal.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/21/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** N/A	**AGW-MW1**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger to 10 feet; HSA from 10 feet to depth	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** CME 85	
	DRILL BIT SIZE: 8-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Drive Sampler	**COORDINATES:**
	SAMPLER TYPE: 3.0-inch Diameter Split Spoon	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	09:30	X		N/A	0.0		SM	Topsoil (2 inches): Fine to medium silty sand, reddish black (2.5YR 2/1), non-plastic, dry, graded, with organics and burn ash.	Sample ID: 010AGW-SB01
1							SM	Fine to medium grained silt, brown (10YR 4/3), non-plasticity, moist, with some fine to medium grained sand.	
2								Fine to medium grained silt, strong brown (7.5YR 4/6), non-plasticity, moist, with subangular weathered granite. Fine grained sand with weathered granite and gravel 6mm to 20mm	
3									
4							SM	Silty sand, dark brown (7.5YR 4/6), non-plastic, moist, with some fine grained sand.	
5	09:43	X			0.0		SW	Weathered Bedrock: Well graded sand, medium brown, dry, coarse, angular,medium dense (granite).	Sample ID: 010AGW-SB02
6							SW	Light grey brown, angular, coarse grained sand, medium dense to dense.	
7									
8									
9									
10	10:35	X	16,19,27		0.0		SW	Weathered granite, coarse grained sand, Mottled light brown w/ black and white specks, dense, homogeneous, dry	Sample ID: 010AGW-SB03
11									
12									
13 ~ 29									
30	11:30	X	17, 20, 25					Slightly weathered granite, coarse grained sand, light brown w/ black and white specks, dense, slightly moist	Sample ID: 010AGW-SB04 Difficult drilling
31									
32									
33									
34									
35									
36								**Total Depth 36 Ft.**	

WELL CONTRUCTION DETAILS:

BORHOLE DIAMETER: 8.25"
CASING DIAMETER: 2" ID
CASING MATERIAL AND GUAGE: Sch 40 PVC
CASING INTERVAL (ft bgs): 0.0 - 25.5
SCREEN DIAMETER: 2" ID
SCREEN MATERIAL: Slot size 0.01, Sch 40 PVC
SCREEN INTERVAL (ft bgs): 25.5 - 35.5

SEALING MATERIAL: Bentonite and Portland Cement
SEAL INTERVAL (ft bgs): 0 - 21.5
PLUG MATERIAL: Bentonite
PLUG INTERVAL (ft bgs): 21.5 - 23.5
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL: 23.5 - 35.5
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs): 23.74
Date: 1.20.15 Time: 0905
DEPTH TO FINAL WATER (ft bgs): 21.7
Date: 1.21.15 Time: 1100

TETRA TECH	**DATE:** 1/15/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** BC2	**AGW-MW2A**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger to 10 feet; HSA from 10 feet to depth	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** CME 85	
	DRILL BIT SIZE: 8-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Drive Sampler	**COORDINATES:**
	SAMPLER TYPE: 3.0-inch Diameter Split Spoon	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	10:20	X			0.0			Fine grained silty sand, dark brown (7.5YR 3/4), moist, loose.	Sample ID: 010AGW-SB06
1									
2									
3								Clayey silt, moist, plastic, cohesive with little coarse weathered granite.	
4								Fine grained sand with silt, dark yellowish brown (10YR 3/4), moist, low plasticity, cohesive, some fine sand and weathered granite.	
5	10:33	X			0.0				Sample ID: 010AGW-SB07
6								Fine grained sand with silt, increasing grain size, moisture, and weathered granite content with depth.	
7									
8									
9									
10	11:07	X							Sample ID: 010AGW-SB08
11									
12									
13									
14								Less moisture, more competent bedrock, granite with black and white specks, some orange/reddish oxidation.	
15									Sampler refusal at 15 feet
16								Very hard, some moisture observed at the tip of water meter	
17									Boring terminated @ 1:24. Boring moved approximately 200 feet SSW, backfilled with grout. One 55 gallon drum with grout used for backfill.

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/16/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** BC2	**AGW-MW2B**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger to 10 feet; HSA from 10 feet to depth	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** CME 85	
	DRILL BIT SIZE: 8-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Drive Sampler	**COORDINATES:**
	SAMPLER TYPE: 3.0-inch Diameter Split Spoon	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0					0.0		MH	Topsoil:Clayey silt, moist, plastic competent. Some fine to coarse grained sand.	
1									
2									
3									
4									
5 ~ 21									
22									
23									
24 ~ 29							SM	Light grey silty fine to coarse sand, dry, dense.	
30	10:01	☒			0.0				Sample ID: 010AGW-SB09
31									
32									
33									
34									
35									
36								Auger Refusal at 36.8 feet	
								Total Depth 36.8 ft	

WELL CONTRUCTION DETAILS:

BORHOLE DIAMETER: 8.25"
CASING DIAMETER: 2" ID
CASING MATERIAL AND GUAGE: Sch 40 PVC
CASING INTERVAL (ft bgs): 0.0 - 25.0
SCREEN DIAMETER: 2" ID
SCREEN MATERIAL: Slot size 0.01, Sch 40 PVC
SCREEN INTERVAL (ft bgs): 25.0 - 35.0

SEALING MATERIAL: 95% Portland cement, 5% bentonite, 55gal total
SEAL INTERVAL (ft bgs): 0 - 21.0
PLUG MATERIAL: 100lb Bentonite, 3/8" chip size
PLUG INTERVAL (ft bgs): 21.0 - 23.0
FILTER PACK MATERIAL AND SIZE: 550lb of #2 sand
FILTER PACK INTERVAL: 23.0 - 35.0
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs): 12.87
Date: 1.20.15 Time: 1300
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/15/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** BC2	**AGW-MW3**
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger to 10 feet; HSA from 10 feet to depth	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** CME 85	
	DRILL BIT SIZE: 8-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Drive Sampler	**COORDINATES:**
	SAMPLER TYPE: 3.0-inch Diameter Split Spoon	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
0	09:30	X			0.3		SM	Topsoil / Colluvium:Fine to medium slightly silty sand, reddish brown (7.5YR 3/4), slightly moist to moist, loose to medium density, no plasticity.	Sample ID: 010AGW-SB11
1									
2									
3									
4									
5	09:43	X			0.0				Sample ID: 010AGW-SB12
6							SW	Colluvium: Coarse to fine sand, light brown (7.5YR 4/3), slightly moist, medium dense to dense, no plasticity.	
7									
8					0.0				
9									
10	10:35	X							Sample ID: 010AGW-SB13
11				50 / 3"			SW	Weatered Bedrock: Coarse to fine sand, brown (10YR 4/4), moist, very dense, no plasticity, weathered granite rock.	
12					0.0				
13									
14									
15									
16									
17									
18									
19									
20				50 / 4"			SW	Coarse to fine sand, dark brown (10YR 3/3), moist, very dense, weathered granite rock becoming slightly moist.	
~									
29									Difficult drilling, switch to concrete core. (CONTINUE ON NEXT PAGE)

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

TETRA TECH	**DATE:** 1/15/15	**BORING**
	LOGGED BY: Sean Cole	
	COMPANY: Tetra Tech	
CLIENT: Department of the Navy - NAVFAC Southwest	**DRILL FOREMAN:** N/A	**AGW-MW3 (Continued)**
PROJECT NUMBER: 103G1959010	**DRILLING COMPANY:** BC2	
PROJECT NAME: Remedial Investigation for MRP Site UXO1	**DRILLING METHOD**: Hand Auger to 10 feet; HSA from 10 feet to depth	
SITE: MRP Site UXO1	**DRILL RIG TYPE:** CME 85	
	DRILL BIT SIZE: 8-inch	
LOCATION: Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, CA	**SAMPLING METHOD:** Drive Sampler	**COORDINATES:**
	SAMPLER TYPE: 3.0-inch Diameter Split Spoon	

DEPTH (ft bgs)	TIME	SAMPLE INTERVAL	RECOVERED/ DRIVEN (in/in)	BLOWS/6in	OVA READING (ppm)	SOIL SYMBOL	USCS CODE	SOIL DESCRIPTION	NOTES
29								Clayey fine to coarse sand, slightly yellowish brown (2.5YR 3/2), moist, very dense, slightly plastic plasticity. Slightly weathered granite.	
30	13:30	X		50 / 5"	0.0		SC		Sample ID: 010AGW-SB14
								Coarse to fine sand, grey (10YR 6/1), slightly moist, very dense, weathered granite rock becoming less weathered with depth.	
31									
32									
33									
34									
35									
36								Very difficult drilling, tripped augers to replace drill bit.	
37									
38									
39									
40								Very difficult drilling, changed drill bit to concrete bit.	
41									
42									
43									
44									
45									
46									
					0.0			Light grey silty sand, dry, very dense, very difficult drilling Drill refusal at 47 ft.	Sample collected from auger drill tip casing
47									
								Total Depth 47.0 ft.	

WELL CONTRUCTION DETAILS: N/A

BORHOLE DIAMETER:
CASING DIAMETER:
CASING MATERIAL AND GUAGE:
CASING INTERVAL (ft bgs):
SCREEN DIAMETER:
SCREEN MATERIAL:
SCREEN INTERVAL (ft bgs):

SEALING MATERIAL:
SEAL INTERVAL (ft bgs):
PLUG MATERIAL (ft bgs):
PLUG INTERVAL (ft bgs):
FILTER PACK MATERIAL AND SIZE:
FILTER PACK INTERVAL:
SUMP INTERVAL (ft bgs):

GROUNDWATER: N/A

DEPTH TO FIRST WATER (ft bgs):
Date: Time:
DEPTH TO FINAL WATER (ft bgs):
Date: Time:

4.9 NATURE AND EXTENT OF CONTAMINATION FOR THE CENTRAL DOWN RANGE SDZ

The following sections describe the investigation results and provides discussion on the nature and extent of both the munitions-related items and MCs.

4.9.1 Investigation Results and Discussion for the Central Down Range SDZ

The Central Down Range SDZ encompasses approximately 17 acres immediately south of the primary (fenced) MRP Site UXO1 (Figure 1-3). This area was considered an area of potential concern (AOPC) since it was a possible landing area for Law Rockets or other fired munitions, should they overshoot the target located within MRP Site UXO1. A 100 percent surface sweep was conducted by the UXO team between January 6 and February 6, 2015. The terrain is characterized by gently south-sloping terrain that has been incised by first order drainages of Pilgrim Creek. At the time of the sweep, visibility was excellent since the area was essentially devoid of vegetation due to the May 2014 Tomahawk wildfire. During the sweep, the team recovered a relatively minor amount of scrap metal and MDAS items. Based upon the lack of MPPEH and type of items identified that are typical throughout the installation (MDAS [empty small arms canisters] and scrap metal [wire, metal straps]) it is considered a very low probability that MEC or MPPEH items exist within the SDZ for Law Rockets beyond the primary MRP Site UXO1 area and.

4.9.2 Extent of MPPEH and MC for the Central Down Range SDZ

There was no MPPEH identified in the UXO surface sweep of this area.

MDAS identified by the UXO technicians consisted of primarily highly weathered empty small arms ammunition canisters and a slap flare base. Approximately 200 lbs. of metal was collected from 17 acres by the field team (Photographs 4.9). This material was placed in a secured bin until transport to the approved demilitarization and recycling facility.

Sampling of the area was not planned during this initial inspection, as such soil samples were not collected

4.9.3 Human Health Risk Assessment Findings

Sampling was not conducted within this area so a HHRA was not conducted.

4.9.4 Ecological Risk Assessment Findings

Sampling was not conducted in this area so an ERA was not conducted.

4.9.5 Conclusions and Recommendations

The following conclusions and recommendations are based on data obtained from the surface sweep of the Central Down Range SDZ:

- Visibility and access within the surveyed area was excellent due to the recent wildfires that removed most of the vegetation.
- No MEC or MPPEH was identified within the survey area during the detector aided surface sweep.
- MDAS found was limited to empty ammunition canisters (small arms) and a slap flare base which are common debris that may be found throughout the installation. These items are not considered to be directly related to activities at the former UXO1 firing range.
- Per the Project Quality Objectives included in the SAP, and the lack of range related items (UXO or MPPEH) observed, no further action is recommended for this area of potential interest and inclusion of the SDZ south of the fence to the UXO1 footprint is not warranted.

SECTION 4.9 PHOTOGRAPHS

SECTION 4.9 – CENTRAL DOWN RANGE SDZ PHOTOGRAPHIC LOG

Photograph 4.9-1
View Looking South Down the Central Portion of the
Down Range Survey Area After the Tomahawk Fire (May 2014)

Photograph 4.9-2
View looking at the Eastern Portion of the
Central Down Range Survey Area After the Tomahawk Fire (May 2014)

Photograph 4.9-3
View Looking South Down the Central Down Range Survey Area
with One of Two Piles of MDAS/Scrap Metal

Photograph 4.9-4
Central Down Range Survey Area
Second Pile With MDAS (Empty Small Arms Ammunition Carriers and Flare Base)

5.0 MEC HAZARD ASSESSMENT

A MEC Hazard Assessment (HA) was performed to evaluate the site risk posed by munitions-related items at MRP Site UXO1. The MEC HA addresses (a) the potential severity if a MEC or MPPEH item functions, (b) the likelihood a receptor will interact with a MEC or MPPEH item, and (c) the likelihood a MEC or MPPEH item will function should a receptor interact with it.

Two MEC HAs were prepared, one that considered the environmental worker, weed control and security as primary receptors within the fenced portion of UXO1 (EUs 2 – 7). A second one considered the environmental worker, security, weed control, rancher and trespassers as the primary receptors for current use outside the fenced portion of the site. Future planned use is anticipated to remain as indicated above for the areas within and outside the fenced areas. Alternatives evaluated include:

(1) Land use controls (LUC) only, including signage and institutional controls (IC).

(2) Surface MEC/MPPEH detection, removal and disposal, and ICs.

(3) Surface and subsurface MEC/MPPEH detection, removal action and disposal, and ICs.

The assessment input factors include:

- Filler type (the energetic material used in the munitions)
- Distance to additional receptors
- Proximity of critical infrastructure
- Proximity of critical resources and proximity of ecological and cultural resources

Accessibility input factors include:

- Site accessibility
- Potential contact hours
- Amount of MEC
- MEC depth relative to intrusive depth
- Migration potential

Sensitivity input factors include:

- MEC category
- MEC size

The MEC HA uses a relative numerical scoring system related to a risk number for the site:

Hazard Level 1: **840-1000** – Munitions Response Sites (MRS) with the *highest* potential explosive hazard conditions with typical characteristics including:

- An MRS that has not undergone a cleanup
- High-explosive-filled UXO, usually "Sensitive UXO" on the surface
- A former target area or OB/OD area
- An MRS with full or moderate accessibility
- Additional human receptors inside the MRS or Explosive Safety Quantity Distance
- May include subsurface MEC with intrusive activities to the depth of subsurface MEC

Hazard Level 2: **725-835** – MRS with high potential explosive hazard conditions with typical characteristics including:

- Former target area, OB/OD area, function test range, or maneuver area
- UXO, or Fuzed Sensitive Discarded Military Munitions (DMM) on the surface, or intrusive activities overlapping with minimum depths of UXO or Fuzed Sensitive DMM located only subsurface
- Full or moderate accessibility to people engaging in intrusive activities

Hazard Level 3: **530-720** – MRS with moderate potential explosive hazard conditions with typical characteristics including:

- DMM on the surface, or intrusive activities overlapping with minimum depths of DMM located only subsurface
- Former target area, OB/OD area, function test range, or maneuver area that has undergone a surface cleanup
- An MRS with moderate or limited accessibility, and a low number of contact hours

Hazard Level 4: 125-525 – MRS with low potential explosive hazard conditions. The presence of MPPEH at an MRS means that an explosive hazard may exist. Therefore, MPPEH may still pose a hazard at a Hazard Level 4 MRS with typical characteristics including:

- A MEC cleanup performed or MEC located only subsurface, below the depth of receptor intrusive activities
- Energetic Material Type is propellant, spotting charge, or incendiary
- Accessibility is Limited or Very Limited, and contact hours are few or very few. This limited access may be the result of LUCs

The MEC HAs were prepared assuming three separate site conditions:

1. The site at baseline before the RI (current land use)
2. The site at baseline before the RI (future land use – cattle grazing outside the fenced former QE Test Area and SKR habitat)
3. The site after MEC clearance (future land use – cattle grazing outside the fenced former QE Test Area and SKR habitat)

Assumptions include restricted access for current land use and accessibility for future use scenarios. Future scenarios also recognize the existence of the SKR, CAGC, SWFL, and LBVI as federal- and California state-protected species at the site. Details regarding scoring for the input factors are included in Appendix C. The following tables summarize the MEC HA Hazard Analysis for Exposure Units Located within the fenced boundary of UXO1 and the area outside the boundary:

MEC Hazard Analysis Summary – Fenced Area (EUs 2 through 7)

MRP Site UXO1	Current Use as Open Space with Natural Resources Management/Weed Control	Future Use for Cattle Grazing Outside the Fenced Former QE Test Area and SKR Habitat		
		Land Use Controls (LUC)	Surface MEC/MPPEH Removal and Land Use Control	MEC/MPPEH Removal Action and Land Use Control
Total Score	800	800	535	405
Hazard Level Category	2	2	3	4

MEC Hazard Analysis Summary – Unfenced Areas (EU 1 and Down Range SDZ)

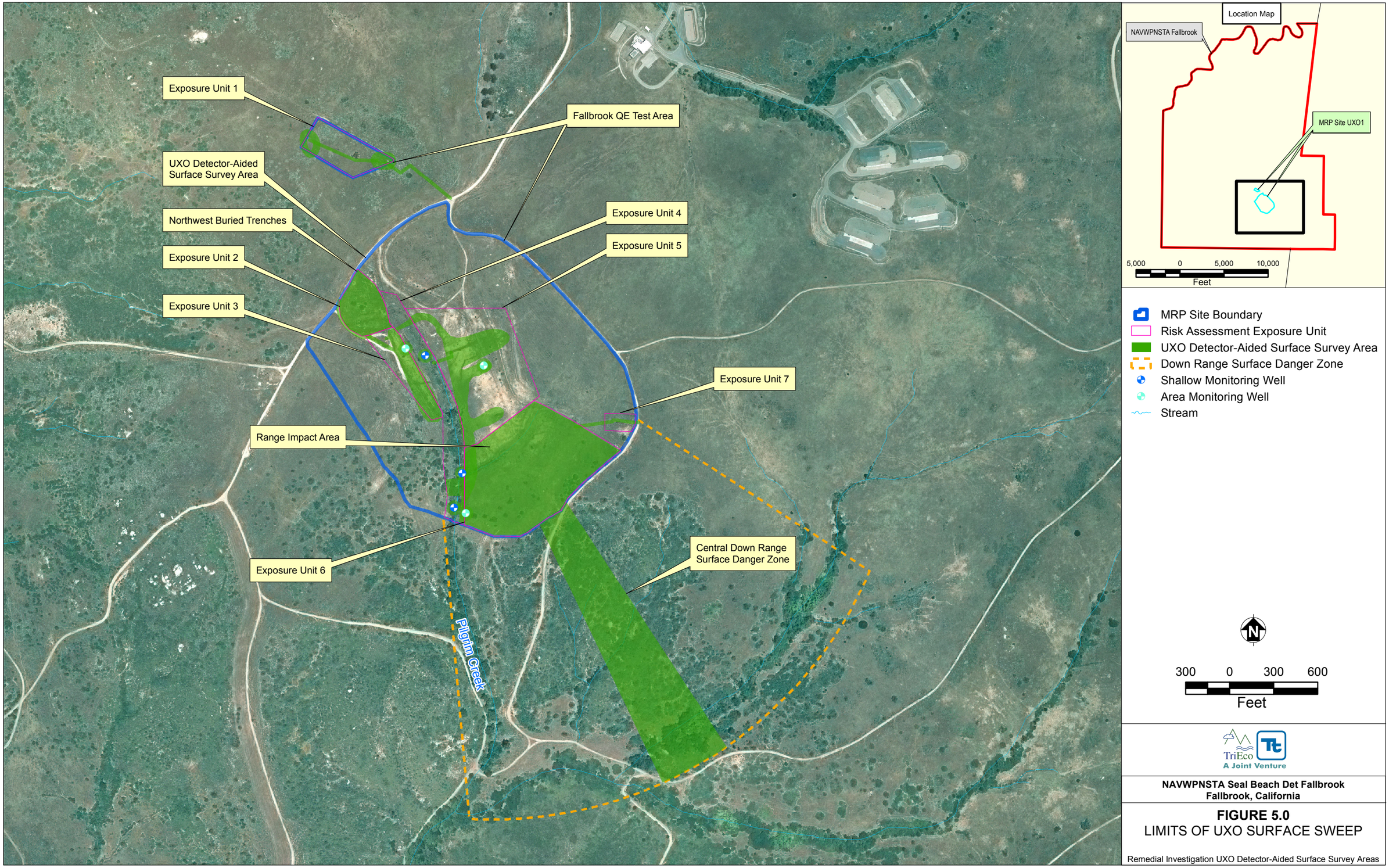
MRP Site UXO1	Current Use for Natural Resources Management and Cattle Grazing	Future Use for Cattle Grazing Outside the Fenced Former QE Test Area and SKR Habitat		
		Land Use Controls (LUC)	Surface MEC/MPPEH Removal and Land Use Control	MEC/MPPEH Removal Action and Land Use Control
Total Score	690	690	425	295
Hazard Level Category	3	3	4	4

The MEC HA prepared for the fenced portion of the MRP site included Exposure Units 2 through 7. As indicated above, the EUs lie within an area determined to have a hazard level category of 2. Features within the site considered most likely to contain UXO or MEC are the Drop Test Tower (EU3), the Target Berm (EU5), and the Range Impact Area (EU6). Detector aided surface sweeps were conducted in each of these areas and a DGM survey was conducted in the Range Impact Area (EU6). Access routes and investigation areas swept by the UXO team during the SI and RI are indicated on Figure 5.0. The potential that UXO exists at or near the surface in these areas has been greatly reduced, but not eliminated. The northwest trenches area (EU2), Burn Slit/Trench 1 (EU3) and Burn Slit/Trench (EU7) contained a significant amount of MPPEH (smoke and pyrotechnic components) and MDAS. These features and adjacent areas were also cleared by the UXO team and are considered to have a low potential for UXO or MEC to be present. Areas within the fenced portion of the site, but outside the cleared features and access routes investigated during the SI (ChaduxTt 2010) and RI are considered to have a very low potential for UXO or MEC since no operations were known or suspected to have taken place.

EU1 and the Central Down Range SDZ are located outside the fenced portion of UXO1. As indicated above, the EUs lie within an area determined to have a hazard level category of 3. Burn Slit/Trench 3 was the only feature identified within EU1. The Trench contained a burn ash layer with no evidence of OB/OD operations involving munitions, pyrotechnical or smoke devices that were observed at the other Burn Slit/Trenches. It appears the primary if not only use was for burning of rocket fuel as described in historical records (Malcolm Pirnie 2007). The area was cleared by the UXO team prior to conducting the investigations, as such the potential for UXO or MEC to be present in this area is considered very low.

The Central Down Range SDZ was considered an AOPI due to the potential that munitions (LAW Rockets) fired at the former range may have overshot the target and range impact area, landing outside of the MRP site. A 100 percent detector aided sweep of the central portion of the SDZ was conducted by the UXO team. No UXO, MEC or MPPEH items associated with a firing range were identified or recovered during the sweep. It should be noted that visibility of the ground surface was excellent at the time clearance was conducted due to the fires that affected the area in 2014. A minor amount of MDAS was recorded by the team, but the items were primarily empty small ammunitions canisters and a single slap flare base. The area is considered to have a very low potential that UXO or MEC are present that would present a risk under current and future use scenarios.

SECTION 5.0 FIGURE



NAVWPNSTA Seal Beach Det Fallbrook
Fallbrook, California

FIGURE 5.0
LIMITS OF UXO SURFACE SWEEP

Remedial Investigation UXO Detector-Aided Surface Survey Areas

11/24/2015 Y:\NAVFAC - AECRU V\CENTRAL IPT\CTO-0010_Fallbrook\Fallbrook-GIS\MXDs\RI_Scoping_2015\MXDs\Fig_5_0_MRP_UXO1_SUrfaceSweep.mxd Tt-SD Mario

6.0 CONCLUSIONS AND RECOMMENDATIONS

The activities during the RI successfully identified the presence of several suspect subsurface features that were tentatively identified during prior assessments and the previous SI (ChaduxTt 2010). Geologic logging and sampling of the former buried disposal and Burn Slit/Trenches has provided comprehensive data regarding the characteristics of the material disposed of during past operations at MRP Site UXO1. During the previous SI, a total of 67 samples were collected with approximately 211 analysis run. In the recent RI a total of 131 samples were collected with nearly 2,000 analysis conducted. In conducting the RI, the UXO team removed all known MPPEH and MDAS from the access and work areas. A total of 225 MPPEH items were disposed of on-site and approximately 7,800 lbs. of MDAS were shipped from the site for demilitarization and recycling. In addition, approximately 18,200 lbs. of scrap metal was removed and sent for recycling.

The DGM survey was successfully completed over a majority of the Range Impact Area. A total of 2,757 targets were detected within the RI DGM survey area (Range Impact Area). The survey detected heavy anomaly areas that indicated the apparent lateral extent of Disposal Trench 12, which is approximately 620 feet or more long and debris detected through an area approximately 100 feet wide in the eastern portion of the trench. Based on the correlation of heavy anomaly areas with previously mapped drainages, Disposal Trench 12 appears to have been located in a former drainage and backfilled with non-explosive debris. In total, 1,201 of the 2,757 target anomalies were detected outside of the apparent limits of Disposal Trench 12. Intrusive investigation of 77 targets (excluding six QC targets suspected to be and found to be no finds) within the Range Impact Area outside of Disposal Trench 12 identified included:

- Four MPPEH items (one 105 mm flare canister, one 40-mm smoke cartridge, and two fire bomb components)
- Ten MDAS items (three, partial 120-mm mortars, three expended 40-mm smoke cartridges, one expended LAW rocket motor, two ballistic windshields, and one ballistic nose cone)
- Sixty-one scrap metal items (metal disks, rings, plates, straps, brackets, horseshoes, wire, chains, pipes, slag, and a bolt)
- Two no-finds (EM61 noise from rough terrain)
- All 14 blind seeds (small ISOs)

The types of items identified and relative percent within the Range Impact Area is provided in the table below:

Item Description	Number of Items	Percent of Total Items
MPPEH	4	5.2
MDAS	10	13
Scrap Metal	61	79.2
No Finds (terrain noise)	2	2.6

NOTE: All 14 blind seeds were located

Detector aided surface sweeps were conducted at all suspected or known operational areas or features during the RI by the UXO team. The sweeps were successful in removing MPPEH, MC or MDAS along with scrap metal from the areas investigated. Areas outside the known or suspect disposal areas or operational areas investigated within UXO1 during the RI are considered to have a low potential for the presence of MPPEH. No MPPEH or range related items were identified beyond the fenced boundary of UXO1 (EU 1 and the Central Down Range SDZ). The MEC HA indicates Hazard Level Categories of 2 for the fenced portion of UXO1 and 4 for the area beyond the fence. There was no evidence that MPPEH or MC related to past operations of the firing range resulted in overshot into the down range portion of the range SDZ. Inclusion of this area into the primary UXO1 site is not warranted.

A baseline HHRA was selected as the appropriate level after a review of the data indicated that maximum detected chemical concentrations were high enough to exceed risk-based screening levels for multiple chemical constituents. Risk evaluations were completed using both federal and State of California toxicity criteria. Results of the HHRA indicate that the estimated cancer risks and noncancer hazards are below a level of concern for the current/future natural resources worker for all EUs. In accordance with standard risk evaluation methodologies, a summary of the HHRA results for other potential human receptors by exposure unit is presented below:

EU 1

- For all exposure scenarios the noncancer hazards are below a level of concern.
- For the future industrial and construction workers the cancer risks are below a level of concern for both surface and subsurface soil.
- For the future resident, **Dioxins** in the fill soils within Burn Slit/Trench 3 indicate a cancer risk (1E-06) that is within the risk management range for both surface and subsurface soil. Residential development is not a planned use scenario for this EU.

EU 2

- For the future industrial and construction workers the cancer risks and noncancer hazards are below a level of concern for both surface and subsurface soil.
- For the future resident, the cancer risk and noncancer hazard are below a level of concern for surface soil.

- For the future resident, the estimated cancer risk (2E-06) from subsurface soil is within the risk management range; and the noncancer hazard (HI=2) is greater than the noncancer hazard threshold of 1.

- The mean lead concentration (1,695 mg/kg) at EU 2 is greater than the RBSLs for lead for both future workers and residents

- **Dioxins** in surface soil, and **dioxins**, **arsenic** and **lead** in subsurface debris fill, are identified as COCs at EU 2. The associated human health risk identified for dioxins and arsenic fall within the range of risk management decision under current and future use scenarios. Lead concentrations in Disposal Trenches 4 and 7 exceed the RBSL for industrial worker, construction worker and residential scenarios.

EU 3

- For all exposure scenarios the cancer risks and noncancer hazards are below a level of concern.

- There are no COCs identified for EU 3 using federal toxicity values.

EU 4

- For all exposure scenarios the noncancer hazards are below a level of concern.

- For the future industrial and construction workers the cancer risks are below a level of concern for both surface and subsurface soil.

- For the future resident, the cancer risk related to dioxins in subsurface soil is below a level of concern for surface soil; and the cancer risk (1E-06) is within the risk management range for subsurface soil.

EU 5

- For all exposure scenarios the noncancer hazards are below a level of concern.

- For the future industrial and construction workers the cancer risks are below a level of concern for both surface and subsurface soil.

- For the future resident, the cancer risk for Dioxins is below a level of concern for surface soil; and the estimated cancer risk (1E-05) is within risk management range for subsurface soil.

EU 6

- For all exposure scenarios the noncancer hazards are below a level of concern.

- For the future construction workers the cancer risks are below a level of concern for both surface and subsurface soil.

- For the future industrial worker, the estimated cancer risk from Dioxins in surface soil (1E-06) and from subsurface soil (2E-06) are within the risk management decision range.

- For the future resident, the estimated cancer risk surface soil related to Dioxins (4E-06) and from subsurface soil (7E-06) are within the risk management range. Residential development is not a planned use for this EU.

- The mean lead concentration (107 mg/kg) at EU 6 is less than the RBSLs for lead for the future industrial worker but greater than the RBSLs for future construction workers and future residents.

- **Dioxins** in surface soil, and **dioxins** and **lead** in subsurface soil, are identified as COCs at EU 6 using federal toxicity criteria.

EU 7

- For the future industrial workers the estimated cancer risk from surface soil (4E-06) and subsurface soil (4E-06) for dioxins are within the risk management decision range; and the noncancer hazards are below a level of concern for both surface and subsurface soil.

- For the future construction workers the cancer risks related to barium are below a level of concern for surface and subsurface soil; and the noncancer hazard (HI=2) is greater than the noncancer hazard threshold of 1.

- For the future resident, the estimated cancer risk surface soil (2E-05) and from subsurface soil (2E-05) are within the risk management range. Residential development is not a planned future use for this EU.

- For the future resident, the noncancer hazard is below a level of concern for surface soil; but for subsurface soil, the noncancer hazard (HI=3) is greater than the noncancer hazard threshold of 1.

Groundwater for MRP Site UXO1 was evaluated on a site-wide basis using the maximum detected concentrations of each detected chemical from five wells. The cancer risk from exposure to groundwater is within the risk management range for the future industrial worker and future resident using federal toxicity criteria, but exceeds the risk using State of California criteria. The noncancer HI from ingestion of groundwater less than the threshold HI of 1 for non-carcinogens for the industrial worker using federal toxicity criteria, but exceeds using State of California toxicity criteria. The noncancer hazard to the future resident from groundwater exposure exceeds HI=1, however the arsenic is believed to be naturally occurring and there is no planned use of groundwater within the site for domestic use. The cancer risk and noncancer hazards from groundwater are associated with ingestion of arsenic. A summary of the various risk drivers for each EU is provided in Table 6-1 below:

TABLE 6-1: SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS

SUMMARY OF INCREMENTAL RISK DRIVERS

Exposure Unit	Medium	Exposure Medium	Exposure Pathway	Current/Future Natural Resource Worker	Future Industrial Worker	Future Construction Worker	Future Resident (Adult and Child)
1	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Dioxins
2	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Arsenic [c] Lead	Lead	Arsenic [c] Dioxins Lead
3	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Arsenic [c]
4	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		--	--	Dioxins
5	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	--		--
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Dioxins	--	Dioxins
6	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	Dioxins		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Dioxins	Lead	Arsenic [c] Diesel Range Organics [c] Dioxins Lead
7	Soil	Surface Soil (0 to 0.5 foot bgs)	Direct Contact [a]	--	Dioxins		Dioxins
		Subsurface Soil (0 to 10 feet bgs)	Direct Contact [a]		Arsenic [c] Dioxins	Barium	Arsenic Dioxins
Site-wide	Groundwater	Groundwater	Domestic Use [b]		Arsenic		Arsenic

Notes: Risk drivers are those chemicals for which the chemical-specific cancer risk for a given exposure medium (for example, subsurface soil) exceeds 1E-06 or the chemical-specific noncancer hazard index exceeds 1. Risk drivers shown are based on results for incremental risk.
Risk drivers shown are based on HHRA results for both federal and State of California toxicity criteria, unless otherwise noted.

a Exposure pathways evaluated for direct contact are incidental ingestion, dermal contact, and inhalation of particulate or volatile chemicals released from soil.

b Groundwater exposure pathways evaluated for domestic use are ingestion, dermal contact, and inhalation during household use. Dermal pathway is insignificant for the industrial worker.

c Based on State of California toxicity values only.

Exposure pathway not evaluated for this receptor.

-- No risk drivers were identified for this exposure pathway for this receptor.

bgs Below ground surface

Results of the ERA indicated that maximum concentrations of several metals pose potential risks to plant, invertebrate, and vertebrate receptors based on the conservative assumptions of the SLERA in all EUs. As noted previously, the Step 3a risk refinement included a screen against background to eliminate from further consideration those chemicals with exposure unit concentrations less than background. Dioxins were evaluated in the SLERA, but were not identified as chemicals of ecological concern. The results of the Step 3a risk refinement for EU 2 indicated that lead and zinc were identified as posing a risk to plants, and cadmium was identified as posing a risk to birds. In EU 3, cadmium was identified as posing a risk to birds. The Step 3a risk refinement for EU 7 indicated that barium and zinc were identified as posing a risk to plants and invertebrates, and zinc was also identified was posing a risk to non-burrowing mammals. Therefore, chemicals in soil at EUs 2, 3, and 7 may pose an unacceptable risk to ecological receptors and warrant further evaluation. For EUs 1, 4, 5, and 6, the Step 3a risk refinement

concluded that no COECs were identified and no unacceptable risk is posed to ecological receptors from chemicals in soil. A summary of the results are provided in Table 6-2 below:

TABLE 6-2: SUMMARY OF ECOLOGICAL RISK ASSESSMENT RESULTS

Exposure Unit	Chemicals of Ecological Concern Identified after the Step 3a Risk Refinement				
	Receptor Group and Depth Interval				
	Plants	Invertebrates	Birds	Non-Burrowing Mammals	Burrowing Mammals
	(0-6 feet bgs)	(0-0.5 feet bgs)*	(0-0.5 feet bgs)*	(0-0.5 feet bgs)*	(0-6 feet bgs)
1	--	--	--	--	--
2	lead (Disposal Trench 7) zinc (Disposal Trenches 4 and 7)	--	cadmium	--	--
3	--	--	cadmium	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	barium, zinc	barium, zinc	--	zinc	--

Notes:

-- No chemicals require further evaluation for the receptor group

* In EU 7, invertebrates, birds, and non-burrowing mammals were evaluated using data from 0 to 2 feet bgs because data from 0 to 0.5 foot bgs were not available.

bgs Below ground surface

Based on analytical data and the resultant risk assessments, elevated concentrations of some metals and dioxins indicate that risks exist for human health and ecological receptors from surface soils and subsurface soils. These contaminants area primarily associated with former burning and disposal operations, and as such, are directly tied to the OB/OD and Burn Slit/Trench locations within EUs 2, 4, 5, 6, and 7. The debris in the OB/OD trenches is essentially buried with a surface cover of one to two feet of topsoil, that combined with the relatively arid environment, has evidently played a role in limiting vertical migration of contaminants as evidenced by the analytical results. Similarly, for the Burn Slit/Trenches, concentrations of the metals arsenic and barium and dioxins were recorded within the surficial slough/debris fill in the central portions of the trenches. Even though these soils are not covered, there is no evidence that vertical migration of COCs is occurring into the underlying bedrock. From a risk management standpoint, Burn Slit/Trenches 1 and 2 are located within the secured (fenced) portion of UXO1. Burn Slit/Trench

3 in EU 1 is not fenced, however there were no associated risks identified for this feature based upon current or likely future uses of the area.

Analysis for explosive compounds showed only two detections of trinitrotoluene out of a total of 160 samples analyzed within UXO1. The highest concentration of 1.60 mg/kg was collected at the surface at Disposal Trench 8 that is well below the residential screening level of 21 mg/kg. Diesel range organics were detect at four locations Burn Slit/Trench 3 and Disposal Trenches 3 and 12. The highest concentration was 49 mg/kg in Disposal Trench 12. All values were well below the residential screening level of 96 mg/kg. Motor oil range organics were detected in 12 samples with the highest concentration in Disposal Trench 12 with a concentration of 430 mg/kg compared to a screening level of 100,000 mg/kg. A total of two VOCs were detected (tetrachloroethene at 0.00068 mg/kg and trichloroflouromethane at 0.0230J mg/kg) in one surface sample at Burn Slit/Trench 2 TP2. These results were well below their respective residential screening levels of 0.480 mg/kg and 630 mg/kg. Pentachlorophenol was not detected at UXO1. Perchlorate was detected in 32 of the 103 soil samples, with the highest concentration of 0.304 mg/kg located at Burn Slit/Trench 2, TP2 (3.0 - .40 ft. bgs). This concentration is also well below the residential screening level of 55 mg/kg. Hydrazine showed estimated values in three soil samples with the highest concentration of 0.00069J mg/kg detected in DT9-TP1at a depth of 9.0 10.0 ft. bgs. The sample from the bedrock below at 11.0 – 12.0 ft. bgs that showed an estimated concentration of 0.0006J mg/kg. The third detection was in AGW-MW1 at a depth of 30 ft. bgs at an estimated concentration of 0.00057J. There was no detection of hydrazine in the groundwater sample collected from the monitoring well with groundwater at a depth of 22 ft. bgs and a screened interval from 25 to 235 feet bgs. These values are below the formal quantitation limits that ranged from 0.002U to 0.0024UJ for hydrazine. There were no detections of white phosphorous for soil samples within UXO1. A summary of the soil results compared to screening values and those that exceeded the screening criteria are provided on Tables 6-3A and 6-3B.

Table 6-4 provides a summary of the key visual findings; sampling activities; human health and ecological screening of contaminants; and recommendations.

SECTION 6 TABLES

TABLE 6-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria: Res. Risk-based Criteria	Comparison Criteria: Ind. Risk-based Criteria	Comparison Criteria: Ecological Screening Criteria	Comparison Criteria: 95th BTV
Volatile Organic Compounds (mg/kg)																
TETRACHLOROETHENE	1/59	0.000680	0.000680	BS2-TP2	0.00 - 0.50	--	--	--	0	0	--	--	0.48	1.3 #	--	--
TRICHLOROFLUOROMETHANE	1/25	0.00230 J	0.00230 J	BS2-TP2	0.00 - 0.50	--	--	--	0	0	--	--	730	3,100	--	--
Petroleum Hydrocarbons (mg/kg)																
Diesel/Motor Oil Range (extractables)																
DIESEL RANGE ORGANICS	4/43	49.0	8.60 J	DT12-TP3	4.00 - 5.00	--	--	--	0	0	--	--	96	440	--	--
MOTOR OIL RANGE ORGANICS	12/43	430	12.0 J	DT12-TP2	5.00 - 6.00	--	--	--	0	0	--	--	100,000	100,000 *	--	--
Semivolatile Organic Compounds (mg/kg)																
None Detected	0/ 34	ND	ND	-	0.00 - 0.00				0	0	0	0	-	-	-	
Metals (mg/kg)																
ALUMINUM	167/167	24,900	4,710	DTT-SS1	3.00 - 4.00	--	--	--	0	0	167	27	77,000	1,100,000	50 +	14,710
ANTIMONY	83/167	13.6	0.108 J	DT7-TP1	2.00 - 3.00	--	--	--	0	0	42	--	31	470	0.27	--
ARSENIC	167/167	6.31	0.569 J	DT7-TP1	2.00 - 3.00	--	--	--	167	167	0	7	0.062	0.25 #	18	3.105
BARIUM	167/167	3,170	29.4	UXO1-SB02	0.00 - 2.00	--	--	--	0	0	9	24	15,000	220,000	330	200.5
BERYLLIUM	161/167	0.490 J	0.0690 J	UXO1-SB22	0.00 - 2.00	--	--	--	0	0	0	7	15.2	183 #	21	0.359
CADMIUM	148/167	19.2	0.0719 J	DT4-TP1	4.00 - 5.00	--	--	--	5	3	30	97	4.58	6.37 #	0.36	0.158
CALCIUM	167/167	7,750	325	UXO1-SB21	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
CHROMIUM	167/167	48.6	4.42	UXO1-SB19	0.00 - 2.00	--	--	--	0	0	13	17	100,000	100,000 *	26	20.3
COBALT	167/167	14.1	2.53	UXO1-SB19	0.00 - 2.00	--	--	--	0	0	2	16	23	350	13	9.39
COPPER	167/167	956	2.49 J	DT2-TP1	4.00 - 5.00	--	--	--	0	0	24	69	3,100	47,000	28	7.785
IRON	167/167	66,600	6,970	DT2-TP1	4.00 - 5.00	--	--	--	2	0	--	12	55,000	100,000 *	--	27,350
LEAD	167/167	14,300	0.998 J	DT7-TP1	2.00 - 3.00	--	--	--	7	2	35	86	80	320 #	11	4.328
MAGNESIUM	167/167	10,200	1,020	UXO1-SB19	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
MANGANESE	167/167	1,670 J	69.9 J	PC-S3	0.00 - 0.50	--	--	--	0	0	95	24	1,800	26,000	220	304
MERCURY	23/166	0.254 J	0.0113 J	BB1-E1	4.00 - 4.50	--	--	--	0	0	3	--	23	350	0.1 +	--
MOLYBDENUM	96/100	5.39	0.117 J	DT2-TP1	4.00 - 5.00	--	--	--	0	0	5	17	390	5,800	2 +	0.524

TABLE 6-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Metals (mg/kg)																
NICKEL	167/167	57.3	1.45	DT2-TP1	4.00 - 5.00	--	--	--	0	0	2	47	1,500	22,000	38	5.15
POTASSIUM	167/167	7,730	939	MW1-S1	30.00 - 30.00	--	--	--	--	--	--	--	--	--	--	--
SELENIUM	119/167	0.656	0.0535 J	UXO1-SB16	0.00 - 2.00	--	--	--	0	0	2	--	390	5,800	0.52	--
SILVER	33/167	37.5	0.0527 J	DT2-TP1	4.00 - 5.00	--	--	--	0	0	2	--	390	4,700	4.2	--
SODIUM	142/167	750	36.1 J	UXO1-SB18	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
STRONTIUM	33/33	115	7.63 J	UXO1-SB18	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	120/167	0.843	0.119 J	UXO1-SB02	0.00 - 2.00	--	--	--	2	0	0	4	0.78	12	1 +	0.552
VANADIUM	167/167	129	16.8 J	DT9-TP2	8.00 - 9.00	--	--	--	0	0	167	2	390	5,800	7.8	96.4
ZINC	167/167	2,690	10.2	DT4-TP1	4.00 - 5.00	--	--	--	0	0	50	43	23,000	350,000	46	50.11
Dioxin (ng/kg)																
1,2,3,4,6,7,8-HPCDD	66/83	3,920	0.782 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HPCDF	63/83	807	0.0292 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HPCDF	32/83	54.9	0.0965 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDD	40/83	10.4	0.0308 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HXCDF	53/83	41.4	0.0366 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDD	57/83	85.7	0.0841 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HXCDF	41/83	49.6	0.120 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDD	52/83	39.8	0.123 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HXCDF	21/83	17.9	0.0442 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDD	31/83	10.6	0.0711 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PECDF	34/83	40.9	0.0784 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HXCDF	47/83	82.7	0.0308 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PECDF	38/83	91.6	0.0650 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	21/83	4.51	0.0923 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	24/83	63.5	0.0912 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
OCDD	71/83	61,600	1.30 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
OCDF	63/83	3,820	0.157 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--

TABLE 6-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detection Frequency	Maximum Detected Result	Minimum Detected Result	Sample Location Containing Maximum Result	Depth of Maximum Result (feet bgs)	95 UCL (0-0.5 feet bgs)	95 UCL (0-6 feet bgs)	95 UCL (0-10 feet bgs)	Number of Samples w/ Results Greater than Res. RBC	Number of Samples w/ Results Greater than Ind. RBC	Number of Samples w/ Results Greater than Eco. Screening Criteria	Number of Samples w/ Results Greater than 95th BTV	Comparison Criteria			
													Res. Risk-based Criteria	Ind. Risk-based Criteria	Ecological Screening Criteria	95th BTV
Dioxin (ng/kg)																
TOTAL HEPTA-DIOXINS	10/10	900	2.17	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEPTA-FURANS	10/10	396	0.384	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-DIOXINS	10/10	58.7	0.147	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HEXA-FURANS	9/10	105	0.309	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDD	71/73	10,000	0.111 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HPCDF	62/73	3,380	0.108 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDD	61/73	1,990	0.113 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL HXCDF	63/73	1,050	0.0370 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDD	37/73	252	0.117 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PECDF	47/73	963	0.119 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-DIOXINS	3/10	2.30	0.698	UXO1-SB06	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL PENTA-FURANS	9/10	8.41	0.268	UXO1-SB02	0.00 - 2.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDD	24/73	427	0.0992 J	DT9-TP2	3.00 - 4.00	--	--	--	--	--	--	--	--	--	--	--
TOTAL TCDF	40/83	1,700	0.117 J	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
TOTAL TETRA-DIOXINS	1/10	0.736	0.736	UXO1-SB11	0.00 - 1.50	--	--	--	--	--	--	--	--	--	--	--
DIOXIN TEQ (Humans/Mammals)	79/83	102	0.0553	DT9-TP2	3.00 - 4.00	--	--	--	13	3	70	--	4.9	22	0.2 @	--
DIOXIN TEQ (Birds)	79/83	197	0.0665	BS2-TP2	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--
Explosives (mg/kg)																
2,4,6-TRINITROTOLUENE	2/160	1.60	0.310 J	DT8-TP1	0.00 - 0.50	--	--	--	0	0	0	--	21	96	8 &	--
PERCHLORATE	91/157	0.304	0.000330	BS2-TP2	3.00 - 4.00	--	--	--	0	0	0	--	55	820	26	--
Hydrazine (mg/kg)																
HYDRAZINE	3/98	0.000690	0.000570	DT9-TP1	9.00 - 10.00	--	--	--	0	0	--	--	0.23	1.1	--	--
Percent Moisture (%)																
PERCENT MOISTURE	158/158	31.3	1.90	BS1-TP1	0.00 - 0.50	--	--	--	--	--	--	--	--	--	--	--

TABLE 6-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Appendix D provides a summary of all detected and non-detected chemicals in soil and surface water used to support the risk assessments. "R" qualified data (rejected results) are excluded from the statistical summary, but are provided in Appendix D.
2. Only chemicals that were detected are shown in Table 4; soil samples collected between 0 to 10 feet bgs were analyzed for some of all of the following - metals, explosives, TPH, VOCs, SVOCs, pentachlorophenol, perchlorate and hydrazine. Soil samples collected from 14 to 30 feet bgs and surface water samples were analyzed for some of all of the following - TPH, VOCs, SVOCs, dioxins, perchlorate and hydrazine.
3. Sample were collected during the 2010 SI investigation and the 2015 RI investigation. Soil samples include discrete surface soil, composite (multi-increment) surface soil, shallow soil boring, and field duplicate samples collected between 0 and 6 feet bgs.
4. RBC is based on the EPA RSL (EPA 2012) unless otherwise noted.
5. Ecological screening criteria are the lowest of the plant, invertebrate, avian, and mammal EPA Eco-SSL (EPA 2010) unless otherwise noted.
6. Human health lead screening criteria are based on OEHHA 2009 guidance.
7. TThe 95th percentile ambient values referenced for comparison of background metals levels in soil are from site specific samples obtained during this RI and the Background study completed in 2012 (Ses-Tech).
8. The 95 UCL was calculated for samples from the following depth intervals: 0-0.5 feet bgs 0-6 feet bgs, and 0-10 feet bgs. One-sided 95 percent upper confidence limit of the arithmetic mean. Following EPA (2002, 2009), this value may be estimated by either a 95, 97.5, or 99 percent UCL depending on sample size, skewness, and degree of censorship. The 95 UCL was only used in estimates of risk and further details of its calculation can be found in Appendix H.

#	Screening criteria is based on DTSC (2013) for the resident.
%	Percent
&	Based on the draft Eco-SSL from Checkai and others 2012.
*	Risk-based screening criteria exceeds the theoretical ceiling limit of 100,000 mg/kg, above which assumptions for soil contact may be invalid (EPA 2015). Thus the ceiling limit is used as the screening criteria.
+	No Eco-SSL was available for this chemical. The lowest of the plant and invertebrate
-	Not applicable
--	No screening criterion or ambient limit has been established
@	Based on the EPA Region 5 RCRA Ecological Screening Level for Soil (EPA 2003).
bgs	below ground surface
CHHSL	California Human Health Screening Level
DTSC	Cal/EPA, Department of Toxic Substances Control
Eco	Ecological
Eco-SSL	Ecological Soil Screening Level
HPCDD	Heptachlorodibenzo-p-dioxin
HPCDF	Heptachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin
HXCDF	Hexachlorodibenzofuran
Ind	Industrial
J	Estimated value
mg/kg	Milligrams per kilogram
ND	None detected
ng/kg	Nanograms per kilogram
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OEHHA	Cal/EPA, Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PECDD	Pentachlorodibenzo-p-dioxin
PECDF	Pentachlorodibenzofuran
PRC	PRC Environmental Management, Inc.
Res	Residential
RI	Remedial investigation
SI	Site investigation
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TEQ	Toxicity equivalence quotient
UCL	Upper confidence limit

TABLE 6-3A: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Source: Checkai, R.T., R.G. Kuperman, M. Simini, and C.T. Phillips. 2012. Derivation of Draft Ecological Soil Screening Levels for TNT and RDX Utilizing Terrestrial Plant and Soil Invertebrate Toxicity Benchmarks. ECBC-TR-963. Edgewood Chemical Biological Center, U.S. Army Research, Development and Engineering Command, Arberdeen Proving Ground, Maryland.

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TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	13,400	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,500	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,900	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,200	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,600	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,560 J	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,600 J	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400 J	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500 J	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,940 J	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	18,400 J	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,800	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,500	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,200	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,600	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,900	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,000	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,800	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,800	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	17,100	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,600	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,490 J	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	107	77,000	1,100,000	**50.0**	14,700

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	11,500 J	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300 J	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,470 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,290 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,520 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,500	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,700	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,700	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,600	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,760	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,000	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,690	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,600	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,740	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,960	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,870	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,400	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,200	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,300	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,800	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,400	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,900	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,200	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,860	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,000	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	107	77,000	1,100,000	**50.0**	14,700

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	11,200 J	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,820 J	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,100 J	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,700 J	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300 J	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,300 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,800 J	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100 J	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,800	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	24,900	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,610	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	22,200	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	4,710	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,500	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,260	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	22,800	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700 J	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,200	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	116	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,040	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	100	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,870	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,810	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,730	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,800	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,570	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,150	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,800	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	118	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,500	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	107	77,000	1,100,000	**50.0**	14,700

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	13,500	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100 J	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,900 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300 J	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	107	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,800 J	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,100 J	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,500	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,200	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	101	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	102	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,400	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	104	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	105	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,660	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,100	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	120	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,300 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	132	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,900 J	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,650 J	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	120	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,080	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	125	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,700	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	118	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,120	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,000	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,510	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,960	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,700	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,130	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	113	77,000	1,100,000	**50.0**	14,700

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	10,700	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,990	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,300	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,850	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,600	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,270	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,970	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,860	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,820	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,830	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,100	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,700	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	18,800	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	109	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,000	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	19,400	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	15,000	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	106	77,000	1,100,000	**50.0**	14,700
ALUMINUM	16,900	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,100	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	103	77,000	1,100,000	**50.0**	14,700
ALUMINUM	20,200	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	108	77,000	1,100,000	**50.0**	14,700
ALUMINUM	20,600 J	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,100 J	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,340 J	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	123	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	8,410 J	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,900 J	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	119	77,000	1,100,000	**50.0**	14,700
ALUMINUM	14,200 J	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,000 J	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,500 J	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ALUMINUM	14,400 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,000 J	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,170 J	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,500 J	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,850 J	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,380 J	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	116	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,020	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	9,960	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,530	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	6,460	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	117	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,900	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,830	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	115	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,100	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	10,600	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,800	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	116	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,700	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	114	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,000	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	12,300	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	112	77,000	1,100,000	**50.0**	14,700
ALUMINUM	5,470	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	110	77,000	1,100,000	**50.0**	14,700
ALUMINUM	7,460	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	111	77,000	1,100,000	**50.0**	14,700
ALUMINUM	11,300	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	113	77,000	1,100,000	**50.0**	14,700
ALUMINUM	13,400	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	114	77,000	1,100,000	**50.0**	14,700
ANTIMONY	0.312 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	31.0	470	**0.270**	NC
ANTIMONY	0.834 J	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	31.0	470	**0.270**	NC
ANTIMONY	10.6 J	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	31.0	470	**0.270**	NC
ANTIMONY	0.462 J	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.540 J	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	31.0	470	**0.270**	NC
ANTIMONY	6.25 J	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	31.0	470	**0.270**	NC
ANTIMONY	0.502 J	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	31.0	470	**0.270**	NC

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ANTIMONY	0.906 J	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	1.76 J	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	31.0	470	**0.270**	NC
ANTIMONY	0.372 J	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	31.0	470	**0.270**	NC
ANTIMONY	0.928 J	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	31.0	470	**0.270**	NC
ANTIMONY	0.364 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	0.978 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	31.0	470	**0.270**	NC
ANTIMONY	0.523 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	31.0	470	**0.270**	NC
ANTIMONY	0.535 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	31.0	470	**0.270**	NC
ANTIMONY	0.776 J	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	31.0	470	**0.270**	NC
ANTIMONY	0.616 J	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.393 J	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	31.0	470	**0.270**	NC
ANTIMONY	6.87 J	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	31.0	470	**0.270**	NC
ANTIMONY	0.407 J	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	4.03	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	31.0	470	**0.270**	NC
ANTIMONY	13.6	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	31.0	470	**0.270**	NC
ANTIMONY	5.50	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.421 J	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	31.0	470	**0.270**	NC
ANTIMONY	0.295 J	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	12.7	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	31.0	470	**0.270**	NC
ANTIMONY	4.41	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	0.725	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	31.0	470	**0.270**	NC
ANTIMONY	0.688	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	31.0	470	**0.270**	NC
ANTIMONY	2.25	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	31.0	470	**0.270**	NC
ANTIMONY	0.321 J	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	31.0	470	**0.270**	NC
ANTIMONY	1.95 J	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	31.0	470	**0.270**	NC
ANTIMONY	0.320 J	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	31.0	470	**0.270**	NC
ANTIMONY	0.319 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	31.0	470	**0.270**	NC
ANTIMONY	1.09	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	31.0	470	**0.270**	NC
ANTIMONY	2.95	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	31.0	470	**0.270**	NC

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ANTIMONY	0.277 J	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	31.0	470	**0.270**	NC
ANTIMONY	1.22 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	1.32	31.0	470	**0.270**	NC
ANTIMONY	0.960 J	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	1.12	31.0	470	**0.270**	NC
ANTIMONY	1.95 J	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	31.0	470	**0.270**	NC
ANTIMONY	1.50 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	1.17	31.0	470	**0.270**	NC
ANTIMONY	4.93 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	1.10	31.0	470	**0.270**	NC
ARSENIC	1.54	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.34	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.43	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.995	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.16	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.32	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.948	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.04	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.68	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.29	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.538	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.547	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.23	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.556	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.40	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.52	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	0.516	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.27	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.37	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	**0.0620**	**0.250**	18.0	3.11

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.42	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.76	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.48	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.72	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.94	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.10	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	0.528	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.77	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.22	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.38	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.07	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.23	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.03	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.28	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.17	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.50	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.58	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.61	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.518	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	6.31	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.89	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.39	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.56	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	4.60	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	**0.0620**	**0.250**	18.0	3.11

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	2.47	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.63	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.88	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.11	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.527	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.04	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.15	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.31	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.43	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.29	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.22	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	0.542	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.41	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.97	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	0.557	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.756	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	0.514	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.04	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	0.535	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.801	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.48	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.879	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	0.524	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.90	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	0.558	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.23	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.952	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.22	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.09	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.77	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	**0.0620**	**0.250**	18.0	3.11

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.83	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.05	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	0.537	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.21	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.569 J	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	0.589	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.83	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.539	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.55	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.535	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.36	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.69	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.41	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.31	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.64	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.78	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	0.520	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.51	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.45	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.52	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.45	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.944 J	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	5.85	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.07 J	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	6.01	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.45 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	6.58	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.49 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	5.65	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.993 J	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.769 J	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	6.02	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.07 J	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.62 J	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	5.46	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.84 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	6.23	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.50 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	5.88	**0.0620**	**0.250**	18.0	3.11

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.35 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	5.66	**0.0620**	**0.250**	18.0	3.11
ARSENIC	3.82 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	5.70	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.10 J	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65 J	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.01 J	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	5.48	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.71 J	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	5.65	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60 J	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53 J	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	5.46	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.65 J	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	5.83	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	5.51	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.86 J	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.24 J	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	5.49	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.29 J	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	5.54	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.14 J	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	5.61	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.52 J	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	5.54	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.96 J	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	5.52	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.75 J	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	5.77	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.66 J	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	5.59	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.59 J	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	5.44	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38 J	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.53 J	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	5.60	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.12 J	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	5.28	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.16 J	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.901 J	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	5.15	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81 J	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	5.71	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.41 J	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	5.41	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.41 J	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	5.84	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.73 J	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	5.49	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.28 J	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	6.13	**0.0620**	**0.250**	18.0	3.11

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ARSENIC	1.79 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	5.85	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.32 J	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	5.75	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.10 J	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	5.94	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.83 J	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.43 J	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.38 J	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.74 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20 J	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	5.76	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.20 J	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	5.67	**0.0620**	**0.250**	18.0	3.11
ARSENIC	0.949 J	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	5.78	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.18 J	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	5.57	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.82 J	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	5.74	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.00 J	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	5.56	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.19 J	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	5.83	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.70 J	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	5.71	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.39 J	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	5.73	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.87 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.48 J	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	5.51	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.71 J	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	5.81	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.89 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	5.69	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.62 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	5.62	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.42 J	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	5.61	**0.0620**	**0.250**	18.0	3.11
ARSENIC	2.68 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	5.48	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.25 J	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	5.53	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.60 J	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	5.64	**0.0620**	**0.250**	18.0	3.11
ARSENIC	1.81 J	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	5.68	**0.0620**	**0.250**	18.0	3.11
BARIUM	1,530	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	2.63	15,000	220,000	**330**	201

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
BARIUM	403	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	15,000	220,000	**330**	201
BARIUM	1,440	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	2.61	15,000	220,000	**330**	201
BARIUM	409 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	15,000	220,000	**330**	201
BARIUM	581	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	15,000	220,000	**330**	201
BARIUM	333	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	15,000	220,000	**330**	201
BARIUM	3,170	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	6.58	15,000	220,000	**330**	201
BARIUM	439	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	5.54	15,000	220,000	**330**	201
BARIUM	790	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	5.41	15,000	220,000	**330**	201
CADMIUM	0.381 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	4.58	6.37	**0.360**	0.158
CADMIUM	0.377 J	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	4.58	6.37	**0.360**	0.158
CADMIUM	1.99	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	4.58	6.37	**0.360**	0.158
CADMIUM	1.06	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	4.58	6.37	**0.360**	0.158
CADMIUM	4.41	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	4.58	6.37	**0.360**	0.158
CADMIUM	5.90	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	**4.58**	6.37	**0.360**	0.158
CADMIUM	2.76	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	4.58	6.37	**0.360**	0.158
CADMIUM	1.25	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	4.58	6.37	**0.360**	0.158
CADMIUM	2.01	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	4.58	6.37	**0.360**	0.158
CADMIUM	0.588	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	4.58	6.37	**0.360**	0.158
CADMIUM	0.611	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	4.58	6.37	**0.360**	0.158
CADMIUM	1.35	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	4.58	6.37	**0.360**	0.158
CADMIUM	0.640	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	4.58	6.37	**0.360**	0.158
CADMIUM	19.2	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	9.83	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	2.52	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	4.58	6.37	**0.360**	0.158
CADMIUM	0.786	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	4.58	6.37	**0.360**	0.158
CADMIUM	0.722	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	4.58	6.37	**0.360**	0.158
CADMIUM	1.88	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	4.58	6.37	**0.360**	0.158
CADMIUM	0.665	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	4.58	6.37	**0.360**	0.158
CADMIUM	0.562	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	4.58	6.37	**0.360**	0.158

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
CADMIUM	0.530 J	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	4.58	6.37	**0.360**	0.158
CADMIUM	0.570	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	4.58	6.37	**0.360**	0.158
CADMIUM	1.42	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.658	4.58	6.37	**0.360**	0.158
CADMIUM	0.608	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	0.566	4.58	6.37	**0.360**	0.158
CADMIUM	0.399 J	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	0.557	4.58	6.37	**0.360**	0.158
CADMIUM	0.737	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	0.561	4.58	6.37	**0.360**	0.158
CADMIUM	4.72	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	0.569	**4.58**	6.37	**0.360**	0.158
CADMIUM	15.6	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	0.562	**4.58**	**6.37**	**0.360**	0.158
CADMIUM	2.37	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	0.561	4.58	6.37	**0.360**	0.158
CHROMIUM	30.6	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	100,000	100,000	**26.0**	20.3
CHROMIUM	31.1	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	100,000	100,000	**26.0**	20.3
CHROMIUM	41.3 J	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	100,000	100,000	**26.0**	20.3
CHROMIUM	33.8	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	100,000	100,000	**26.0**	20.3
CHROMIUM	33.7	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	100,000	100,000	**26.0**	20.3
CHROMIUM	34.3	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	100,000	100,000	**26.0**	20.3
CHROMIUM	43.7	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	2.18	100,000	100,000	**26.0**	20.3
CHROMIUM	28.5	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	2.16	100,000	100,000	**26.0**	20.3
CHROMIUM	48.6	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	2.24	100,000	100,000	**26.0**	20.3
CHROMIUM	34.9	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	2.11	100,000	100,000	**26.0**	20.3
CHROMIUM	41.4	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	2.28	100,000	100,000	**26.0**	20.3
CHROMIUM	33.4	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	2.06	100,000	100,000	**26.0**	20.3
CHROMIUM	31.9	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	100,000	100,000	**26.0**	20.3
COBALT	13.7	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	23.0	350	**13.0**	9.39
COBALT	14.1	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	23.0	350	**13.0**	9.39
COPPER	32.1 J	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	3,100	47,000	**28.0**	7.79
COPPER	956	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	3,100	47,000	**28.0**	7.79
COPPER	202	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	3,100	47,000	**28.0**	7.79
COPPER	474	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	3,100	47,000	**28.0**	7.79
COPPER	91.3 J	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	3,100	47,000	**28.0**	7.79

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
COPPER	29.7	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	3,100	47,000	**28.0**	7.79
COPPER	37.6	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	3,100	47,000	**28.0**	7.79
COPPER	33.0	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	3,100	47,000	**28.0**	7.79
COPPER	56.9	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	3,100	47,000	**28.0**	7.79
COPPER	41.6	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	3,100	47,000	**28.0**	7.79
COPPER	547	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	3,100	47,000	**28.0**	7.79
COPPER	96.0	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	3,100	47,000	**28.0**	7.79
COPPER	48.2	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	3,100	47,000	**28.0**	7.79
COPPER	34.6 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	2.63	3,100	47,000	**28.0**	7.79
COPPER	154 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	2.26	3,100	47,000	**28.0**	7.79
COPPER	67.1	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.21	3,100	47,000	**28.0**	7.79
COPPER	247	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.24	3,100	47,000	**28.0**	7.79
COPPER	38.6	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	2.18	3,100	47,000	**28.0**	7.79
COPPER	46.1	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	2.24	3,100	47,000	**28.0**	7.79
COPPER	32.6 J	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	2.25	3,100	47,000	**28.0**	7.79
COPPER	154 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	2.28	3,100	47,000	**28.0**	7.79
COPPER	353 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	3,100	47,000	**28.0**	7.79
COPPER	47.6 J	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	2.24	3,100	47,000	**28.0**	7.79
COPPER	53.0	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.19	3,100	47,000	**28.0**	7.79
IRON	66,600	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	527	**55,000**	100,000	NC	27,400
IRON	56,700	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	107	**55,000**	100,000	NC	27,400
LEAD	16.5	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	80.0	320	**11.0**	4.33
LEAD	157	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	**80.0**	320	**11.0**	4.33
LEAD	108	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	**80.0**	320	**11.0**	4.33
LEAD	11.6	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	80.0	320	**11.0**	4.33
LEAD	25.5	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	80.0	320	**11.0**	4.33
LEAD	13.1	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	80.0	320	**11.0**	4.33
LEAD	20.9	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	80.0	320	**11.0**	4.33
LEAD	20.8	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	80.0	320	**11.0**	4.33

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
LEAD	73.1	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	80.0	320	**11.0**	4.33
LEAD	90.7	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	**80.0**	320	**11.0**	4.33
LEAD	17.7	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	80.0	320	**11.0**	4.33
LEAD	244	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	**80.0**	320	**11.0**	4.33
LEAD	20.9	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	80.0	320	**11.0**	4.33
LEAD	52.9	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	80.0	320	**11.0**	4.33
LEAD	14,300	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	10.7	**80.0**	**320**	**11.0**	4.33
LEAD	249	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	**80.0**	320	**11.0**	4.33
LEAD	24.6	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	80.0	320	**11.0**	4.33
LEAD	325	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	**80.0**	**320**	**11.0**	4.33
LEAD	44.6	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	80.0	320	**11.0**	4.33
LEAD	16.6	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	80.0	320	**11.0**	4.33
LEAD	13.9	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	2.34	80.0	320	**11.0**	4.33
LEAD	40.8 J	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	2.63	80.0	320	**11.0**	4.33
LEAD	20.7 J	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	2.26	80.0	320	**11.0**	4.33
LEAD	12.2 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	2.35	80.0	320	**11.0**	4.33
LEAD	22.9 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	2.26	80.0	320	**11.0**	4.33
LEAD	16.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	2.23	80.0	320	**11.0**	4.33
LEAD	11.2	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	2.18	80.0	320	**11.0**	4.33
LEAD	18.0	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.21	80.0	320	**11.0**	4.33
LEAD	50.2	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.24	80.0	320	**11.0**	4.33
LEAD	13.7	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	2.31	80.0	320	**11.0**	4.33
LEAD	12.0 J	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	2.34	80.0	320	**11.0**	4.33
LEAD	16.4 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	2.25	80.0	320	**11.0**	4.33
LEAD	18.6 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	2.28	80.0	320	**11.0**	4.33
LEAD	11.8 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.25	80.0	320	**11.0**	4.33
LEAD	40.7	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.19	80.0	320	**11.0**	4.33
MANGANESE	242 J	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	1,800	26,000	**220**	304
MANGANESE	225 J	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	1,800	26,000	**220**	304

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	314 J	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	1,800	26,000	**220**	304
MANGANESE	290 J	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	1,800	26,000	**220**	304
MANGANESE	425 J	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	1,800	26,000	**220**	304
MANGANESE	285 J	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	1,800	26,000	**220**	304
MANGANESE	229 J	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	1,800	26,000	**220**	304
MANGANESE	290 J	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	1,800	26,000	**220**	304
MANGANESE	314 J	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	1,800	26,000	**220**	304
MANGANESE	248	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	1,800	26,000	**220**	304
MANGANESE	226	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	1,800	26,000	**220**	304
MANGANESE	278	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	1,800	26,000	**220**	304
MANGANESE	244	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	1,800	26,000	**220**	304
MANGANESE	490	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	1,800	26,000	**220**	304
MANGANESE	247	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	1,800	26,000	**220**	304
MANGANESE	338	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	1,800	26,000	**220**	304
MANGANESE	251	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	1,800	26,000	**220**	304
MANGANESE	270	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	1,800	26,000	**220**	304
MANGANESE	237	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	1,800	26,000	**220**	304
MANGANESE	262	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	1,800	26,000	**220**	304
MANGANESE	248	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	1,800	26,000	**220**	304
MANGANESE	274	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	1,800	26,000	**220**	304
MANGANESE	378	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	1,800	26,000	**220**	304
MANGANESE	341	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	1,800	26,000	**220**	304
MANGANESE	302	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	1,800	26,000	**220**	304
MANGANESE	387	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	1,800	26,000	**220**	304
MANGANESE	260	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	1,800	26,000	**220**	304
MANGANESE	339	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	1,800	26,000	**220**	304
MANGANESE	232	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	1,800	26,000	**220**	304
MANGANESE	245	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	271	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	1,800	26,000	**220**	304

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	644	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	260	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	1,800	26,000	**220**	304
MANGANESE	239	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	1,800	26,000	**220**	304
MANGANESE	355	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	1,800	26,000	**220**	304
MANGANESE	224	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	1,800	26,000	**220**	304
MANGANESE	235	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	1,800	26,000	**220**	304
MANGANESE	244	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	1,800	26,000	**220**	304
MANGANESE	324	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	1,800	26,000	**220**	304
MANGANESE	238	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	1,800	26,000	**220**	304
MANGANESE	277	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	1,800	26,000	**220**	304
MANGANESE	255 J	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	1,800	26,000	**220**	304
MANGANESE	222 J	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	1,800	26,000	**220**	304
MANGANESE	379	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	1,800	26,000	**220**	304
MANGANESE	254	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	1,800	26,000	**220**	304
MANGANESE	248 J	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	1,800	26,000	**220**	304
MANGANESE	234	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	1,800	26,000	**220**	304
MANGANESE	224	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	1,800	26,000	**220**	304
MANGANESE	1,670 J	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	2.84	1,800	26,000	**220**	304
MANGANESE	842	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	1,800	26,000	**220**	304
MANGANESE	275 J	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	1,800	26,000	**220**	304
MANGANESE	247 J	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	1,800	26,000	**220**	304
MANGANESE	253 J	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	1,800	26,000	**220**	304
MANGANESE	230 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	1,800	26,000	**220**	304
MANGANESE	225 J	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	1,800	26,000	**220**	304
MANGANESE	253 J	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	1,800	26,000	**220**	304
MANGANESE	268 J	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	1,800	26,000	**220**	304
MANGANESE	254 J	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	1,800	26,000	**220**	304
MANGANESE	263 J	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	1,800	26,000	**220**	304
MANGANESE	259 J	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	1,800	26,000	**220**	304

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	257 J	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	1,800	26,000	**220**	304
MANGANESE	227	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	3.00	1,800	26,000	**220**	304
MANGANESE	326	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	3.29	1,800	26,000	**220**	304
MANGANESE	271	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	310	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	2.84	1,800	26,000	**220**	304
MANGANESE	278 J	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	2.81	1,800	26,000	**220**	304
MANGANESE	257 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	3.12	1,800	26,000	**220**	304
MANGANESE	311 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	2.85	1,800	26,000	**220**	304
MANGANESE	312 J	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	2.81	1,800	26,000	**220**	304
MANGANESE	287 J	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	2.74	1,800	26,000	**220**	304
MANGANESE	343 J	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	2.82	1,800	26,000	**220**	304
MANGANESE	231 J	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	2.73	1,800	26,000	**220**	304
MANGANESE	281	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	2.77	1,800	26,000	**220**	304
MANGANESE	275	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	2.81	1,800	26,000	**220**	304
MANGANESE	227	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	2.77	1,800	26,000	**220**	304
MANGANESE	238	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	2.76	1,800	26,000	**220**	304
MANGANESE	255	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	2.84	1,800	26,000	**220**	304
MANGANESE	229	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	2.57	1,800	26,000	**220**	304
MANGANESE	261	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	2.92	1,800	26,000	**220**	304
MANGANESE	446	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	2.92	1,800	26,000	**220**	304
MANGANESE	299	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	234	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	234	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	239	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	224	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	2.82	1,800	26,000	**220**	304
MANGANESE	341	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	2.88	1,800	26,000	**220**	304
MANGANESE	271	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	2.81	1,800	26,000	**220**	304
MANGANESE	334	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	2.83	1,800	26,000	**220**	304
MANGANESE	247	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	2.89	1,800	26,000	**220**	304

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
MANGANESE	296 J	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	2.87	1,800	26,000	**220**	304
MANGANESE	276 J	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	2.78	1,800	26,000	**220**	304
MANGANESE	233 J	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	2.86	1,800	26,000	**220**	304
MANGANESE	404 J	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	2.82	1,800	26,000	**220**	304
MANGANESE	247 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	2.81	1,800	26,000	**220**	304
MANGANESE	256 J	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	2.74	1,800	26,000	**220**	304
MERCURY	0.254 J	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.108	23.0	350	**0.100**	NC
MERCURY	0.122	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.107	23.0	350	**0.100**	NC
MERCURY	0.116	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	0.112	23.0	350	**0.100**	NC
MOLYBDENUM	5.39	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	5,800	**2.00**	0.524
MOLYBDENUM	3.16	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	5,800	**2.00**	0.524
MOLYBDENUM	3.13	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	390	5,800	**2.00**	0.524
MOLYBDENUM	2.07	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	390	5,800	**2.00**	0.524
MOLYBDENUM	4.43	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**2.00**	0.524
NICKEL	57.3	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	1,500	22,000	**38.0**	5.15
NICKEL	43.2	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	1,500	22,000	**38.0**	5.15
SELENIUM	0.571	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**0.520**	NC
SELENIUM	0.656	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	0.554	390	5,800	**0.520**	NC
SILVER	37.5	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	4,700	**4.20**	NC
SILVER	16.3	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	4,700	**4.20**	NC
THALLIUM	0.843	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.658	**0.780**	12.0	1.00	0.552
THALLIUM	0.781	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	0.549	**0.780**	12.0	1.00	0.552
VANADIUM	44.7	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	0.542	390	5,800	**7.80**	96.4
VANADIUM	48.8	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	31.9	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	41.7	DT1-TP2	010MBDA-TP06	3.00 - 4.00	01/29/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	45.9	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	42.5	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	28.8	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.525	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	33.6	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.553	390	5,800	**7.80**	96.4
VANADIUM	42.2	DT10-TP2	010MBDA-TP59	5.00 - 5.50	01/28/15	0.537	390	5,800	**7.80**	96.4
VANADIUM	33.2	DT10-TP2	010MBDA-TP60	5.50 - 6.00	01/28/15	0.547	390	5,800	**7.80**	96.4
VANADIUM	30.6	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	63.3	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.531	390	5,800	**7.80**	96.4
VANADIUM	47.8	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.538	390	5,800	**7.80**	96.4
VANADIUM	62.0	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.547	390	5,800	**7.80**	96.4
VANADIUM	50.5	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.556	390	5,800	**7.80**	96.4
VANADIUM	43.5	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.512	390	5,800	**7.80**	96.4
VANADIUM	47.9	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	92.1	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	70.8	DT12-TP2	010MBDA-TP72	12.00 - 13.00	02/05/15	0.516	390	5,800	**7.80**	96.4
VANADIUM	43.0	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	41.6	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.556	390	5,800	**7.80**	96.4
VANADIUM	66.1	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.523	390	5,800	**7.80**	96.4
VANADIUM	66.9	DT12-TP3	010MBDA-TP76	9.00 - 10.00	02/06/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	40.1	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	33.1	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	47.3	DT2-TP1	010MBDA-TP11	7.50 - 8.00	02/02/15	0.515	390	5,800	**7.80**	96.4
VANADIUM	57.1	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	0.522	390	5,800	**7.80**	96.4
VANADIUM	31.2	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	39.5	DT2-TP2	010MBDA-TP14	2.00 - 4.00	01/30/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	44.6	DT2-TP2	010MBDA-TP15	4.00 - 4.50	01/30/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	58.4	DT3-TP1	010MBDA-TP17	0.00 - 0.50	01/30/15	0.528	390	5,800	**7.80**	96.4
VANADIUM	36.1	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	38.0	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.523	390	5,800	**7.80**	96.4
VANADIUM	37.1	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	0.513	390	5,800	**7.80**	96.4
VANADIUM	46.6	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.529	390	5,800	**7.80**	96.4
VANADIUM	40.6	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.521	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	60.4	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	67.1	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	0.509	390	5,800	**7.80**	96.4
VANADIUM	54.0	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	58.8	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	32.5	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	44.0	DT5-TP1	010MBDA-TP28	4.00 - 5.00	02/03/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	40.1	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.531	390	5,800	**7.80**	96.4
VANADIUM	38.6	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	38.9	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.518	390	5,800	**7.80**	96.4
VANADIUM	41.7	DT6-TP1	010MBDA-TP32	5.00 - 6.00	02/03/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	38.7	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	43.9	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	40.2	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	36.3	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	41.2	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	43.9	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.533	390	5,800	**7.80**	96.4
VANADIUM	64.7	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	47.2	DT8-TP1	010MBDA-TP40	6.00 - 6.50	02/03/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	48.3	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.584	390	5,800	**7.80**	96.4
VANADIUM	40.8	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	55.4	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	61.0	DT8-TP2	010MBDA-TP44	5.50 - 6.00	02/03/15	0.534	390	5,800	**7.80**	96.4
VANADIUM	45.6	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.527	390	5,800	**7.80**	96.4
VANADIUM	34.2	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	97.0	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	81.8	DT9-TP1	010MBDA-TP48	11.00 - 12.00	01/13/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	49.6	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.542	390	5,800	**7.80**	96.4
VANADIUM	55.0	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.562	390	5,800	**7.80**	96.4
VANADIUM	59.3	DT9-TP2	010MBDA-TP51	4.00 - 5.00	01/28/15	0.542	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	129	DT9-TP2	010MBDA-TP52	8.00 - 9.00	01/28/15	0.541	390	5,800	**7.80**	96.4
VANADIUM	41.1 J	DTT-SS1	010DTT-SS01	0.00 - 0.50	01/22/15	0.541	390	5,800	**7.80**	96.4
VANADIUM	68.2 J	DTT-SS1	010DTT-SS02	3.00 - 4.00	01/22/15	0.557	390	5,800	**7.80**	96.4
VANADIUM	16.8 J	DTT-SS2	010DTT-SS03	0.00 - 0.50	01/22/15	0.514	390	5,800	**7.80**	96.4
VANADIUM	59.9 J	DTT-SS2	010DTT-SS04	3.00 - 4.00	01/22/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	26.7	DTT-SS3	010DTT-SS05	0.00 - 0.50	01/22/15	0.512	390	5,800	**7.80**	96.4
VANADIUM	61.1	DTT-SS3	010DTT-SS06	3.00 - 4.00	01/22/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	29.9	DTT-SS4	010DTT-SS07	0.00 - 0.50	01/22/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	72.4	DTT-SS4	010DTT-SS08	3.00 - 4.00	01/22/15	0.558	390	5,800	**7.80**	96.4
VANADIUM	81.0	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	0.520	390	5,800	**7.80**	96.4
VANADIUM	61.8	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.578	390	5,800	**7.80**	96.4
VANADIUM	62.4	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.501	390	5,800	**7.80**	96.4
VANADIUM	43.9	PC-S1	010PC-SB01	0.00 - 0.50	01/20/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	54.5	PC-S1	010PC-SB02	2.50 - 3.00	01/21/15	0.540	390	5,800	**7.80**	96.4
VANADIUM	27.3	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.530	390	5,800	**7.80**	96.4
VANADIUM	27.8	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	0.524	390	5,800	**7.80**	96.4
VANADIUM	57.3	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	0.569	390	5,800	**7.80**	96.4
VANADIUM	20.6	PC-S3	010PC-SB06	2.50 - 3.00	01/21/15	0.537	390	5,800	**7.80**	96.4
VANADIUM	27.9	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.525	390	5,800	**7.80**	96.4
VANADIUM	67.1	PC-S4	010PC-SB08	2.50 - 3.00	01/15/15	0.589	390	5,800	**7.80**	96.4
VANADIUM	64.4	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.539	390	5,800	**7.80**	96.4
VANADIUM	44.2	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	47.7	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.536	390	5,800	**7.80**	96.4
VANADIUM	53.8	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.532	390	5,800	**7.80**	96.4
VANADIUM	47.5	SD2-TP1	010MBDA-TP85	0.00 - 0.50	01/28/15	0.517	390	5,800	**7.80**	96.4
VANADIUM	55.1 J	SD2-TP1	010MBDA-TP86	3.00 - 4.00	01/28/15	0.519	390	5,800	**7.80**	96.4
VANADIUM	47.3	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.535	390	5,800	**7.80**	96.4
VANADIUM	67.1	SD2-TP2	010MBDA-TP90	2.00 - 3.00	01/28/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	83.0	SD2-TP2	010MBDA-TP91	3.00 - 4.00	01/28/15	0.520	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	61.0	TB-TP1	010WFTA-TP01	0.00 - 0.50	02/04/15	0.518	390	5,800	**7.80**	96.4
VANADIUM	59.6	TB-TP1	010WFTA-TP02	2.00 - 4.00	02/04/15	0.506	390	5,800	**7.80**	96.4
VANADIUM	56.1	TB-TP2	010WFTA-TP03	0.00 - 0.50	02/04/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	56.7	TB-TP2	010WFTA-TP04	2.50 - 3.00	02/04/15	0.509	390	5,800	**7.80**	96.4
VANADIUM	58.7	TB-TP3	010WFTA-TP05	0.00 - 0.50	02/04/15	0.522	390	5,800	**7.80**	96.4
VANADIUM	55.4	TB-TP3	010WFTA-TP06	2.50 - 3.00	02/04/15	0.526	390	5,800	**7.80**	96.4
VANADIUM	34.7	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	40.9	UXO1-SB01	UXO1-SB01(2-3)	2.00 - 3.00	12/18/08	1.20	390	5,800	**7.80**	96.4
VANADIUM	49.7	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	1.32	390	5,800	**7.80**	96.4
VANADIUM	49.7	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	30.0	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	27.9	UXO1-SB04	UXO1-SB04(4-6)	4.00 - 6.00	12/19/08	1.20	390	5,800	**7.80**	96.4
VANADIUM	27.2	UXO1-SB05	UXO1-SB05(0-2)	0.00 - 2.00	12/20/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	50.3	UXO1-SB05	UXO1-SB05(4-6)	4.00 - 6.00	12/20/08	1.09	390	5,800	**7.80**	96.4
VANADIUM	53.3	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	1.25	390	5,800	**7.80**	96.4
VANADIUM	48.1	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	1.18	390	5,800	**7.80**	96.4
VANADIUM	31.6	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	64.2	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	27.7	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	43.3	UXO1-SB09	UXO1-SB09(4-6)	4.00 - 6.00	12/21/08	1.08	390	5,800	**7.80**	96.4
VANADIUM	27.5	UXO1-SB10	UXO1-SB10(0-2)	0.00 - 2.00	12/21/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	38.3	UXO1-SB10	UXO1-SB10(3-4)	3.00 - 4.00	12/21/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	42.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	52.8	UXO1-SB12	UXO1-SB12(0-2)	0.00 - 2.00	12/21/08	1.09	390	5,800	**7.80**	96.4
VANADIUM	51.3	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	40.3	UXO1-SB13	UXO1-SB13(2-3.5)	2.00 - 3.50	12/21/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	52.3	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4
VANADIUM	32.0	UXO1-SB14	UXO1-SB14(4-6)	4.00 - 6.00	01/05/09	1.10	390	5,800	**7.80**	96.4
VANADIUM	33.4	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	38.3	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	1.12	390	5,800	**7.80**	96.4
VANADIUM	39.3	UXO1-SB16	UXO1-SB16(0-2)	0.00 - 2.00	01/05/09	1.11	390	5,800	**7.80**	96.4
VANADIUM	48.1	UXO1-SB16	UXO1-SB16(4-6)	4.00 - 6.00	01/05/09	1.10	390	5,800	**7.80**	96.4
VANADIUM	47.0	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	1.15	390	5,800	**7.80**	96.4
VANADIUM	45.2	UXO1-SB17	UXO1-SB17(4-6)	4.00 - 6.00	01/05/09	1.12	390	5,800	**7.80**	96.4
VANADIUM	78.4	UXO1-SB18	UXO1-SB18(0-2)	0.00 - 2.00	01/05/09	1.09	390	5,800	**7.80**	96.4
VANADIUM	55.2	UXO1-SB18	UXO1-SB18(4-6)	4.00 - 6.00	01/05/09	1.08	390	5,800	**7.80**	96.4
VANADIUM	74.7	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	1.12	390	5,800	**7.80**	96.4
VANADIUM	56.2	UXO1-SB19	UXO1-SB19(4-6)	4.00 - 6.00	01/05/09	1.06	390	5,800	**7.80**	96.4
VANADIUM	60.4	UXO1-SB20	UXO1-SB20(0-2)	0.00 - 2.00	01/05/09	1.14	390	5,800	**7.80**	96.4
VANADIUM	64.9	UXO1-SB20	UXO1-SB20(4-6)	4.00 - 6.00	01/05/09	1.03	390	5,800	**7.80**	96.4
VANADIUM	51.3	UXO1-SB21	UXO1-SB21(0-2)	0.00 - 2.00	01/06/09	1.14	390	5,800	**7.80**	96.4
VANADIUM	44.1	UXO1-SB21	UXO1-SB21(3-4)	3.00 - 4.00	01/06/09	1.08	390	5,800	**7.80**	96.4
VANADIUM	69.4	UXO1-SB22	UXO1-SB22(0-2)	0.00 - 2.00	01/06/09	1.17	390	5,800	**7.80**	96.4
VANADIUM	54.5	UXO1-SB22	UXO1-SB22(4-5)	4.00 - 5.00	01/06/09	1.10	390	5,800	**7.80**	96.4
VANADIUM	73.2	UXO1-SS01	UXO1-SS01	0.00 - 2.00	12/19/08	1.23	390	5,800	**7.80**	96.4
VANADIUM	52.4	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	37.5	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	43.3	UXO1-SS04	UXO1-SS04	0.00 - 2.00	12/19/08	1.19	390	5,800	**7.80**	96.4
VANADIUM	57.5	UXO1-SS05	UXO1-SS05	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	46.4	UXO1-SS06	UXO1-SS06	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	44.2	UXO1-SS07	UXO1-SS07	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	59.2	UXO1-SS08	UXO1-SS08	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	47.8	UXO1-SS09	UXO1-SS09	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	42.6	UXO1-SS10	UXO1-SS10	0.00 - 0.50	12/19/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	48.9	UXO1-SS11	UXO1-SS11	0.00 - 0.50	12/19/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	34.1	UXO1-SS12	UXO1-SS12	0.00 - 0.50	12/19/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	28.3	UXO1-SS13	UXO1-SS13	0.00 - 0.50	12/19/08	1.16	390	5,800	**7.80**	96.4
VANADIUM	33.6	UXO1-SS14	UXO1-SS14	0.00 - 0.50	12/20/08	1.11	390	5,800	**7.80**	96.4

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
VANADIUM	53.9	UXO1-SS15	UXO1-SS15	0.00 - 0.50	12/20/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	28.7	UXO1-SS16	UXO1-SS16	0.00 - 0.50	12/20/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	32.0	UXO1-SS17	UXO1-SS17	0.00 - 0.50	12/20/08	1.17	390	5,800	**7.80**	96.4
VANADIUM	53.8	UXO1-SS18	UXO1-SS18	0.00 - 0.50	12/20/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	39.1	UXO1-SS19	UXO1-SS19	0.00 - 0.50	12/20/08	1.15	390	5,800	**7.80**	96.4
VANADIUM	50.1	UXO1-SS20	UXO1-SS20	0.00 - 0.50	12/20/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	40.3	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	46.6	UXO1-SS22	UXO1-SS22	0.00 - 0.50	12/20/08	1.16	390	5,800	**7.80**	96.4
VANADIUM	33.6	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	1.14	390	5,800	**7.80**	96.4
VANADIUM	41.2	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	38.4	UXO1-SS25	UXO1-SS25	0.00 - 0.50	12/20/08	1.12	390	5,800	**7.80**	96.4
VANADIUM	25.0	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	1.10	390	5,800	**7.80**	96.4
VANADIUM	35.1	UXO1-SS27	UXO1-SS27	0.00 - 0.50	12/21/08	1.11	390	5,800	**7.80**	96.4
VANADIUM	52.1	UXO1-SS28	UXO1-SS28	0.00 - 0.50	12/21/08	1.13	390	5,800	**7.80**	96.4
VANADIUM	57.9	UXO1-SS29	UXO1-SS29	0.00 - 0.50	12/21/08	1.14	390	5,800	**7.80**	96.4
ZINC	360	BB1-E1	010MBDA-BB01	4.00 - 4.50	02/04/15	2.71	23,000	350,000	**46.0**	50.1
ZINC	56.0	BB1-E1	010MBDA-BB02	6.00 - 6.50	02/04/15	2.64	23,000	350,000	**46.0**	50.1
ZINC	46.1	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	2.56	23,000	350,000	**46.0**	50.1
ZINC	329	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	2.63	23,000	350,000	**46.0**	50.1
ZINC	54.1	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	2.59	23,000	350,000	**46.0**	50.1
ZINC	283	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	2.78	23,000	350,000	**46.0**	50.1
ZINC	79.7	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	2.63	23,000	350,000	**46.0**	50.1
ZINC	57.3	DT2-TP1	010MBDA-TP12	9.00 - 9.50	02/02/15	2.61	23,000	350,000	**46.0**	50.1
ZINC	121 J	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	2.64	23,000	350,000	**46.0**	50.1
ZINC	137 J	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	2.61	23,000	350,000	**46.0**	50.1
ZINC	124 J	DT3-TP1	010MBDA-TP20	5.00 - 6.00	01/30/15	2.56	23,000	350,000	**46.0**	50.1
ZINC	2,690	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	13.0	23,000	350,000	**46.0**	50.1
ZINC	395	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	2.59	23,000	350,000	**46.0**	50.1
ZINC	380	DT4-TP1	010MBDA-TP24	8.50 - 9.00	02/02/15	2.55	23,000	350,000	**46.0**	50.1

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ZINC	464	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	69.5	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	646	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	254	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	2.66	23,000	350,000	**46.0**	50.1
ZINC	2,660	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	1,040	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	2.60	23,000	350,000	**46.0**	50.1
ZINC	108	DT7-TP1	010MBDA-TP36	4.50 - 5.00	02/03/15	2.62	23,000	350,000	**46.0**	50.1
ZINC	338	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	2.67	23,000	350,000	**46.0**	50.1
ZINC	174	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	56.3	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	2.68	23,000	350,000	**46.0**	50.1
ZINC	46.3	DT9-TP1	010MBDA-TP47	9.00 - 10.00	01/13/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	51.8	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	2.71	23,000	350,000	**46.0**	50.1
ZINC	50.0	MW1-S1	010AGW-SB04	30.00 - 30.00	01/13/15	2.60	23,000	350,000	**46.0**	50.1
ZINC	73.5	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	2.65	23,000	350,000	**46.0**	50.1
ZINC	100	PC-S2	010PC-SB04	2.50 - 3.00	01/21/15	2.62	23,000	350,000	**46.0**	50.1
ZINC	69.0	PC-S3	010PC-SB05	0.00 - 0.50	01/21/15	2.84	23,000	350,000	**46.0**	50.1
ZINC	78.2	UXO1-SB01	UXO1-SB01(0-2)	0.00 - 2.00	12/18/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	702	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	13.2	23,000	350,000	**46.0**	50.1
ZINC	154	UXO1-SB03	UXO1-SB03(0-2)	0.00 - 2.00	12/19/08	11.3	23,000	350,000	**46.0**	50.1
ZINC	55.0 J	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	12.5	23,000	350,000	**46.0**	50.1
ZINC	69.0 J	UXO1-SB07	UXO1-SB07(0-2)	0.00 - 2.00	12/20/08	11.8	23,000	350,000	**46.0**	50.1
ZINC	66.5 J	UXO1-SB08	UXO1-SB08(0-2)	0.00 - 2.00	12/20/08	11.3	23,000	350,000	**46.0**	50.1
ZINC	46.3 J	UXO1-SB08	UXO1-SB08(4-6)	4.00 - 6.00	12/20/08	11.4	23,000	350,000	**46.0**	50.1
ZINC	69.1	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	11.1	23,000	350,000	**46.0**	50.1
ZINC	50.1	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	87.7	UXO1-SB14	UXO1-SB14(0-2)	0.00 - 2.00	01/05/09	11.1	23,000	350,000	**46.0**	50.1
ZINC	225	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	11.1	23,000	350,000	**46.0**	50.1
ZINC	1,410	UXO1-SB15	UXO1-SB15(3-4)	3.00 - 4.00	01/05/09	11.2	23,000	350,000	**46.0**	50.1
ZINC	99.1	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	11.5	23,000	350,000	**46.0**	50.1

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Metals (mg/kg)										
ZINC	46.8	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	11.2	23,000	350,000	**46.0**	50.1
ZINC	92.9	UXO1-SS02	UXO1-SS02	0.00 - 2.00	12/19/08	11.7	23,000	350,000	**46.0**	50.1
ZINC	50.2	UXO1-SS03	UXO1-SS03	0.00 - 2.00	12/19/08	11.5	23,000	350,000	**46.0**	50.1
ZINC	48.1 J	UXO1-SS21	UXO1-SS21	0.00 - 0.50	12/20/08	11.0	23,000	350,000	**46.0**	50.1
ZINC	110 J	UXO1-SS23	UXO1-SS23	0.00 - 0.50	12/20/08	11.4	23,000	350,000	**46.0**	50.1
ZINC	92.3 J	UXO1-SS24	UXO1-SS24	0.00 - 0.50	12/20/08	11.2	23,000	350,000	**46.0**	50.1
ZINC	269	UXO1-SS26	UXO1-SS26	0.00 - 2.00	12/21/08	11.0	23,000	350,000	**46.0**	50.1
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.904	BS1-TP1	010BS-TP01	0.00 - 0.50	01/12/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.63	BS1-TP2	010BS-TP03	0.00 - 0.50	01/12/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.71	BS1-TP2	010BS-TP04	2.00 - 4.00	01/12/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.84	BS2-TP1	010BS-TP05	0.00 - 0.50	01/27/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.05	BS2-TP1	010BS-TP06	3.00 - 3.50	01/27/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	74.6	BS2-TP2	010BS-TP07	0.00 - 0.50	01/27/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.43	BS2-TP2	010BS-TP08	3.00 - 4.00	01/27/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.77	BS3-TP1	010BS-TP09	0.00 - 0.50	01/29/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.362	BS3-TP1	010BS-TP10	2.00 - 4.00	01/29/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.36	BS3-TP2	010BS-TP11	0.00 - 0.50	01/29/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.280	DT1-TP2	010MBDA-TP05	0.00 - 0.50	01/29/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.540	DT10-TP1	010MBDA-TP53	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.368	DT10-TP1	010MBDA-TP54	2.50 - 3.00	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.303	DT10-TP2	010MBDA-TP57	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.327	DT10-TP2	010MBDA-TP58	2.00 - 4.00	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.367	DT11-TP1	010MBDA-TP61	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.302 U	DT11-TP1	010MBDA-TP62	4.00 - 5.00	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	20.2	DT12-TP1	010MBDA-TP65	0.00 - 0.50	02/05/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.477	DT12-TP1	010MBDA-TP66	2.00 - 3.00	02/05/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.449	DT12-TP1	010MBDA-TP67	6.00 - 7.00	02/05/15	0.0	4.90	22.0	**0.200**	NC

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	5.99	DT12-TP2	010MBDA-TP69	0.00 - 0.50	02/05/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	34.2	DT12-TP2	010MBDA-TP70	5.00 - 6.00	02/05/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.809	DT12-TP2	010MBDA-TP71	9.00 - 10.00	02/05/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.80	DT12-TP3	010MBDA-TP73	0.00 - 0.50	02/06/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	12.9	DT12-TP3	010MBDA-TP74	4.00 - 5.00	02/06/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.452	DT12-TP3	010MBDA-TP75	5.50 - 6.00	02/06/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.500	DT2-TP1	010MBDA-TP09	0.00 - 0.50	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.354	DT2-TP1	010MBDA-TP10	4.00 - 5.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.311	DT2-TP2	010MBDA-TP13	0.00 - 0.50	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.913	DT3-TP1	010MBDA-TP18	3.00 - 4.00	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.503	DT3-TP1	010MBDA-TP19	4.00 - 5.00	01/30/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.19	DT4-TP1	010MBDA-TP21	0.00 - 0.50	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.94	DT4-TP1	010MBDA-TP22	4.00 - 5.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	3.63	DT4-TP1	010MBDA-TP23	7.00 - 8.00	02/02/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	5.05	DT5-TP1	010MBDA-TP25	3.00 - 4.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.870	DT5-TP1	010MBDA-TP26	5.00 - 6.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.280	DT5-TP1	010MBDA-TP27	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.219	DT6-TP1	010MBDA-TP29	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.452	DT6-TP1	010MBDA-TP30	2.00 - 3.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.318	DT6-TP1	010MBDA-TP31	4.00 - 5.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.83	DT7-TP1	010MBDA-TP33	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	8.45	DT7-TP1	010MBDA-TP34	2.00 - 3.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	6.55	DT7-TP1	010MBDA-TP35	4.00 - 4.50	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.57	DT8-TP1	010MBDA-TP37	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	10.9	DT8-TP1	010MBDA-TP38	3.00 - 4.00	02/03/15	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	4.17	DT8-TP1	010MBDA-TP39	5.00 - 6.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.529	DT8-TP2	010MBDA-TP41	0.00 - 0.50	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.464	DT8-TP2	010MBDA-TP42	3.00 - 4.00	02/03/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.313	DT8-TP2	010MBDA-TP43	5.00 - 5.50	02/03/15	0.0	4.90	22.0	**0.200**	NC

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Analyte	Detected Concentration	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	95th Background Threshold Value
Dioxin (ng/kg)										
DIOXIN TEQ (Humans/Mammals)	0.406	DT9-TP1	010MBDA-TP45	0.00 - 0.50	01/13/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.396	DT9-TP1	010MBDA-TP46	4.00 - 6.00	01/13/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.19	DT9-TP2	010MBDA-TP49	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	102	DT9-TP2	010MBDA-TP50	3.00 - 4.00	01/28/15	0.0	**4.90**	**22.0**	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.275	MW2B-S2B	010AGW-SB09	30.00 - 30.00	01/16/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.236	MW3-S3	010AGW-SB14	30.00 - 30.00	01/14/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.892	PC-S2	010PC-SB03	0.00 - 0.50	01/21/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.39	PC-S4	010PC-SB07	0.00 - 0.50	01/15/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.679	SD1-TP1	010MBDA-TP77	3.00 - 3.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.684	SD1-TP1	010MBDA-TP78	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.541	SD1-TP2	010MBDA-TP81	0.00 - 0.50	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.821	SD1-TP2	010MBDA-TP82	3.00 - 4.00	02/04/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.683	SD2-TP2	010MBDA-TP89	0.00 - 0.50	01/28/15	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.14	UXO1-SB02	UXO1-SB02(0-2)	0.00 - 2.00	12/19/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.607	UXO1-SB04	UXO1-SB04(0-2)	0.00 - 2.00	12/19/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	11.7	UXO1-SB06	UXO1-SB06(0-2)	0.00 - 2.00	12/20/08	0.0	**4.90**	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	2.59	UXO1-SB09	UXO1-SB09(0-2)	0.00 - 2.00	12/21/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.609	UXO1-SB11	UXO1-SB11(0-1.5)	0.00 - 1.50	12/21/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.351	UXO1-SB13	UXO1-SB13(0-2)	0.00 - 2.00	12/21/08	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	1.06	UXO1-SB15	UXO1-SB15(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.329	UXO1-SB17	UXO1-SB17(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC
DIOXIN TEQ (Humans/Mammals)	0.550	UXO1-SB19	UXO1-SB19(0-2)	0.00 - 2.00	01/05/09	0.0	4.90	22.0	**0.200**	NC

TABLE 6-3B: SOIL ANALYTICAL RESULTS EXCEEDING CRITERIA - ALL EXPOSURE UNITS (Continued)

Remedial Investigation Report, Munitions Response Program
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Notes:

1. Exceeded human health and ecological screening criterion is shown in bold. 95th background threshold value is shown as reference.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

ID	Identification
J	Estimated value
mg/kg	Milligrams per kilogram
NC	No criteria
ng/kg	Nanograms per kilogram
TEQ	Toxicity equivalence quotient
U	Nondetected

TABLE 6-4: A SUMMARY OF KEY VISUAL FINDINGS; SAMPLING ACTIVITIES; HUMAN HEALTH AND ECOLOGICAL COMPARISONS OF CONTAMINANTS; AND RECOMMENDATIONS
Remedial Investigation Report for Munitions Response Program Site UXO1 Exposure Units
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Exposure Units	Key Features/ Source(s) of Contaminants	Key Findings	Sample Locations	MPPEH/MDAS Observations	Contaminants and Human Health Screening Results	Contaminants and Ecological Screening Results	Conclusions/Recommendations
Exposure Unit 1	▪ Suspect Disposal Trench 1 ▪ Burn Slit/Trench 3	▪ Suspect Disposal Trench 1 was not located where previously indicated by geophysical data (Marrs 2007). There is no evidence that suspect Disposal Trench 1 exists. ▪ Supplemental detector aided surface survey of the area during the RI did not identify magnetic anomalies in the area where trench was expected. ▪ Burn Slit/Trench 3 contained a one to two foot thick burn ash layer observed at or near the surface of the soil within the trench. No metal or wood debris was observed indicating the primary use of the trench was for burning of rocket fuel.	▪ A detector aided surface sweep and two Test pits were completed at the location of suspect Disposal Trench 1. Samples were obtained at the surface and bottom of test pits (3 – 4 ft. bgs). ▪ Two test pits were completed in central portion of Burn Slit/Trench 3.Samples collected at surface (0-0.5 ft. bgs) which included burn ash material and in weathered bedrock below the burn ash layer (4-6 ft. bgs)	▪ No MPPEH observed ▪ Due to visual evidence and field data from the EU, there is no identified risk/hazard related to MPPEH	▪ The soil located within Burn Slit/Trench 3 contained a burn ash layer where dioxins were identified as a COC in surface and subsurface soil for future industrial workers; arsenic and dioxins were identified under a future residential scenario. ▪ The cancer risk identified is below the risk management range for current or future land use scenarios	▪ The ERA Step 3a refinement indicates there are no COECs for this EU.	▪ There was no evidence that suspected Disposal Trench 1 exists. No further investigation is recommended for this feature. ▪ Debris fill/slough is contained within the central portion of Burn Slit/Trench 3. This material is approximately one to two feet thick and contains burn ash. ▪ There were no explosives, VOCs, SVOCs, PCP, TPD-d, perchlorate, white phosphorous, or hydrazine detected at concentrations above initial screening levels. ▪ Analytical data from samples obtained in the bedrock below the fill containing the burn ash indicates that dioxins identified in Burn Slit/Trench 3 are not migrating vertically into the underlying bedrock. ▪ No further response action is recommended for this EU.
Exposure Unit 2	▪ Suspect Disposal Trenches 2 through 8	▪ Debris fill was identified in all seven suspect disposal trench locations. ▪ The Disposal trenches ranged in width from 18 feet and in length from 50 to 240 feet based upon geologic logging and geophysical data. Debris fill was observed to a maximum depth of approximately eight feet bgs. ▪ All of the trenches were covered with one to two feet of topsoil ▪ A significant amount of kick-out or other metal debris from OB/OD operations was observed at the surface in the southern portion and south of Disposal Trenches 2 and 3.	▪ A geophysical survey was completed in this area during the SI (ChaduxTt 2010) ▪ A total of nine test pits were completed in this area during the RI. ▪ Samples were collected in each test pit at the surface (0-0.5 ft. bgs), within the central debris fill layer (2-8 ft. bgs), at the debris fill to bedrock contact (6-8 ft. bgs), and two feet below the contact (8-10 ft. bgs).	▪ MPPEH items were recovered from Disposal Trench 2, Test Pit 1 (incendiary bomb components [thermite]), and Test Pit 2 (ammunition canisters and shipping container), as well as Disposal Trench 7 (grenade fuze). These items were treated on-site. ▪ Debris fill within the test pits contained an abundance of scrap metal (target frames, straps, small containers, sheet metal, wire, and pipes), fused metal (metal slag) and MDAS (grenade fuses, igniters, and other debris such as wood, burned wood, and burn ash. ▪ The volume of debris ranged from 35 to 75 percent with a majority of the material being scrap metal and MDAS	▪ Arsenic, Dioxins, and Lead are identified as COCs in subsurface soil for future residents. ▪ Arsenic and Lead are identified as COCs for future industrial workers in subsurface soil. ▪ Lead is identified as a COC for the construction worker in subsurface soil. ▪ Lead is identified as a risk driver from Disposal Trench 7 TP-1 (2-3 ft. bgs). However, if the maximum detected lead is treated as a "hotspot" and removed, lead would be below a level of concern for subsurface soil for the future industrial worker, construction worker and future resident. ▪ The cancer risk for arsenic is within the risk management range for current or future land use scenarios.	▪ The ERA Step 3a refinement indicates that lead and zinc are COECs for plants to a depth of six feet ▪ At the surface, cadmium is a risk driver for birds.	▪ Debris fill is contained within the central portion of Disposal Trenches 2 through 8. This material is approximately four to six feet thick and contains 35 to 70% debris and/or ash. ▪ There were no TPH-d, VOCs, SVOCs, explosives, PCP, white phosphorous, or hydrazine detected, or if detected, were at concentrations above screening levels. ▪ Analytical data from samples obtained in the bedrock below the debris fill indicates that the COCs Arsenic, Dioxins, Cadmium and Lead identified in the disposal trenches are not migrating vertically into the underlying bedrock. ▪ Lead and cadmium are risk drivers for plants to a depth of 6 feet and cadmium at the surface is a risk driver for birds. ▪ Metal (slag and scrap) and concrete debris was observed at the surface throughout this area ▪ If the maximum detected concentration of lead observed in Disposal Trench 7 TP-1 at a depth of 2-3 feet bgs was to be treated as a "hotspot" and removed, lead would be below a level of concern for subsurface soil for the future industrial worker, construction worker and future resident. ▪ Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH, along with lead and for ecological risks within the EU.

TABLE 6-4: A SUMMARY OF KEY FINDINGS; SAMPLING ACTIVITIES; HUMAN HEALTH AND ECOLOGICAL SCREENING OF CONTAMINANTS; AND RECOMMENDATIONS (CONTINUED)
Remedial Investigation Report for Munitions Response Program Site UXO1 Exposure Units
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Exposure Units	Key Features/ Source(s) of Contaminants	Key Findings	Sample Locations	MPPEH/MDAS Observations	Contaminants and Human Health Screening Results	Contaminants and Ecological Screening Results	Conclusions/Recommendations
Exposure Unit 3	▪ Surface Disturbance 1 ▪ Drop Test Tower	▪ No fill or debris was observed in the two test pits completed at the suspected location of the Surface Disturbance 1. ▪ A surface sweep was conducted by the UXO team of an area extending approximately 100 feet out from the Drop Test Tower. ▪ All debris observed or detected by the team during the surface sweep was removed by the team.	▪ . Four soil borings were hand augured in the area east of the tower at locations where MPPEH or MDAs was observed. ▪ Samples were collected at 0 to 0.5 foot bgs and three to four feet bgs. ▪ The samples collected from this area during the RI were analyzed for metals and explosives. ▪ Area groundwater well AGW-MW1 was completed to a depth of approximately 35 feet bgs and groundwater was measured at a depth of approximately 21 feet bgs	▪ No MPPEH items were identified within EU 3. ▪ During the detector-aided surface clearance for the Drop Test Tower, monitoring well location, and Surface Disturbance 1 by the UXO technicians, some MDAS items (small arms casings, slap flare base plates) and scrap metal were identified and placed in the on-site MDAS/Scrap Metal bins.	▪ Arsenic was identified as a COC section of this report subsurface soil for future residents based upon State of California risk criteria. ▪ The cancer risk identified is below the risk management range for current or future land use scenarios.	▪ The ERA Step 3a refinement indicates that cadmium at the surface is a COEC for birds.	▪ There was no fill observed in test pits completed at Surface Disturbance 1. There is no evidence that the suspected surface feature was a disposal trench. No further investigation is recommended for this feature. ▪ No UXO of MPPEH items were identified in or around the Drop Test Tower during the SI or RI. No further response action is recommended for this feature. ▪ Analytical data from samples obtained in the bedrock below the debris fill indicates that COCs (metals, explosive or pyrotechnical compounds) that would normally be associated with the surface items removed (small arms casings, slap flare base plates, and scrap metal) from the Drop Test Tower area are not migrating vertically into the underlying topsoil or bedrock. ▪ Further response action should be considered in the FS based upon ecological risk.
Exposure Unit 4	▪ Two Metal Burn Barrels (removed during RI) ▪ Burn Slit/Trench 1 ▪ Former Trailer ▪ Pilgrim Creek alluvial soil ▪ Surface water and Perched groundwater within Pilgrim Creek (if present).	▪ Approximately two feet of slough/debris fill that included a significant amount of burned debris and scrap metal is present within Burn Slit/Trench 1. ▪ Burn Slit/Trench 1 is not directly connected with Pilgrim Creek drainage as previously thought ▪ Groundwater was observed at a depth of approximately 16.5 feet bgs in the temporary Pilgrim Creek monitoring well PC-MW1 and at a depth of eight feet bgs in PC-MW2. There was no groundwater observed in the PC-MW3 well completed to a depth of eight feet bgs. Based upon this data and the understanding that the region has been in a prolonged drought, it is assumed that "perched" groundwater may occur seasonally within the drainage or after periods of prolonged precipitation.	▪ Two test pits were excavated within the central portion of Burn Slit/Trench 1. Surface (0 to 0.5 foot bgs) and subsurface (two to four feet bgs) samples were collected from each test pit. Approximately 1.5 to 2 feet of slough or surface soil that included a significant amount of burned debris, scrap metal, and ▪ At the location of the former trailer, two surface samples were collected and analyzed for VOCs. ▪ The two burn barrels were removed and samples were collected at the bottom of the debris fill (approximately four feet bgs) and another two feet below that at a depth of approximately six feet bgs. ▪ Four locations were sampled within Pilgrim Creek to evaluate the alluvial soils. Samples were collected at 0 to 0.5 foot bgs and 2.5 to 3.0 feet bgs ▪ Samples of the shallow groundwater were collected from two of the three temporary wells installed within Pilgrim Creek.	▪ MPPEH identified within this EU included two 40-mm smoke grenades. These items were disposed of on-site during demolition operations. ▪ MDAS identified in the area consisted of rocket motor housings, ammunition carriers (empty), black powder cans, flare base plates, and flare housing components.	▪ Based upon the results of samples obtained from the debris soils within Burn Slit/Trench 1, Dioxins are COCs in surface and subsurface soil for future residents. ▪ The cancer risk identified is below the risk management range for current or future land use scenarios	▪ Based on the results of the SLERA and the Step 3a risk refinement, no COECs were identified	▪ A significant amount of metal and concrete debris exists within the Pilgrim Creek drainage, including the burned debris related to the former trailer. ▪ There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, present at concentrations that exceed initial screening levels. ▪ Analytical results from samples collected two feet below the bottom of the former burn barrels indicate there has not been any vertical migration of COCs normally associated with small arms casings (metals) to the underlying bedrock soils. ▪ There were COCs or COECs identified in the eight alluvial soil samples obtained from the Pilgrim Creek drainage. ▪ Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH within Burn Slit/Trench 1.

TABLE 6-4: A SUMMARY OF KEY FINDINGS; SAMPLING ACTIVITIES; HUMAN HEALTH AND ECOLOGICAL SCREENING OF CONTAMINANTS; AND RECOMMENDATIONS (CONTINUED)
Remedial Investigation Report for Munitions Response Program Site UXO1 Exposure Units
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Exposure Units	Key Features/ Source(s) of Contaminants	Key Findings	Sample Locations	MPPEH/MDAS Observations	Contaminants and Human Health Screening Results	Contaminants and Ecological Screening Results	Conclusions/Recommendations
Exposure Unit 5	▪ Suspect Disposal Trenches 9 through 11 ▪ Surface Disturbance 2 ▪ Firing Range Floor, Metal Target and Target Berm	▪ Debris fill was identified in Disposal Trenches 9 and 10. ▪ No fill was identified at the suspect location of Disposal Trench 11. ▪ Disposal Trench 9 is one of the longest OB/OD trenches within the site, measuring approximately 390 feet in length. ▪ The debris in the trenches were covered with one to two feet of fill or topsoil ▪ Debris was only encountered in the eastern portion of the Surface Disturbance 2 so the footprint of this feature was reduced. ▪ No UXXO or MPPEH was observed in the earthen berm located behind the metal target.. ▪ Groundwater was not observed within the maximum explored depth of 47 feet bgs in AGM-MW3, (monitoring well was not installed at this location)	▪ Geophysical surveys were previously completed in the central range floor (Marrs 2007 and ChaduxTt 2010) ▪ A total of seven test pits were completed at suspect disposal trench (9 - 11) or Surface Disturbance 2 during the RI. ▪ Samples were collected at the surface (0 – 0.5 foot bgs), within the central portion of the debris fill (4-6 ft. bgs), at the fill to native contact (4-5 and 9-10 ft. bgs, respectively) and approximately two feet below that in native undisturbed bedrock (8-9 and 11 to 12 ft. bgs, respectively). ▪ Debris fill within the test pits contained a variety of MDAS, scrap metal, wood, and other burned debris/burn ash ▪ Three test pits were completed in the Target Berm with samples collected at the surface and at a depth of 4-6 ft. bgs. ▪ Two test pits were excavated across Surface Disturbance 2 alignment. The debris fill in the eastern portion of the feature contained burned wood, burn ash and scrap metal (metal drum lid). Samples were collected at the surface (0 – 0.5 foot bgs), in the debris (two to three feet bgs), just above the native contact, and in the bedrock (three to feet bgs).	▪ No UXO or MPPEH items were recovered from the three Target Berm test pits ▪ MPPEH item discovered during the RI included a 4.5-inch barrage rocket casing removed from Disposal Trench 10 Test Pit 2. This item was disposed of on-site during demolition operations ▪ Nine MDAS items previously identified as MPPEH during the SI were removed from the surface during the initial site clearance sweep. ▪ MDAS identified in the area consisted of a 40-mm cartridge case, 20-mm casing, flare plates, and flare caps	▪ Dioxins are COCs in surface and subsurface soil for future industrial workers and future residents. ▪ The cancer risk identified is within the risk management range for current or future land use scenarios	▪ Based on the results of the SLERA and the Step 3a risk refinement, no COECs were identified.	▪ There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, present at concentrations that exceed initial screening levels. ▪ Analytical data from the bedrock below the debris fill indicates that dioxin identified as the only COC in the disposal trenches is not migrating vertically into the underlying bedrock material. ▪ Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH at Disposal Trenches 9 and 10, the eastern portion of Surface Disturbance 2 and the earthen Target berm.

TABLE 6-4: A SUMMARY OF KEY FINDINGS; SAMPLING ACTIVITIES; HUMAN HEALTH AND ECOLOGICAL SCREENING OF CONTAMINANTS; AND RECOMMENDATIONS (CONTINUED)
Remedial Investigation Report for Munitions Response Program Site UXO1 Exposure Units
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Exposure Units	Key Features/ Source(s) of Contaminants	Key Findings	Sample Locations	MPPEH/MDAS Observations	Contaminants and Human Health Screening Results	Contaminants and Ecological Screening Results	Conclusions/Recommendations
Exposure Unit 6	▪ Suspect Disposal Trench 12 ▪ Range Impact Area	▪ A Geophysical survey was completed in the Range Impact Area (14 acres) during the RI followed with investigation of a subset of the anomalies by the UXO technicians ▪ 1,201 of the 2,757 target anomalies were detected outside of the apparent limits of Disposal Trench 12. Intrusive investigation was conducted on 77 targets. ▪ No UXO was identified during the investigation of the targets or during the surface seep of the range impact area ▪ Disposal Trench 12 contains primarily building related debris with no evidence of OB/OD operations or munitions related material in the debris. ▪ The trench is approximately 600 feet in length with debris fill observed in the test pits to a maximum width of 50 and a depth of 12 feet bgs. Geophysical data suggests debris is present to a maximum width of 100 feet in the eastern portion of the trench. ▪ The trench was covered with one to two feet of fill or topsoil. However some range related MDAS and MPPEH were removed from the surface during the clearance sweep of the Range Impact and disposal trench areas. ▪ Groundwater was observed at a depth of approximately 22 feet bgs in AGW-MW2	▪ A total of three test pits were excavated within the pre-RI suspected limits of the disposal trench. Two of them encountered debris fill. ▪ Samples were collected at the surface (0 – 0.5 foot bgs), within the central portion of the debris fill (4-8 ft. bgs), at the fill to native contact (4-5 and 9-12 ft. bgs, respectively) and at least two feet below that in native undisturbed soil (11 to 12 ft. bgs).	▪ MPPEH items identified within EU 6 during the DGM investigation included: one 105-mm flare, one 4 lb. incendiary bomb (body), and two incendiary bomb components. These items were treated on-site. ▪ MDAS items recovered by the UXO team included: three 120-mm mortars (partial), three expended 40-mm smoke cartridges, one LAW rocket motor, two ballistic windshields, and one ballistic nose cone	▪ Dioxins are COCs in surface and subsurface soil for future industrial workers and future residents. ▪ Lead is a COC for the future construction worker in subsurface soil. ▪ Arsenic diesel range organics and lead are identified as risk drivers for the future resident in subsurface soil. ▪ The cancer risk identified is within the risk management range for current or likely future land use scenarios	▪ Based on the results of the SLERA and the Step 3a risk refinement, no COPECs were identified.	▪ The four MPPEH items removed from the site during the geophysical survey and intrusive investigation by the UXO team represented 5.2 percent of the total target items recovered. ▪ MDAS and scrap metal comprised 13 percent and 79 percent of the debris recovered, respectively ▪ There were no exceedances of initial screening levels for explosives, VOCs, SVOCs, TPH-d, perchlorate, PCP, white phosphorous, or hydrazine. ▪ Analytical data from the bedrock below the debris fill indicates that the COCs of dioxins, arsenic and lead identified in the disposal trench are not migrating vertically into the underlying native material. ▪ Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH within Disposal Trench 12 and the Range Impact Area and subsurface lead in Disposal Trench 12.
Exposure Unit 7	▪ Burn Slit/Trench 2	▪ The trench is approximately 80 feet long, 15 feet wide, and approximately 12 feet deep. ▪ A one- to two-foot thick burn ash layer was observed at or near the surface in the central portion of the Burn Slit/Trench	▪ Two test pits were completed in central portion of the Burn Slit/Trench. Samples collected at surface (0-0.5 ft. bgs) which included burn ash material and in weathered bedrock below the burn ash layer (2-4 ft. bgs)	▪ MPPEH identified with Burn Slit/Trench 3 included the following: expended smoke grenades (2), candle mix (pyrotechnic) (1), and flare components (150). These items were treated on-site. ▪ MDAS identified included numerous 35-mm slap flares and 40-mm illumination flare components ▪ No MPPEH or MDAS was observed outside the trench limits	▪ Dioxins surface soils of the Burn Slit/Trench and both dioxins and arsenic (State of California only) are COCs in subsurface soil for the future industrial worker ▪ Dioxins in surface soils of the Burn Slit/Trench and both arsenic and dioxins are COCs in subsurface soil for future residents ▪ Barium is identified as a non-cancer chemical risk driver in subsurface soil of the Burn Slit/Trench for the future construction worker ▪ The cancer risk identified for dioxins is within the risk management range for current or future land use scenarios	▪ The ERA Step 3a refinement indicates that barium and zinc are COECs for plants to a depth of 0 – 6 feet, and invertebrates to a depth of 0-0.5 feet ▪ Zinc is a COPEC for non-burrowing animals at 0 – 0.5 foot bgs.	▪ Debris fill/slough is contained within the central portion of Burn Slit/Trench 2. This material is approximately one to two feet thick and contains MPPEH, MDAS metal slag and other burned debris and/or ash. ▪ There were no explosives, VOCs, SVOCs, PCP, TPH-d, perchlorate, white phosphorous, or hydrazine detected or, if detected, were present at concentrations that exceed initial screening levels ▪ Analytical data from samples obtained in the bedrock below the debris fill indicates that COCs (dioxins, arsenic and barium) identified in Burn Slit/Trench 2 are not migrating vertically into the underlying bedrock material. ▪ Further response action should be considered in the FS based upon the possible presence of MEC/MPPEH, barium and ecological risks within Burn Slit/Trench 2.

TABLE 6-4: A SUMMARY OF KEY FINDINGS; SAMPLING ACTIVITIES; HUMAN HEALTH AND ECOLOGICAL SCREENING OF CONTAMINANTS; AND RECOMMENDATIONS (CONTINUED)
Remedial Investigation Report for Munitions Response Program Site UXO1 Exposure Units
Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California

Exposure Units	Key Features/ Source(s) of Contaminants	Key Findings	Sample Locations	MPPEH/MDAS Observations	Contaminants and Human Health Screening Results	Contaminants and Ecological Screening Results	Conclusions/Recommendations
Surface Water and Groundwater	▪ Area Groundwater Wells AGW-MW1 and AGW-MW2 ▪ Pilgrim Creek Temporary Shallow Groundwater Wells PC-MW1 and PC-MW2	▪ Groundwater was observed at depths of approximately 20 feet at Monitoring well locations AGW-MW1 and AGW- MW2. ▪ Groundwater was not observed at the location of proposed monitoring well AGW-MW3 that was drilled to a depth of 47 ft. bgs. ▪ Perched groundwater was observed within the temporary wells hand augered within the Pilgrim Creek drainage. Groundwater was observed in PC-MW1 at a depth of approximately 16.5 ft bgs and in PC-MW2 at a depth of 8.5 ft bgs. A third well was attempted (7.5 ft bgs) between the two well locations with no groundwater encountered to a depth of 7.5 ft bgs where refusal was encountered in the hand auger. ▪ The presence of area groundwater is highly variable the bedrock as well as within the Pilgrim Creek drainage. ▪ There was no surface water observed in the Pilgrim Creek Drainage at the time of the investigation, as such no samples could be collected.	▪ Monitoring well AGW-MW1, located in EU 3, was completed to a depth of 34.2 feet bgs, with a stabilized potentiometric surface of approximately 24.7 feet bgs. ▪ The second deep well completed, AGW-MW2, is located in the southern portion of the site (EU 6) and was completed to a depth of 36.2 feet bgs, with a potentiometric surface at 19.9 feet bgs. ▪ The third planned area monitoring well is located in the east central portion of the site, within EU 5. The well boring was advanced to a depth of 47 feet bgs; however, no water was present in the boring, so the well was not installed ▪ Temporary well PC-MW1 was hand augered to a depth of 17.2 feet bgs, with groundwater observed at 16.4 feet bgs. ▪ Temporary well PC-MW2 was completed to a depth of 10.6 feet bgs with groundwater observed at 8.6 feet bgs. ▪ A third well (PC-MW3) was installed approximately 240 feet upgradient of PC-MW2. This well was completed to a depth of 7.5 feet bgs with no groundwater or moist soil conditions were observed.	▪ All MPPEH or MDAS observed in the Pilgrim Creek drainage was removed during clearance operations ▪ Perchlorate was detected in all three groundwater samples analyzed for explosive compounds. Detected concentrations ranged from 0.995 to 3.65 µg/L, which are below the residential risk based criteria of 14 µg/L	▪ Groundwater for MRP Site UXO1 was evaluated on a site-wide basis using the maximum detected concentrations of each detected chemical from four wells. ▪ Only one VOC (chloromethane) was detected in well PCMW1-GW1. The detected concentration (0.16 µg/L) of chloromethane is far below the screening concentration for the vapor intrusion pathway (260 µg/L) for a residential receptor (EPA 2014b). Thus, the vapor intrusion pathway was determined to be insignificant and not evaluated further. ▪ Arsenic is identified as a chemical risk driver with detections that exceeded screening levels in 3 of the 4 samples (a maximum concentration of 5.42 µg/L). ▪ The cancer risk identified is below the risk management range for current or future land use scenarios	▪ An ERA was not conducted since there is no exposure pathway for area or perched groundwater. ▪ Surface water was not present during the investigation, as such samples could not be collected.	▪ There was no detections of explosive compounds, TPH-D, SVOCs or hydrazine in groundwater. ▪ The propellant perchlorate was detected in all three groundwater samples submitted (AGW-MW1, AGW-MW2, PC-MW2) with results ranging from 0.995 to 3.71 ug/l. These results are below the residential screening level of 14 ug/l. ▪ The VOC chloromethane was detected at a concentration of 160J ug/l in temporary well PC-MW1. The value is below the residential screening level of 190 ug/l. ▪ Arsenic values ranged from non-detect to a maximum concentration of 5.68 ug/l which exceeds the MCL for domestic tap water screening values of 5.0 ug/l. Arsenic is believed to be naturally occurring and is within the risk management range under current and likely future use scenarios. ▪ No further response action is recommended for this EU.
Central Down Range SDZ	▪ Former Firing range central surface danger zone (SDZ)	▪ No UXO or MPPEH items were observed or recovered during the 100% detector aided surface sweep of the central portion of the SDZ (17 acres) ▪ MDAS and scrap metal consisted of empty ammunition carriers, a slap flare base plate. ▪ Visibility of the ground surface was excellent due to the Tomahawk fire that effected the area in 2014.	▪ Sampling was not planned for this potential area of concern, as such no samples were collected.	▪ No UXO or MPPEH items were observed or recovered by the UXO team during the 100% detector aided surface sweep. ▪ Approximately 200 lbs. of MDAS and scrap metal was collected that consisted of empty ammunition carriers, a slap flare base plate, wire and metal straps.	▪ Sampling was not conducted within this area so a HHRA was not conducted.	▪ Sampling was not conducted in this area so an ERA was not conducted.	▪ The results of the detector aided surface sweep indicates that there was no overshot during test firing operations at the former range. Or if there was overshot, the fired items were recovered by the supporting EOD team. ▪ Based upon the lack of range related items recovered, adding the portion of the SDZ beyond the MRP boundary to the MRP site is not warranted. ▪ No further response action is recommended for this area of potential interest.

Notes:
bgs Below ground surface
COC Chemical of Concern
COPEC Chemical of Potential Environmental Concern
MDAS Munitions designated as safe
MPPEH Munitions potentially posing an explosive hazard
MRP Munitions Response Program
PCP Pentachlorophenol
RI/FS Remedial Investigation and Feasibility Study
SI Site Inspection
SVOC Semi-volatile organic compound
TPH-d Total Petroleum Hydrocarbon - diesel
VOC Volatile organic compound

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