Draft

Site Inspection Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1, and AOC2

Naval Weapons Station Seal Beach, California

September 30, 2010

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

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Site Inspection Report

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Naval Weapons Station Seal Beach
California

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PREPARED FOR
DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

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EXECUTIVE SUMMARY

The Naval Facilities Engineering Command (NAVFAC) Southwest, contracted with a joint venture of Tetra Tech EM Inc. and St. George Chadux Corporation (ChaduxTt) to perform site inspections (SIs) at five Munitions Response Program (MRP) Sites (Unexploded Ordinance [UXO]1, UXO2, UXO6, area of concern [AOC]1, and AOC2) at Naval Weapons Station (NAVWPNSTA) Seal Beach. The activities described in this SI report were conducted at the MRP sites during November and December of 2009 in accordance with the work plan for SI MRP Sites UXO1, UXO2, UXO6, AOC1 and AOC2 (ChaduxTt 2009a). The purpose of the SI is to:

- Build on the preliminary site inspection (Malcolm Pirnie 2008) by gathering initial field data.
- Perform site reconnaissance and surveys according the SI work plan.
- Outline potential sources (disposal areas, target areas, operations areas).
- Refine site boundaries.
- Conduct initial munitions hazard screening.
- Refine the conceptual site model (CSM) using field reconnaissance and survey data and initial hazard and screening results.
- Summarize information and recommend future site actions.
- Collect field data necessary to evaluate the site using Department of Defense (DoD) Munitions Response Site Prioritization Protocol.

SI field activities included limited biased and unbiased soil sampling and laboratory analysis of samples for metals, explosive compounds, total Kjeldahl nitrogen (TKN), inorganic nitrogen, ammonia, picrate, and perchlorate. The enhanced SI sampling program included soil sampling, sediment sampling, and surface water sampling. In addition, land-based and marine geophysical surveys were completed at MRP Site UXO1 where burial or disposal of munitions and explosives of concern (MEC) was suspected.

A summary of the key visual findings, sampling, human health and ecological screening comparison results, and recommendations is in Table ES-1. The locations of the sites are shown on Figure ES-1. A brief summary of site-specific recommendations is provided below:

MRP SITE UXO1 (PRIMER/SALVAGE YARD AND POLB MITIGATION POND)

MRP Site UXO1 (Primer/Salvage Yard and Port of Long Beach [POLB] Mitigation Pond) is a known MEC area located in the south-central portion of the installation (Figure ES-1). Unreported disposal of munitions are documented at the site, and there were certification errors in the classification of ordnance as inert or live during past operations (Malcolm Pirnie 2008). The approximately 48 acre Primer/Salvage Yard area occupies the northern portion of UXO1.

The 39 acre POLB Mitigation Pond is located immediately south of Slough Road and makes up the southern portion of UXO1. From 1944 through the 1990s, the Primer/Salvage Yard was actively used for ordnance storage related to rocket and projectile (such as 20- to 40-millimeter [mm]) segregation, inspection, and repackaging, as well as bomb and rocket (for example, 2.75- and 7.2-inch) overhaul. The Primer/Salvage Yard received thousands of cleaned projectile casings and damaged ammunition, along with non-ordnance materials, such as lumber, batteries, wings, telemetry, circuitry, and other types of scrap (Naval Energy and Environmental Support Activity [NEESA] 1985). Because of the variety of past practices in the site, the SI approach for UXO1 focused on three primary areas: (1) the depriming area, where projectile primers were removed and smoke pots were filled with petroleum product; (2) the recovered live ammunition and grenades area, where live small-caliber ammunition and grenades were recovered by station personnel; and (3) the explosive ordnance disposal (EOD) safety demonstrations area that is now occupied by the POLB Mitigation Pond.

The SI for UXO1 included UXO detector-aided visual surveys, geophysical (EM61) surveys at two areas to locate buried suspect MEC, soil sampling, sediment sampling, and surface water sampling from the bottom of the POLB Mitigation Pond. Twenty-eight soil samples, 12 sediment samples, and 5 surface water samples were submitted to the laboratory for analysis of metals, TKN, inorganic nitrogen, ammonia, perchlorate, and explosive compounds.

Suspect MEC (suspect bomb live unit [BLU]-36, M-40 bomblets, 75-mm cartridge casings, and a 40-mm cartridge casing) and materials that present a potential explosive hazard (MPPEH) were observed throughout UXO1. Explosives or propellants were not detected in soils, sediment, and surface water at MRP Site UXO1. Ammonia, nitrate/nitrite-N, and TKN, at less than the human health screening criteria, were detected in soil. Perchlorate was detected in 19 of 28 samples but at concentrations less than human health screening criteria. Cadmium and lead were detected in soil at concentrations greater than the human health and background screening criteria. Four of 28 samples exceeded human health screening criteria and background levels. Concentrations of five metals (cadmium, copper, lead, selenium, and zinc) detected in the soil exceeded the corresponding ecological and background screening criteria. Concentrations of seven metals (arsenic, cadmium, copper, lead, mercury, nickel, and zinc) detected in the sediment exceeded the corresponding ecological benchmarks. Chemicals detected in surface water were less than the ecological benchmark screening criteria.

Based on the types and density of suspect MEC and MPPEH at UXO1, a time critical removal action (TCRA) for surface MEC is recommended for the Primer/Salvage Yard and around the embankment of the POLB Mitigation Pond. Because of the density of target anomalies detected during geophysical and UXO detector-aided visual surveys and the SI soil and sediment sampling results for metals exceeding screening criteria, it is recommended that the TCRA be followed with a remedial investigation and feasibility study (RI/FS) for MEC and MC.

MRP SITE UXO2 (BUILDINGS 101 AND 102 AND ASSOCIATED EVAPORATION PONDS)

MRP Site UXO2 is located south of Westminster Street at 8th Street (Figure ES-1). The site comprises five unlined evaporation ponds and a settling basin associated with Buildings 101, 102, and 98. The complex operated from 1945 through the mid-1950s, in 1962, and in 1971 to

demilitarize 5-inch projectiles. When the projectiles were retired, Explosive D (ammonium picrate) was drilled out of the casings. The initial drillout procedure did not remove all the Explosive D from the casings, and the remaining portion was removed by rinsing with warm water and steam. During peak production periods (1945 to 1947 and 1953 to 1955), an estimated average of 250, 5-inch projectiles were drilled out each working day (NEESA 1985; NEESA 1990). The wash water from final steam and warm water washout of projectile casings contained Explosive D. It was discharged from a tank in Building 98, for primary settling and cooling, into a series of 10-foot by 10-foot baffled concrete settling basins located on the south side of the building. Once the wash water containing Explosive D went through the concrete primary settling basins, it drained through a 2-foot-deep, 150-foot-long concrete trench into a series evaporation ponds, covering 2.3 acres. Reportedly, some of the ponds were connected by 6-inch-diameter pipes (NEESA 1985; NAVFAC SW 1990). Treatment in the ponds consisted of controlled burns that were done while the ponds were in operation. It is reported that in 1948 the ponds detonated rather than burned. The last controlled burn was in 1962 (NEESA 1985; NAVFAC SW 1990; Naval Surface Warfare Center [NSWC] Indian Head 2003). The facilities ceased operation in 1972 and have been inactive since that time. In February 2009, Buildings 101 and 102 and associated drain lines were demolished and removed.

The SI for UXO2 included a UXO detector-aided visual survey and soil sampling along the former drain lines, at former discharge points, and in the former ponds. Fifty soil samples were submitted to the laboratory for analysis of picrate, TKN, inorganic nitrogen, ammonia, and explosive compounds.

No explosives or picrate was detected in soil, and nitrate/nitrite-N and TKN (breakdown products) were detected less than the residential and industrial human health screening criteria. This infers there could have been significant natural attenuation of ammonium picrate at the site or that previous controlled burning of the ponds could have resulted in attenuation. Ammonium picrate has shown significant natural attenuation under certain soil conditions (Tan and others 2006). No clear correlation has been found between the degree of degradation and grain size, clay content, organic content, and carbonate content of soil. Because soil samples were collected from potential source areas (former drain lines, evaporation ponds, former concrete settling pond, and former settling pond), and because explosives or picrate were not detected, and associated breakdown products were detected less than human health screening criteria, no further action (NFA) for MEC and MC is recommended for UXO2.

MRP SITE UXO6 (WESTMINSTER POLB FILL AREA)

MRP Site UXO6, Westminster POLB Fill Area, is located south of Westminster Avenue and along the Westminster railroad spur (Figure ES-1). The approximately 180 acre site is estimated to be 1.75 miles long and 715 feet wide. In 1989 and 1990, the site was reportedly used to place approximately 3 to 5 feet of fill that had been excavated from the POLB Mitigation Pond (the southern portion of the current MRP Site UXO1), a known MEC area. A calculated 330,000 cubic yards of soil from the 7th Street POLB Mitigation Pond, excavated to an average depth of 5 feet below ground surface (bgs) (based on a required average depth of 3 feet below the mean lower low water tide), was placed in the Westminster POLB Fill Area. During excavation of the 7th Street POLB Mitigation Pond, it was reported that 3-inch rounds were seen falling out of trucks, and that

EOD responded to these incidents (Malcolm Pirnie 2008). The potential munitions concern at the POLB Mitigation Pond was documented in a 1989 POLB memorandum before the pond was excavated (POLB 1989). ChaduxTt interviewed the current agriculture lease owner for the station, Mr. Roy Pursche, in December 2009. Mr. Pursche indicated that fill was excavated from the southern portion of MRP Site UXO1 and taken to MRP Site UXO6 and that debris was removed from the fill while it was placed at the site.

Suspected munitions at the POLB Mitigation Pond that may have been transported to the Westminster POLB Fill Area include live, inert, or damaged rockets (for example, 2.75- and 7.2-inch), cartridge casings and projectiles (for example, 20- to 105-mm), grenades, obscurants (fog oil), black and smokeless powders, primers, fuzes, small arms ammunition, cartridge actuated devices (CADs), propellant actuated devices (PADs), and submunitions (NEESA 1985).

The SI for UXO6 included a UXO detector-aided visual survey as well as biased and unbiased soil sampling. Sixty soil samples were submitted to the laboratory for analysis of metals, picrate, perchlorate, and explosive compounds.

A CAD and an artillery cartridge casing (similar MPPEH items observed at UXO1), were also observed at UXO6 during the 2009 SI. Explosives, propellants, and picrate were not detected in soils at MRP Site UXO6. Perchlorate less than the human health screening criteria was detected in soil. Arsenic and lead were detected in soil at concentrations greater than the human health and background screening criteria. Concentrations of metals (arsenic, lead, and selenium) detected in soil exceeded the corresponding ecological benchmarks and background levels. Arsenic exceeded ecological benchmark and background screening criteria in one soil sample. Lead exceeded background in 3 of the 66 soil samples. The highest lead concentration was 197 milligams per kilogram (mg/kg).

Because of the MPPEH items found at UXO6 (which were also found at UXO1), and the distribution of subsurface anomalies throughout the site, exceedances of screening criteria for metals in soil, and because fill material from MRP Site UXO1 was likely placed at the site, according to interviews, an RI/FS for MEC and MC is recommended for MRP Site UXO6.

MRP SITE AOC1 (BUILDING 94 SETTLING BASIN)

MRP Site AOC1, Building 94 Settling Basin, is located east of Case Road in the central portion of the installation (Figure ES-1). Building 94 (a gun propellant-charge loading and breakdown facility) was commissioned in 1945 and operated until at least 1981 for loading and breakdown of 20-mm, 40-mm, 3-inch, and 5-inch projectiles (NEESA 1985). Cartridge case loading consisted of filling 3-inch and 5-inch casings with smokeless powder (NEESA 1985). Reportedly, approximately 1.5 tons of waste smokeless powder was generated per week between 1945 and 1970. To prevent smokeless powder dust from accumulating, the interior of Building 94 was occasionally washed down with water, and the wash water drained through floor drains. According to engineering diagrams, the floor drains led to a 50-foot by 50-foot settling basin east of Building 94. The frequency, period of use, and amount of MC drained to the basin are

unknown. The settling basin is no longer visible and its previous location is now graded and used for agriculture.

Reportedly, small spills occurred during operations at Building 94. These were swept up, placed in powder cans, and taken to a magazine for storage. In 2003, analytical sampling from inside Building 94 found less than-hazard-threshold concentrations of Royal Demolition explosive (RDX), high melting explosive (HMX), and picrate in floor drains (NAVFAC SW 2005). The existence of the wash-down and draining system implies that release of MC is possible. This hypothesis is supported by a Naval Surface Warfare Center (NSWC) explosive hazard characterization evaluation for Building 94 that noted that a conveyor shaft and four floor drains in the east side of the building have less than-hazard-threshold concentrations of explosives, including RDX, HMX, and picrate. The primary concern noted during the investigation was that Building 94 has the potential for accumulation of gun propellant in drains that were inaccessible (NSWC Indian Head 2003). In January 2010, Building 94 and associated drain lines were demolished and removed from MRP Site AOC1.

The SI for MRP Site AOC1 included a UXO detector-aided visual survey and biased soil sampling. Twenty soil samples were submitted to the laboratory for analysis of metals, picrate, and explosive compounds.

During the 2009 SI, unexploded ordnance (UXO) technicians identified MPPEH consisting of a single suspect 20-mm cartridge casing. Explosives or picrate were not detected, and all metals were detected less than human health screening criteria and background. Selenium slightly exceeded both the ecological benchmark screening criterion (0.52 mg/kg) and background (0.44 mg/kg) in one sample with an estimated concentration 0.62 mg/kg. Selenium is not an MC associated with former use of the settling basin and may be attributed to background or agricultural runoff. Cobalt exceeded ecological screening criteria but has no available background screening criteria. The maximum cobalt result (13.4 mg/kg) only slightly exceeded the ecological screening criteria (13 mg/kg) for a sample (043AOC1SB016) collected outside of the former settling basin.

Explosives were not detected in soil samples collected from the potential source areas (at the end of the former drain line discharge area in the settling basin). Because other MC (metals) in soil were less than screening criteria, and because the single MPPEH item (half of a suspect 20-mm cartridge casing) observed outside of the former settling basin could likely be attributed to haphazard disposal, NFA is recommended for MEC or MC for AOC1.

MRP SITE AOC2 (EXPLOSIVES DROP TEST TOWER)

MRP Site AOC2, Explosives Drop Test Tower, is located at the southern terminus of 7th Street in the Seal Beach National Wildlife Refuge (NWR) (Figure ES-1). The Explosives Drop Test Tower was used from 1955 to 1977, in conjunction with former Buildings 435 and 437, to perform free-fall and guided safety drop testing on fuzes, cartridges, experimental propellants, and other low-level explosive items. Reportedly, the tower was also used for safety testing of 1.4 cartridges that pose a minor explosion hazard (Malcolm Pirnie 2008).

Engineering diagrams show that ordnance was dropped through the center of the 50-foot-tall tower into a 2.5-foot-square, 6-foot-high thick steel box for guided drop testing. The bottom of the box was reinforced with a below-ground 4-inch-thick armor plate block on top of a 3-foot-thick concrete block (Appendix A). Based on the engineering diagram, a small ball-type object the size of a large grenade was dropped into the steel box (Appendix A).

The SI for AOC2 included a UXO detector-aided visual survey as well as biased and unbiased soil sampling. Twenty soil samples were submitted to the laboratory for analysis of metals, perchlorate, and explosive compounds.

During the 2009 SI, UXO technicians identified munitions debris consisting of a blasting cap and a 2.75-inch rocket motor end cap, and metal kickout debris at MRP Site AOC2. Explosives were not detected in soils at the site. Perchlorate was detected in 11 of 20 soil samples at concentrations less than the human health screening criteria. Cadmium and lead exceeded human health and background screening criteria in 4 of the 20 samples. Cadmium and lead were detected at concentrations greater than the corresponding residential and background screening criteria. Three of 20 samples exceeded human health criteria and detected concentrations of five metals in soil (cadmium, copper, lead, selenium, and zinc) exceeded the corresponding ecological benchmarks and background screening criteria.

An RI/FS for MEC and MC is recommended for AOC2 because of the presence of an MPPEH item; evidence of free fall, or unguided, drop testing (signs posted on the tower and metal kickout debris around the tower); the distribution of subsurface anomalies around the tower; and human health, ecological, and background screening criteria exceedances for metals in soil.

TABLE ES-1: A SUMMARY OF FINDINGS AND RECOMMENDATIONS
Site Inspection Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1 and AOC2
Naval Weapons Station Seal Beach, California

Site Name	Potential Sources of Contaminants	Sample Types and Numbers	Key Findings	MEC Observations	Contaminants and Human Health Screening Criteria	Contaminants and Ecological Screening Criteria	Recommendations
MRP Site UXO1 (Primer/Salvage Yard and POLB Mitigation Pond)	▪ MEC ▪ MPPEH ▪ Metals ▪ Propellants ▪ Wood debris	▪ 14 hand-auger borings were completed to a maximum depth of 1.5 feet bgs at biased locations; ▪ Three biased and three unbiased hand-auger sediment borings were completed to a maximum depth of 1.5 feet bss in the POLB Mitigation Pond; ▪ Two biased and three unbiased surface water samples were collected 6 inches above the pond bottom; ▪ Twenty-eight biased soil samples were collected; ▪ Six biased and six unbiased sediment samples were collected; ▪ Two biased and three unbiased surface water samples were collected; ▪ All samples were analyzed for metals, TKN, inorganic nitrogen, ammonia, perchlorate, and explosive compounds.	▪ No concentrations of explosives or propellants were detected in soils at MRP Site UXO1; ▪ Fifteen suspect MEC items consisting of bomblets (suspect BLU-36 and M-40) and 75-mm cartridge casings, 91 MPPEH findings, and numerous non-munitions related debris throughout UXO1; ▪ Detector-aided visual surveys identified 441 subsurface anomalies throughout the areas surveyed in the site; ▪ The EM61-MKII geophysical survey revealed 797 target anomalies throughout the areas surveyed in the site.	▪ Suspect MEC found at the site included suspect BLU-36 and M-40 bomblets, 75-mm cartridge casings, and a 40-mm cartridge casing; ▪ MPPEH found at the site included bomblets (BLU-36 fragments and M-40 shell halves), cartridge casings (artillery, 105-mm, 75-mm, and 20-mm), fuzes, a CAD, primers, flash tubes, 81-mm mortar shipping containers, and small arms ammunition; ▪ Based on visual evidence and past practices as well as the nature, extent, and distribution of geophysical anomalies mapped at the site, the MEC risk/hazard at the UXO1 is high.	▪ Cadmium was detected in soil at concentrations greater than the corresponding residential, industrial, and background screening criteria. ▪ Lead was detected in soil at concentrations greater than the corresponding residential and background screening criteria. ▪ Perchlorate, ammonia, nitrate/nitrite-N, and TKN were detected less than the human health screening criteria.	▪ Detected concentrations of five metals in soil (cadmium, copper, lead, selenium, and zinc) exceeded both their ecological benchmarks and background; ▪ Detected concentrations of seven metals in sediment (arsenic, cadmium, copper, lead, mercury, nickel, and zinc) exceeded ecological benchmarks; ▪ Only barium and zinc were detected in surface water. Zinc concentrations were less than the ecological benchmark, and no ecological benchmark was available for barium.	▪ Based on the types and density of suspect MEC and MPPEH at UXO1, a TCRA for surface MEC is recommended for the Primer/Salvage Yard and around the embankment of the POLB Mitigation Pond. Because of the density of target anomalies detected during geophysical and UXO detector-aided visual surveys and the SI soil and sediment sampling results for metals exceeding screening criteria, the TCRA should be followed up with an RI/FS for MEC and MC.
MRP Site UXO2 (Buildings 101 and 102 and Associated Evaporation Ponds)	▪ Wash water containing Explosive D (ammonium picrate)	▪ Eighteen hand-auger borings were completed to a maximum depth of 1.5 feet bgs at biased locations; ▪ Seven hand-auger borings were completed to a maximum depth of 1.5 feet bgs at unbiased locations; ▪ Thirty-six biased and 14 unbiased soil samples were collected; ▪ All samples were analyzed for picrate, TKN, inorganic nitrogen, ammonia, perchlorate, and explosive compounds.	▪ No concentrations of explosives or picrate were detected in soils at MRP Site UXO2; ▪ Nitrate/nitrite-N and TKN were detected less than the residential and industrial human health screening criteria; ▪ Berms supporting evidence of five evaporation ponds; ▪ Trenches associated with former drain lines.	▪ MEC was not observed.	▪ All detected chemicals were less than human health screening criteria.	▪ No chemicals of potential ecological concern were detected.	▪ Because soil samples were collected from the potential source areas (former drain lines, evaporation ponds, a former concrete settling pond, and a former settling pond), and given explosives or picrate were not detected and associated breakdown products were detected less than screening levels, NFA for MEC and MC is recommended for UXO2.

TABLE ES-1: A SUMMARY OF FINDINGS AND RECOMMENDATIONS
Site Inspection Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1 and AOC2
Naval Weapons Station Seal Beach, California

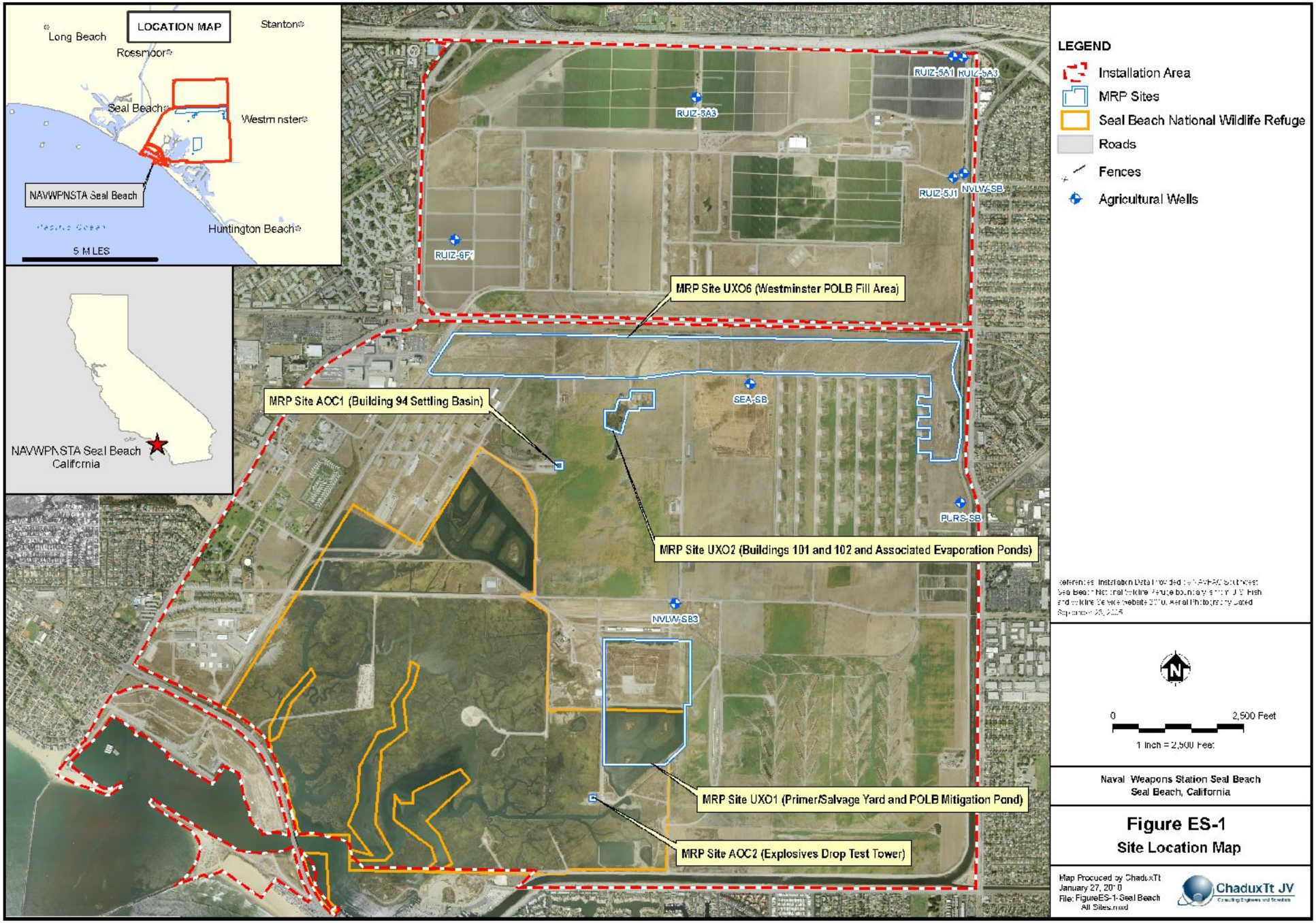
Site Name	Potential Sources of Contaminants	Sample Types and Numbers	Key Findings	MEC Observations	Contaminants and Human Health Screening Criteria	Contaminants and Ecological Screening Criteria	Recommendations
MRP Site UXO6 (Westminster POLB Fill Area)	▪ MEC ▪ MPPEH ▪ Metals ▪ Propellants ▪ Wood debris	▪ Ten hand auger soil borings were completed to a maximum depth of 1.5 feet bgs at biased locations; ▪ Twenty hand auger soil borings were completed to a maximum depth of 1.5 feet bgs at unbiased locations; ▪ Twenty biased and 40 unbiased soil samples were collected; ▪ All samples were analyzed for metals, picrate, perchlorate, and explosive compounds.	▪ No explosives or propellants were detected; ▪ Two MPPEH items were observed; ▪ Metal and rubber debris possible associated with munitions shipping containers that were also observed at MRP Site UXO1 ▪ Wood debris and scrap metal at portions of the site; ▪ Detector-aided visual surveys identified 119 magnetic or electromagnetic (EM) anomalies.	▪ Observed MPPEH included one CAD and one artillery cartridge casing. ▪ Based on visual evidence and past practices of fill placement as well as the nature, extent, and density of magnetic anomalies identified during UXO detector-aided visual surveying, the MEC risk/hazard at the UXO6 is anticipated to be from low to high.	▪ Perchlorate was detected less than the human health screening criteria; ▪ Lead was detected at concentrations greater than the corresponding residential and background screening criteria; ▪ Arsenic exceeded both residential and industrial human health screening criteria and background in one soil sample (043UXO6SB060).	▪ Detected concentrations of three metals in soil (arsenic, lead, and selenium) exceeded both ecological benchmarks and background; ▪ Arsenic exceeded both ecological benchmark screening criteria and background in only one soil sample (043UXO6SB060).	▪ Because of the MPPEH items found at UXO6 which were also found at UXO1 and the distribution of subsurface anomalies throughout the site, exceedances of screening criteria and background levels for metals in soil, and given fill material from UXO1 was likely placed at the site according to interviews, an RI/FS for MEC and MC is recommended for UXO6.
MRP Site AOC1 (Building 94 Settling Basin)	▪ Explosives wash water	▪ Ten hand auger soil borings were completed to a maximum depth of 4 feet bgs at biased locations; ▪ One exploratory hand auger soil boring was completed to a maximum depth of 5 feet bgs to determine appropriate sampling depth intervals; ▪ Twenty biased soil samples were collected; ▪ Analysis included metals, picrate, and explosive compounds.	▪ No explosives or picrate was detected; ▪ One MPPEH item was observed; ▪ The detector-aided visual survey identified 14 magnetic anomalies; ▪ The discharge location to the former settling basin and all locations of the former Building 94 drain lines.	▪ MEC was not observed; ▪ Observed MPPEH included a single 20-mm cartridge casing.	▪ All detected chemicals were less than human health screening criteria.	▪ Selenium exceeded both ecological benchmark screening criteria (0.52 mg/kg) and background (0.44 mg/kg) in one sample with an estimated concentration 0.62 mg/kg.	▪ Because soil samples were collected from the potential source area (settling basin) and explosives were not detected in soil and other MC (metals) in soil were less than screening criteria and background levels (excluding selenium and cobalt), and given the single MPPEH item (half of a suspect 20-mm cartridge casing) observed outside of the former settling basin could likely be attributed to haphazard disposal, NFA for MEC and MC is recommended for AOC1.

TABLE ES-1: A SUMMARY OF FINDINGS AND RECOMMENDATIONS
Site Inspection Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1 and AOC2
Naval Weapons Station Seal Beach, California

Site Name	Potential Sources of Contaminants	Sample Types and Numbers	Key Findings	MEC Observations	Contaminants and Human Health Screening Criteria	Contaminants and Ecological Screening Criteria	Recommendations
MRP Site AOC2 (Explosives Drop Test Tower)	▪ MEC ▪ MPPEH ▪ Metals ▪ Propellants	▪ No explosives were detected in soils; ▪ Two munitions related items (i.e., one MPPEH item and one MDAS item); ▪ Kickout debris surrounding the tower; ▪ The detector-aided visual survey identified 12 magnetic anomalies.	▪ Six hand auger soil borings were completed to a maximum depth of 1.5 feet bgs at biased locations; ▪ Four hand auger soil borings were completed to a maximum depth of 1.5 feet bgs at unbiased locations; ▪ Twelve biased and 8 unbiased soil samples were collected; ▪ All samples were analyzed for metals, picrate, perchlorate, and explosive compounds.	▪ Observed munitions related items included a 2.75-inch rocket motor end cap (MDAS) and a blasting cap (MPPEH) as well as kickout debris. ▪ Based on visual evidence and past practices as well as the nature, extent, and the distribution of magnetic anomalies mapped at the site, the MEC risk/hazard is anticipated to be low.	▪ Perchlorate was detected less than the human health screening criteria; ▪ Cadmium and lead were detected at concentrations greater than the corresponding residential and background screening criteria.	▪ Detected concentrations of five metals in soil (cadmium, copper, lead, selenium, and zinc) exceeded their ecological benchmarks and background.	▪ Because of the presence of a MPPEH item, evidence of free fall drop testing including metal kickout debris around the tower, and the distribution of subsurface anomalies around the tower, as well as human health, ecological, and background screening criteria exceedances for metals in soil, an RI/FS for MEC and MC is recommended for AOC2.

Notes:

bgs	Below ground surface	MPPEH	Material the Presents a Potential Explosive Hazard
BLU	Bomb live unit	MRP	Munitions Response Program
bss	Below sediment surface	NFA	No further action
CAD	Cartridge actuated device	POLB	Port of Long Beach
MDAS	Material documented as safe	RI/FS	Remedial Investigation and Feasibility Study
MC	Munitions constituent	SI	Site Inspection
MEC	Munitions and Explosives of Concern	TCRA	Time critical removal action
mg/kg	Milligrams per kilogram	TKN	Total Kjeldahl Nitrogen
mm	Millimeter		



Naval Weapons Station Seal Beach
Seal Beach, California

Figure ES-1
Site Location Map

Map Procured by ChaduxTt
January 27, 2010
File: FigureES-1-Seal Beach All Sites.mxd

ChaduxTt JV
Consulting Engineers and Scientists

TABLE OF CONTENTS

Appendix

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF TABLES

LIST OF TABLES (CONTINUED)

ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
%R	Percent recovery
AOC	Area of concern
bgs	Below ground surface
BLU	Bomb live unit
bss	Below sediment surface
C4	Composition C explosive
CAD	Cartridge actuated device
CCC	Criterion Continuous Concentrations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ChaduxTt	A joint venture of Tetra Tech EM Inc. and St. George Chadux Corporation
COPC	Chemical of potential concern
COPEC	Chemical of potential ecological concern
CSM	Conceptual Site Model
DID	Data item description
DGM	Digital geophysical mapping
DGPS	Differential Global Positioning System
DoD	Department of Defense
DQI	Data quality indicator
DQO	Data quality objective
DTSC	State of California Department of Toxic Substances Control
Eco-SSL	Ecological soil screening level
EM	Electromagnetic
EM61	Geonics EM61 Mark II
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ER-L	Effects Range-Low
ESO	Explosives safety officer
GPS	Global positioning system
GTD	Geophysical technology demonstration
HHRA	Human health risk assessment
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (high melting explosive)

ACRONYMS AND ABBREVIATIONS (CONTINUED)

IAS	Initial Assessment Study
ICS	Interference check sample
ID	Identification
IDW	Investigation-derived waste
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
MC	Munitions constituent
MDAS	Material documented as safe
MDL	Method detection limit
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams per kilogram
mm	Millimeter
MPPEH	Material the presents a potential explosive hazard
MRP	Munitions Response Program
MS	Matrix spike
MSD	Matrix spike duplicate
mV	Millivolts
NAD83	North American Datum 1983
NAND	Naval Ammunition and Net Depot
NAVFAC SW	Naval Facilities Engineering Command Southwest
NAVWPNSTA	Naval Weapons Station
NDAI	No Department of Defense action indicated
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NSWC	Naval Surface Warfare Center
NWR	National Wildlife Refuge
OCWD	Orange County Water District
ORNL	Oak Ridge National Laboratory
PAD	Propellant actuated devices
PDOP	Position dilution of precision
pH	A measurement of concentration of hydrogen ions in any solution (measure of acidity or alkalinity)
PM	Project manager

ACRONYMS AND ABBREVIATIONS (CONTINUED)

POLB	Port of Long Beach
PRRL	Project required reporting limit
PSI	Preliminary Site Inspection
QA/QC	Quality assurance and quality control
QL	Quantitation limit
RDX	Cyclotrimethylenetrinitramine (Royal Demolition explosive)
RI/FS	Remedial Investigation and Feasibility Study
RPD	Relative percent difference
RSL	Regional screening level
RTK	Real-time kinematic
SAP	Sampling and analysis plan
SI	Site Inspection
SOW	Statement of Work
TCRA	Time-critical removal action
TKN	Total Kjeldahl nitrogen
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded ordnance

1.0 INTRODUCTION

A joint venture between Tetra Tech EM Inc. and St. George Chadux Corporation (ChaduxTt) performed the site inspection (SI) work described in this document under an Architectural-Engineering Services Contract (No. N62473-07-D-3213 Delivery Order No. 0043). The SI scope of work included preparing plans, gathering and evaluating field data, providing the findings, and presenting recommendations regarding five Munitions Response Program (MRP) sites or areas at Naval Weapons Station Seal Beach (NAVWPNSTA Seal Beach) in Seal Beach, California (Figure 1-1). Environmental data were collected at MRP sites Unexploded Ordinance (UXO)1, UXO2, UXO6, Area of Concern (AOC)1, and AOC2 in accordance with the approved SI work plan (ChaduxTt 2009a). The data, results, findings, and recommendations are presented in this SI report.

1.1 PURPOSE OF REPORT

The purpose of the SI report is to evaluate and summarize the data collected during the SI to assess whether chemicals of potential concern (COPCs) or chemicals of potential ecological concern (COPECs) are present in soil, sediment, or surface water at the MRP sites. The SI is intended to evaluate whether these chemicals are in concentrations or quantities that may pose a threat to human health or the environment, and thus require proceeding to further evaluations. An additional purpose, for health and safety reasons, was to evaluate whether munitions constituents (MC) and munitions and explosives of concern (MEC) are also present at the MRP sites. Potential recommendations for each site could include no Department of Defense (DoD) action indicated (NDAI), further evaluation as part of a remedial investigation and feasibility study (RI/FS), or a removal action that may be a time-critical removal action (TCRA) or a non-time critical removal action.

The objectives of the MEC evaluation portion of the SI were: (1) to avoid physical hazards associated with potential MEC while the field team evaluated the presence of MC, (2) to assess whether potential MEC is present that requires further evaluation, and (3) to evaluate whether MC are present in concentrations or quantities that require proceeding to an RI/FS. These evaluations were prepared in accordance with "Guidance for Performing Site Inspections under CERCLA, Interim Final" (U.S. Environmental Protection Agency [EPA] 1992), U.S. Army Corps of Engineers (USACE) guidance on ordnance and response actions under the Defense Environmental Restoration Program (USACE 2003a), and Department of the Navy Environmental Restoration Program Manual (Navy 2006).

1.2 REPORT ORGANIZATION

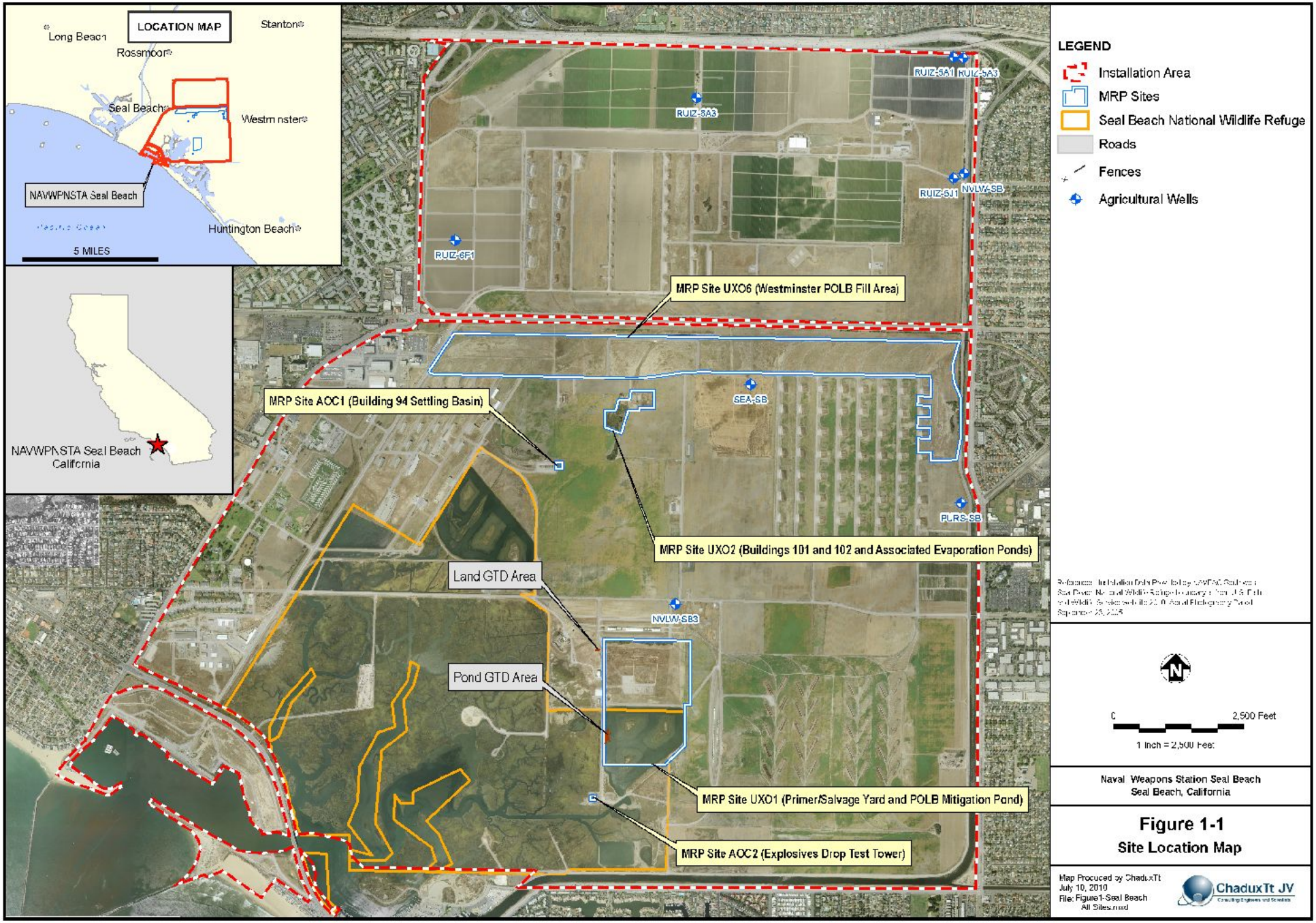
The report is organized into sections:

- Section 1.0 contains an introduction, the overall purpose, and objectives for the project and the report organization.
- Section 2.0 has a brief overview of the facility and environmental setting for the regional area and a brief summary of the previous investigation at the facility.

- Section 3.0 has an overview of the field work design and methods used in the MEC and MC field programs conducted at the MRP sites.
- Section 4.0 has a summary of the data quality review and data validation process.
- Section 5.0 describes the process for developing the conceptual site models for each MRP site.
- Section 6.0 describes the methods for the human health and ecological screening evaluation of the analytical data collected during the SI.
- Section 7.0 includes a description of the history and current condition of MRP Site UXO1 (Primer/Salvage Yard and Port of Long Beach [POLB] Mitigation Pond); a detailed discussion of the site sampling locations and depths; detector-aided survey results, geophysical survey results, and MEC findings; deviations from the work plan, if any; MC soil, sediment, and surface water sampling results; data quality review findings; a human health and ecological screening evaluation for COPCs; an updated conceptual site model; conclusions and recommendations for the site; and figures and data summary tables.
- Section 8.0 includes a description of the history and current condition of MRP Site UXO2 (Buildings 101 and 102 and Associated Evaporation Ponds); a detailed discussion of the site sampling locations and depths; detector-aided survey results; deviations from the work plan, if any; MC soil sampling results; data quality review findings; a human health and ecological screening evaluation for COPCs; an updated conceptual site model; conclusions and recommendations for the site; and figures and data summary tables.
- Section 9.0 includes a description of the history and current condition of MRP Site UXO6 (Westminster POLB Fill Area); a detailed discussion of the site sampling locations and depths; detector-aided survey results and MEC findings; deviations from the work plan, if any; MC soil sampling results; data quality review findings; a human health and ecological screening evaluation for COPCs; an updated conceptual site model; conclusions and recommendations for the site; and figures and data summary tables.
- Section 10.0 includes a description of the history and current condition of MRP Site AOC1 (Building 94 Settling Pond); a detailed discussion of the site sampling locations and depths; detector-aided survey results, geophysical survey results, and MEC findings; deviations from the work plan, if any; MC soil sampling results; data quality review findings; a human health and ecological screening evaluation for COPCs; an updated conceptual site model; conclusions and recommendations for the site; and figures and data summary tables.

- Section 11.0 describes the history and current condition of MRP Site AOC2 (Explosive Drop Test Tower); a detailed discussion of the site sampling locations and depths; detector-aided survey results, marine geophysical survey results, and MEC findings; deviations from the work plan, if any; MC soil sampling results; data quality review findings; a human health and ecological screening evaluation for COPCs; an updated conceptual site model; conclusions and recommendations for the site; and figures and data summary tables.

Site-specific figures and tables are at the end of each MRP site section. Appendices are at the end of the SI report. Appendix A has Historical Aerial Photographs and Maps; Appendix B the Geophysical Investigation Report; Appendix C soil boring logs, Appendix D a list of the suspect MEC, MPPEH, and subsurface anomalies; and Appendix E the analytical results; Appendix F has the Data Quality Review Summary Report and Appendix G the investigation derived waste (IDW) disposal documentation.



Naval Weapons Station Seal Beach
Seal Beach, California

Figure 1-1
Site Location Map

Map Procured by ChaduxTt
July 10, 2010
File: Figure1-Seal Beach All Sites.mxd

ChaduxTt JV

2.0 BACKGROUND

This section provides descriptions of the facility, regional setting, regional installation geology, regional hydrogeology, regional hydrology, ecological and environmental setting, and previous investigations pertaining to the MRP sites.

2.1 FACILITY DESCRIPTION

NAVWPNSTA Seal Beach is one of several weapons stations the Navy maintains to provide fleet combatants with ready-for-use ordnance. The installation currently serves as a supply point for more than one-half of the operating Navy and Marine Corps forces in the Pacific.

The Navy uses NAVWPNSTA Seal Beach to receive, store, and guard large quantities of explosives and ammunition and to distribute and deliver them as needed to other installations. Missiles, torpedoes, countermeasure devices, and conventional ammunition are loaded onto ships at the facility's 1,000-foot-long wharf. In addition, personnel perform maintenance on some weapons systems. On average, 60 vessels per year are loaded or unloaded (NAVWPNSTA Seal Beach, undated). There is one active small arms firing range at the installation.

In 1944, the Eleventh Naval District, Bureau of Ordnance, commissioned the naval facility at Seal Beach as the Naval Ammunition and Net Depot (NAND) Seal Beach. In 1962, the depot was redesignated as a Naval Weapons Station. The mission of NAVWPNSTA Seal Beach is to provide shore-based infrastructure support to the Navy's ordnance mission and other fleet and fleet support activities. The original depot site was approximately 3,090 acres; expansion to include a classification and segregation yard necessitated the acquisition of 1,717 additional acres. In 1972, the Seal Beach National Wildlife Refuge (NWR) was established on Naval Weapon Station land. In October 1998, the base was redesignated as Naval Weapons Station Seal Beach (Naval Facilities Engineering Command, Southwest [NAVFAC SW] 2005).

In the 1940s, NAND Seal Beach was responsible for issuing ammunition; replacing ammunition and ammunition components; and receiving, segregating, and shipping cargo of light ammunition and explosives. Because of the rapid demobilization after World War II, large quantities of ammunition were shipped to the depot during 1945 and 1946 (NAVFAC SW 2005). Ordnance production and handling facilities constructed and used during World War II and the post-World War II era typically processed munitions containing trinitrotoluene (TNT), Royal Demolition explosive (RDX), tetryl, and ammonium picrate (Explosive D). Gun propellants manufactured for World War II and throughout most of the twentieth century contained smokeless powders of nitrocellulose and nitroglycerin. The introduction of composite propellants into Naval processing facilities that typically contained ammonium perchlorate as the energetic constituent occurred after World War II (NAVFAC SW 2005).

During the Korean War, 1950 through 1953, handling of ammunition accelerated steadily. Ammunition handling operations included demilitarization of large quantities of World War II ammunition in stock. During this time, the depot constructed additional ammunition storage facilities, a static rocket test firing facility, and a fuze and detonator magazine. Between 1958 and 1962, operations at NAND Seal Beach continued to shift from conventional ammunition to

guided missiles and related components including surface-launched missiles and underwater weapons (NAVFAC SW 2005). This shift of emphasis led to the redesignation of NAND Seal Beach to the NAVWPNSTA Seal Beach in 1962. In 1966, production of surface missile systems continued with the Terrier, Tartar, and Talos missiles being produced at Seal Beach. Renovation of conventional ammunition increased during 1966. Between 1966 and 1970, ordnance production numbers decreased and two reductions-in-force had occurred (NAVFAC SW 2005).

2.2 REGIONAL SETTING

NAVWPNSTA Seal Beach is a 5,000-acre facility adjacent to the Pacific Ocean in the City of Seal Beach, Orange County, California, 26 miles south of the Los Angeles urban center. The U.S. Fish and Wildlife Service (USFWS) manages about 911 acres in the southwestern portion of the station as part of Seal Beach NWR that provides habitat for various federally and state listed species (USFWS 2007). Urban areas surrounding NAVWPNSTA Seal Beach include the cities of Huntington Beach and Westminster to the east and Los Alamitos to the north. The City of Seal Beach is adjacent to the installation to the north, south, and west. Anaheim Bay and the Pacific Ocean are adjacent to and south of the installation. The location of the installation and the sites addressed by the SI are shown on Figure 1-1.

2.2.1 Regional and Installation Geology

Surface geology at NAVWPNSTA Seal Beach includes paralic estuarine deposits (Qpe), young alluvial fan and valley deposits (Qyf), young paralic estuarine deposits (Qype), old paralic deposits (Qop), artificial fill (af), and debris fill (df) (Saucedo and others 2003). A general surface geologic map for the installation is provided in Figure 2-1.

Paralic estuarine deposits (Qpe) are late Holocene in age and consist of unconsolidated estuarine deposits composed mostly of loose to moderately dense fine-grained sand, silt, and clay. The young alluvial fan and valley deposits (Qyf) are Holocene and late Pleistocene in age and consist of gently sloping, slightly dissected alluvial fan deposits composed mostly of poorly to moderately consolidated and poorly sorted silty clay and sand. Young paralic estuarine deposits (Qype) are also Holocene and late Pleistocene in age and are unconsolidated estuarine deposits composed of mostly fine-grained sand and clay. The old paralic deposits (Qop) are late to middle Pleistocene in age and are mostly poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone, and conglomerate. These deposits rest on the now emergent wave cut abrasion platforms preserved by regional uplift. Locally, these deposits may include older alluvium (Saucedo and others 2003).

The Newport-Inglewood uplift is a major regional feature extending about 42 miles in a northwest-southeast direction from Beverly Hills in Los Angeles County to Newport Beach in Orange County. Along the coast of Orange County, the Newport-Inglewood uplift forms a belt of hills and mesas, separated by stream-cut gaps. The Newport-Inglewood fault zone parallels the coastline and runs through the southwest portion of NAVWPNSTA Seal Beach and generally forms a barrier to groundwater flow. Erosion channels filled with permeable alluvium break this barrier at the Alamitos Gap (Department of Water Resources 2003). The

Los Alamitos fault runs through the northeast portion of the installation and apparently terminates in a sharp fold.

Bedrock beneath NAVWPNSTA Seal Beach consists of a thick sequence of Tertiary and Quaternary sedimentary rocks deposited on a basement of pre-Tertiary metamorphic and crystalline rocks. Tertiary rocks range from Oligocene to Pliocene and include sandstone, siltstone, shale, and mudstone, and are almost exclusively of marine origin (NAVFAC SW 2005). Table 2.2 has a summary of the geologic formations present at NAVWPNSTA Seal Beach (Higgins and others 1984; NAVFAC SW 2005).

TABLE 2.2: SUMMARY OF NAVWPNSTA SEAL BEACH FORMATIONS

Geologic Age (Name)		Formation Name	Aquifer System	Aquifer
Holocene	–	Recent alluvium	Upper Aquifer	Perched to semiconfined water
Pleistocene	Upper	Lakewood		Exposition-Artesia, Gage
	Lower	San Pedro	Middle Aquifer	Lynwood, Silverado, Sunnyside
Pliocene	Upper	Pico	Lower Aquifer	Sunnyside
	Lower	Repetto	*No freshwater aquifer*	
Miocene	Upper	Puente		
	Middle	Topanga		
Jurassic to Cretaceous	–	Schist and granitic basement		

2.2.2 Regional Hydrogeology

Hydrogeologic information pertaining to NAVWPNSTA Seal Beach obtained from previous investigations and a regional groundwater contour study by the Orange County Water District (OCWD) show that groundwater flow direction at the station is influenced by groundwater extraction and, in the vicinity of the Los Alamitos injection barrier, by groundwater injection.

The installation is located in the western corner of the Orange County basin, overlying important confined alluvial groundwater supply aquifers of sand, gravel, and clay deposits of Pleistocene to Pliocene age (Table 2.2). There is fresh groundwater containing less than 50 parts per million chloride in aquifers east of the Newport-Inglewood fault. West of the fault, groundwater is predominantly brackish to saline. In general, groundwater flows away from the Seal Beach NWR to the northeast; however, the direction may vary seasonally (Naval Energy and Environmental Support Activity [NEESA] 1985; NAVFAC SW 2002).

The upper aquifers (75 to 200 feet deep) are no longer used for water supply. The primary freshwater aquifers at NAVWPNSTA Seal Beach are 600 to 1,000 feet below ground surfaced (bgs) and are confined by a 100- to 200-foot-thick clay layer. These aquifers correspond to the Middle (or Principal) Aquifer System of OCWD. A June 2007 OCWD report indicates groundwater elevation contours for the Middle Aquifer System at NAVWPNSTA range from about 65 to 85 feet below mean sea level and generally form a northeasterly gradient. The confined freshwater aquifers lie entirely inland from the Newport-Inglewood fault. Groundwater recharge occurs primarily from rainfall in the upgradient areas of the aquifer. Groundwater migration from the shallow semiperched aquifer to the lower aquifers is unlikely because of the thick clay layer (confining layer) that separates the deeper aquifers (Malcolm Pirnie 2008).

The confined aquifers are artesian and have historically supplied potable water to NAVWPNSTA Seal Beach and surrounding communities. Currently, groundwater on NAVWPNSTA Seal Beach is used only for agricultural irrigation. Nine agricultural production wells are reported on NAVWPNSTA Seal Beach (Figure 2-1), with six reported active in 2008. The wells are located east of MRP Site UXO1, west of MRP Site UXO6, and in the northeastern corner of the northern half of NAVWPNSTA Seal Beach (NAVFAC SW 1998a, 2002; NAVWPNSTA Seal Beach 2007).

Lateral groundwater movement in the moderately-permeable shallow aquifer is estimated to be on the order of several hundred feet per year (NEESA 1985). The hydraulic conductivity of the shallow aquifer is estimated to be about 450 feet per day, and the maximum hydraulic gradient on the station is about 7.5 feet per mile, or 0.0014. The porosity of sand and gravel ranges from 0.25 to 0.5, with an effective porosity of 0.3. With these parameters, the calculated velocity for groundwater in the shallow aquifer beneath the station is estimated at 2.1 feet per day or approximately 770 feet per year (NEESA 1985).

Depth to groundwater in the shallow aquifer underlying the installation typically ranges less than 5 feet bgs to 20 feet bgs and can be tidally influenced. Direction of groundwater flow in the shallow aquifer is generally to the northeast and varies seasonally (NEESA 1985; NAVFAC SW 1998b, 1999).

2.2.3 Regional Hydrology

Surface water at NAVWPNSTA is mostly confined in the tidal flats and wetland marshes in the Seal Beach NWR. These tidal areas are generally wet or damp, except during extended dry periods. Surface water drainage at NAVWPNSTA Seal Beach is in drainages and tidal sloughs through flat-lying clay deposits. Water floods the tidal flats during high tides. The extent of tidal flooding in the Seal Beach NWR is controlled by raised roadbeds that serve as barriers. Stream flow in drainages is intermittent and depends on rainfall and irrigation runoff.

Three major tidal subchannels branch northward from the main channel leading from Anaheim Bay. The west branch supplies water to areas west of Oil Island and to the northern portion of the Seal Beach NWR (Malcolm Pirnie 2008). Oil Island is located in the southern center of the Seal Beach NWR and connects to the Pacific Coast Highway. The middle branch supplies water to Oil Island and the area north to Bolsa Avenue. The east branch supplies water to the largest

tidal flat and the southeast portion of the Seal Beach NWR. Water is present perennially in the lower reaches of the major sloughs closer to the mouth of the bay (NAVFACSW 2002).

2.2.4 Ecological and Environmental Setting

Malcolm Pirnie (2008) identified no cultural resources in or adjacent to the boundaries of the five MRP sites in the preliminary site inspection (PSI) report. Cultural resource features have been identified in NAVWPNSTA Seal Beach, including prehistoric archeological sites and World War II and Apollo space program-era historic buildings (NAVFAC SW 2002; COUP Incorporated, undated).

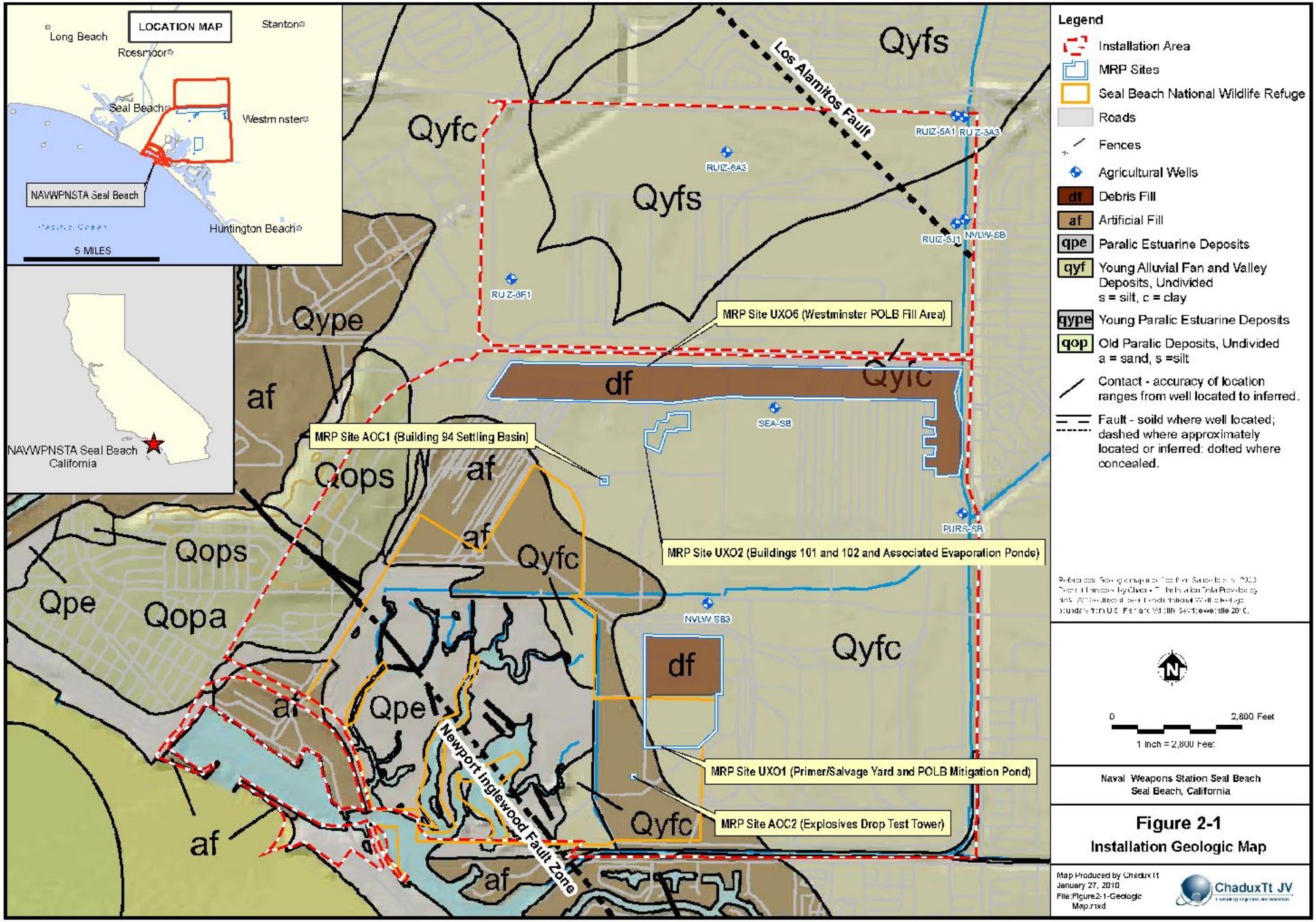
The Seal Beach NWR, one of the largest remaining salt marshes along the southern California coast, is protected in the station boundaries. About 740 acres of the 911-acre Seal Beach NWR are subject to unobstructed tidal influence, including 565 acres of salt marsh vegetation, 60 acres of intertidal mudflats, and 115 acres of tidal channels and open water. Since it was established in 1974, Seal Beach NWR's principal focus has been on protecting federally listed species and coastal wetlands used for foraging and resting by migratory waterfowl, shorebirds, and raptors that travel along the Pacific Flyway (USFWS 2007). The Seal Beach NWR supports federally and state listed sensitive, threatened, and endangered species, as listed in Section 3.1.2 (NAVWPNSTA Seal Beach 2007).

Several significant producing oil fields are in the vicinity of the installation, including the Seal Beach oil field that extends into the western portion of the installation.

2.3 PREVIOUS INVESTIGATIONS

An initial assessment study (IAS) for NAVWPNSTA Seal Beach was completed by NEESA in February 1985 (NEESA 1985). In 1989, NAVWPNSTA Seal Beach requested that NEESA update the IAS; an addendum to the IAS was issued in August 1990 (NEESA 1990). Sites addressed in the IAS and the addendum included Installation Restoration Program (IRP) Site 16 that is now part of MRP Site UXO1 (Primer/Salvage Yard and POLB Mitigation Pond), and IRP Sites 2, 3, and 36 (currently MRP Site UXO2, Buildings 101 and 102 and Associated Evaporation Ponds). Building 94, which is associated with MRP Site AOC1 (Building 94 Settling Basin), was an active building, and, therefore, not included in the IAS. The IAS recommended an SI at IRP Sites 16, 2, 3, and 36. After the SI phase, these three sites have been closed under the IRP.

A PSI for the MRP was done in 2008 (Malcolm Pirnie 2008). The study addressed all the sites included in this SI. The PSI recommended an SI for MEC and MC at MRP Sites UXO1 (Primer/Salvage Yard and POLB Mitigation Pond) and UXO6 (Westminster POLB Fill Area); and an SI for MC at MRP Sites UXO2 (Building 101 and 102 and Associated Evaporation Ponds), AOC1 (Building 94 Settling Basin), and AOC2 (Explosives Drop Test Tower).



Naval Weapons Station Seal Beach
Seal Beach, California

Figure 2-1
Installation Geologic Map

Map Produced by ChaduxTt
January 27, 2010
File:Figure2-1-Geologic Map.mxd

ChaduxTt JV

3.0 FIELD WORK DESIGN AND METHODS FOR MRP SITES

This section contains a summary of the design and methods for the MC and MEC investigations at the MRP sites.

3.1 PRELIMINARY ACTIVITIES

Preliminary activities for the site investigation at the MRP sites included MEC avoidance measures and biological avoidance and minimization measures as described in the SI work plan (ChaduxTt 2009a).

3.1.1 MEC Avoidance Measures

As described in the SI work plan, MRP Sites UXO1, UXO2, UXO6, AOC1, and AOC2 required procedures to avoid disturbing suspect MEC during the SI field work because of the potential to encounter live explosively configured or fuzed munitions or explosives residue in soil at concentrations high enough to pose explosive hazard. Qualified UXO technicians were present during field work at all the sites to provide clearance before sampling and to assist with clearing and restricting work areas, establishing necessary controls, and protecting personnel on-site. The UXO technicians screened work areas and sampling locations with a Schonstedt Magnetic Locator GA-52Cx (magnetic gradiometer). A Whites spectrum XLT detector was also used for Primer/Salvage Yard at UXO1 and UXO6 since bomblets with only a small component of ferrous metal were identified at the Primer/Salvage Yard. A Schonstedt magnetic gradiometer was used to clear the sediment sample locations collected in the POLB Mitigation Pond at UXO1 since munitions debris observed in and around banks of the pond were ferrous. The gradiometer was partially submerged in the pond to clear these sample locations. The gradiometer was lowered into the hole for clearance for soil borings at AOC1 before each 2-foot interval was advanced down to a maximum of 5 feet bgs. If an anomaly was detected, the surface soil sampling location or soil boring was moved to an adjacent location that was free of anomalies.

Security was maintained at each site to ensure that non-essential personnel did not access the exclusion zone during the MEC detector-aided surface sweep or UXO avoidance operations. All activities involving work in areas potentially containing MEC hazards were conducted in full compliance with the SI work plan in terms of personnel, equipment, and procedures.

3.1.2 Biological Avoidance and Minimization Measures

Biologists have documented federally listed and state listed endangered and threatened species and California Department of Fish and Game (CDFG) species of concern in NAVWPNSTA Seal Beach. The Seal Beach NWR, one of the largest remaining salt marshes along the southern California coast, is protected within the station boundaries. A summary of the protected species documented, particularly in the Seal Beach NWR, is listed below.

Federal and State Endangered

- California least tern (*Sterna antillarum browni*)
- Light-footed clapper rail (*Rallus longirostris levipes*)

Federal Threatened

- Western snowy plover (*Charadrius alexandrinus nivosus*)
- Green sea turtle (*Chemonia mydas*)

Federally Protected

- Bald eagle (Haliaeetus leucocephalus)
- Golden eagle (*Aquila chrysaetos Canadensis*)

State Endangered

- Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)

CDFG Species of Concern

- American white pelican (*Pelecanus erythrorhynchos*)
- Black skimmer (*Rynchops niger*)
- Black tern (*Chlidonias niger*)
- Brant (*Branta bernicula*)
- Burrowing owl (*Athene cunicularia*)
- California gull (*Larus californicus*)
- Common loon (*Gavia immer*)
- Cooper's hawk (*Accipiter cooperii*)
- Double-crested cormorant (*Phalacrocorax auritus*)
- Elegant tern (*Thalasseus elegans*)
- Ferruginous hawk (*Buteo regalis*)
- Large-billed savannah sparrow (*Passerculus sandwichensis rostratus*)
- Loggerhead shrike (*Lanius ludovicianus*)
- Long-billed curlew (*Numenius americanus*)
- Merlin (*Falco columbarius*)
- Mountain plover (*Charadrius montanus*)
- Northern harrier (*Circus cyaneus*)

- Osprey (*Pandion haliaetus*)
- Prairie falcon (*Falco mexicanus*)
- San Diego black-tailed jackrabbit (*Lepus californicus bennettii*)
- San Diego horned lizard (*Phrynosoma coronatum blainvillii population*)
- Sharp-shinned hawk (*Accipiter striatus*)
- Short-eared owl (*Asio flammeus*)
- Tricolored blackbird (*Agelaius tricolor*)
- Western snowy plover (*Charadrius alexandrinus nivosus*)
- White-faced ibis (*Plegadis chihi*)
- Yellow warbler (*Dendroica petechia brewsteri*)

No endangered or threatened species was expected to be present at any site during the SI field investigation. Species of particular concern were ground-nesting and burrowing birds that may occur on all five sites. Before field work began, the NAVWPNSTA Seal Beach biologist and the Seal Beach Wildlife Refuge Office, represented by USFWS, were notified of the field work schedule and activities. The installation biologist did preliminary site walks at each site to ensure that ground nests and species of concern were not present in sampling and access areas.

ChaduxTt did field work at the five MRP sites between November and December 2009 to avoid the breeding season for the following potential ground nesting species: mourning dove (*Zenaida macroura*), horned lark (*Eremophila alpestris*), killdeer (*Charadrius vociferous*), and burrowing owl (*Athene cunicularia*). The breeding season for these ground-nesting species is generally between March and September.

During the SI field work, ChaduxTt adhered to general installation practices to avoid impacts to these species and other ecological receptors on the NAVWPNSTA Seal Beach. General installation practices include minimizing brush clearance and off-road vehicle and foot traffic access routes. Only 12 sediment samples from six locations and five surface water samples were collected from the POLB Mitigation Pond at MRP Site UXO1 using a non-powered raft and clean and decontaminated sampling equipment. Equipment was not staged, samples were not collected, and equipment was not decontaminated in areas where wildlife activity was observed.

3.2 MEC INVESTIGATION

As part of the MEC investigation for the SIs, detector-aided visual surveys were conducted at each MRP site (UXO1, UXO2, UXO6, AOC1, and AOC2). Geophysical surveys were conducted at geophysical technology demonstration (GTD) test areas (Figure 1-1) and MRP Site UXO1 to locate suspect buried MEC. This section has a summary of the methodology, analysis, and QC procedures implemented for each survey.

3.2.1 Detector-Aided Visual Survey

Qualified ChaduxTt UXO technicians did visual and detector-aided surface sweeps at the five MRP sites (UXO1, UXO3, UXO6, AOC1, and AOC2) and in support of the GTD and geophysical surveys at MRP Site UXO1.

The UXO team did visual and detector-aided surface sweeps for the GTD test area to confirm that the area did not contain suspect MEC or ordnance-related material. This sweep was done before the GTD test plot location was selected and seeded with test items. A Schonstedt Magnetic Locator GA-52Cx (magnetic gradiometer) was used during the detector-aided visual surveys at the MRP sites to aid in locating surface and near-surface ferrous metal debris. A Whites spectrum XLT detector was also used for detector-aided visual surveys at the Primer/Salvage Yard of UXO1 and UXO6 since bomblets with only a small component of ferrous metal were identified at the Primer/Salvage Yard.

The Schonstedt Magnetic Locator GA-52Cx has two fixed fluxgate magnetic sensors, 20 inches apart, that are passed close to and over the ground. Audible frequency of the sound emitted from the instrument is a function of the magnetic field gradient between the two sensors. When it is far from a magnetic object, where the instrument is primarily detecting the earth's magnetic field, it emits a low-frequency audible sound. When the instrument passes over buried iron-containing objects, the magnetic field is significantly different at the two sensors, and the frequency of the emitted sound increases. The Whites spectrum XLT detector uses electromagnetic induction (an active source) to locate both ferrous and non-ferrous metals. The all-metals detector required field calibration. Calibration settings for the Whites spectrum XLT are in the SI work plan (ChaduxTt 2009a). Like the Schonstedt, the Whites detector provides an audio signal for response, but does not store data.

Both the magnetic gradiometer and all-metals detector can be used to detect anomalies to approximately 2 to 3 feet bgs, depending on the material, size, depth, and orientation of the object as well as the strength of the background noise. As a general rule, the maximum detection depth is determined from U.S. Army Corps of Engineers (USACE's) 11x rule, which is 11 times the diameter of the munition.

Detector-aided visual surveys were done along parallel traverses (survey lines) spaced 5 feet apart (100 percent coverage) over the GTD test plot and accessible areas of MRP Sites AOC1 and AOC2. Detector-aided visual surveying was done along transects nominally spaced 40 feet apart at MRP Site UXO1 and 60 feet apart at MRP Site UXO6. The POLB Mitigation Pond geophysical survey area at MRP Site UXO1 did not require detector-aided visual surface sweeps since the geophysical survey was conducted over the pond where the floatable sensor platform was located, and survey personnel did not tread on or come in contact with the pond bottom.

If a suspect MEC item was encountered during the surface sweeps, it was flagged, photographed, and its location was recorded with the sub-meter accuracy Trimble ProXRS differential global positioning system (DGPS), and the UXO team assessed its condition before the sweep proceeded. The UXO team attempted to establish a suspect item's condition, if possible without moving or disturbing it, before the sweep proceeded. After each area was surveyed by the UXO

team, the UXO quality control (QC) specialist screened the areas to ensure that every item was properly identified and that no items were overlooked.

A simulated 20-millimeter (mm) projectile was buried 0.5 foot bgs and a simulated 40-mm projectile was buried 1 foot bgs at each MRP site before detector-aided visual surveying began to evaluate the instrument response associated with larger and smaller MEC. The UXO technicians buried each test item in an anomaly-free location in each site that has no visual indication of MEC or MPPEH at the surface. The location of each buried test item at each site was mapped with a DGPS. Once the seed items were detected and the instruments were verified to function properly, the seeds were removed and the holes were backfilled with the soil removed from the hole. The detectors were checked daily before detector-aided surface sweeps began and after any battery change. The normal daily instrument check for detector-aided surface sweep operations consisted of moving the sensor over small surface or near surface metal objects.

3.2.2 UXO Escort Operations

ChaduxTt UXO escorts were present to enforce MEC avoidance measures for field work at MRP Sites UXO1, UXO2, UXO6, AOC1, and AOC2. The UXO escort used a hand-held magnetic gradiometer (Schonstedt Magnetic Locator GA-52Cx) to check each proposed sample location for possible metallic ordnance or ordnance-related material for the five MRP sites. A Whites spectrum XLT detector was also used for the Primer/Salvage Yard at UXO1 and UXO6 to clear sampling locations. The UXO escort clearly marked the location containing visible ordnance or suspect MEC with plastic pin flags, and these areas were avoided. The UXO escort was to report any UXO or suspect MEC to the project manager (PM) or his designee, and no ordnance, munitions, explosives, or ordnance-related materials were to be moved, removed, detonated, or disposed of during UXO escort duties.

The locations of all stakes used to delineate site boundaries, soil borings locations, surface soil sample locations, benchmarks, and daily geophysical instrument test locations were cleared by the UXO escort using the gradiometer before any stakes were driven or any groundbreaking activity occurred. Proposed soil sample locations (0 to 1.5 feet bgs) were cleared at the ground surface using the magnetic gradiometer or all-metals detector. The gradiometer was lowered into soil borings to clear at 2-foot intervals down to 5 feet bgs at MRP Site AOC1 where soil samples were collected from below the tilled or disturbed soil horizon. A Schonstedt magnetic gradiometer was used to clear the sediment sample locations collected in the POLB Mitigation Pond at MRP Site UXO1. The gradiometer was partially submerged in the pond to clear the sediment sample locations. If a magnetic anomaly was detected where any groundbreaking activity, such as hand-auguring, soil sampling, or stake driving was proposed, the location was moved to an area clear of anomalies.

3.2.3 Geophysical Investigations

This section describes in detail the approach, methods, and operational procedures used to collect geophysical data to identify subsurface electromagnetic (EM) anomalies at MRP Site UXO1. The geophysical data collected at the sites were used to identify anomalies potentially associated with MEC and to aid in selection of biased soil sampling locations. The following discussion documents the site-specific application of the geophysical sensors, navigation equipment, data

analysis, data management, and associated equipment that were used to meet the site-specific data quality objectives (DQO) and project performance goals.

The geophysical investigation conducted for this SI included (1) two GTDs (one on land and one in the POLB Mitigation Pond) to evaluate geophysical surveying techniques, personnel, and survey design; and (2) geophysical surveys that were done to evaluate the potential presence of MEC in the Primer/Salvage Yard and POLB Mitigation Pond at MRP Site UXO1. Additional details regarding the GTD and the geophysical investigation are in Appendix B.

3.2.3.1 Geophysical Technology Demonstrations

The SI field program for MEC at NAVWPNSTA Seal Beach was designed to address site-specific concerns. Two GTDs were performed to evaluate geophysical surveying techniques, personnel, and survey design that apply to the Primer/Salvage Yard and POLB Mitigation Pond at MRP Site UXO1. The land GTD area was selected in a relatively flat area that represented typical site conditions, soils, and terrain encountered at the Primer/Salvage Yard at UXO1. This area was selected by ChaduxTt and approved by the Navy before the SI geophysical mobilization. The land GTD test plot was selected in an area approximately 150 feet west of UXO1 (Figure 1-1). The water GTD area was selected in an area free of MEC and anomalies in the western portion of the POLB Mitigation Pond. Both GTD areas were known to be clear of underground utilities, and a dig permit was acquired from the Navy before mobilization for the geophysical survey.

The elements of the GTD field effort included UXO sweep and anomaly avoidance and digital geophysical mapping (DGM) data collection and analysis. A more detailed description of the GTDs is in the geophysical evaluation report (Appendix B) prepared by GEOVision Geophysical Services, Inc (Geovision). Under the supervision of the Geovision and ChaduxTt project geophysicists, Geovision collected, processed, and interpreted geophysical data for the land and marine GTDs.

All UXO sweep and avoidance and geophysical surveys were done in accordance with all local, state, and federal regulations, and included general guidance from applicable USACE data item description (DID) requirements, including Engineer Pamphlet EP-75-1-2 (USACE 2004), DID MR-001 (USACE 2003c), DID MR-005-05A (USACE 2003d), DID MR-005-05 (USACE 2003e), and DID MR-005-07 (USACE 2003f). Additional applicable guidance was provided in Ordnance and Explosives Digital Geophysical Mapping Guidance – Operational Procedures and Quality Control Manual (USACE 2003g).

The GTDs were done to evaluate the geophysical instrumentation, survey personnel, data collection processes and procedures, and data analysis processes and procedures. Results of both GTDs are in Appendix B.

3.2.3.2 Objectives

The specific objectives for the GTDs were:

- Demonstrate that the geophysical investigation systems and equipment are operating properly.
- Provide a safe test location, representative of the sites, with a known set of isolated objects (such as inert munitions or munitions surrogates). The sensor response from these items was used to evaluate the equipment limitations within site conditions and to optimize equipment, procedures, and data analysis.
- Assess the operators' performance and update related procedures to assist in development of operator measurement techniques.
- Establish a baseline of performance capabilities for the selected instruments.
- Evaluate all data processing, including corrections, map production, latency, and target selection, used to produce final datasets.
- Evaluate detection depth capabilities.
- Detect at least three of four buried test items.
- Yield no more than 15 percent false positives (anomalies identified that were not seed items or detected during the pre-seeded geophysical survey).
- Identify horizontal positions of detected test items within 3 feet of known locations.

3.2.3.3 Geophysical and Navigation Equipment and Rationale for Selection

The EM61-MKIIA (EM61) was selected for the geophysical surveys because it is capable of detecting both ferrous (iron or steel) and non-ferrous (for example, aluminum or brass) metal targets. Records of the types of ordnance items that may have been disposed of at MRP Site UXO1 are limited. In addition, suspect MEC items with only a small amount of ferrous metal were identified at the sites during the site visits before project planning for the SI. The EM61 was hand-towed or pushed on land and towed on an inflatable raft approximately 16 feet behind a Mercury Hypalon 430XD Inflatable Boat in the POLB Mitigation Pond. Two fiberglass tow rods were mounted on the support struts of the EM61 bottom coil and attached to a ball hitch mounted on the boat for the boat-towed configuration.

The EM61 is a time-domain EM instrument. The EM61 generates 150 EM pulses per second and measures during the off time between pulses. After each pulse, secondary EM fields are induced briefly in moderately electrically conductive soils and for a longer time in metallic objects. The EM61 waits between each pulse until the response from the conductive medium (subsurface) dissipates and then measures the prolonged response from the buried metal. This response is recorded in millivolts (mV). By sensing only the buried metal response, the EM61 detects metallic targets that might otherwise be missed or masked by background response. The EM61 is able to detect all types of metallic objects, not just ferrous material. This

capability is important to detect potential targets at the sites that are likely to contain more aluminum than iron or steel (such as pyrotechnics). The EM61 measures multiple time gates (216, 366, 660, and 1,266 microseconds) to provide a more complete measurement of the response decay rate. As a general rule, the maximum detection depth for the EM61 determined from USACE's 11x rule is 11 times the diameter of the munition. The EM61 can record up to 12 readings per second with up to four time gates or channels. The sampling rate for the EM61 for both GTD surveys and site surveys was 10 readings per second to provide high resolution of smaller anomalies that may be associated with MEC. Data were collected along 50-foot long transects spaced 10 feet apart for the land GTD and along widely spaced transects for the Primer/Salvage Yard survey. Data were collected along meandering transects for the water GTD and along meandering transects nominally spaced 5 feet apart for the POLB Mitigation Pond survey.

The EM61 was pulled by hand towing or boat towing according to the field procedure outlined in Appendix B. The GPS used to provide the northing and easting coordinates for the EM61 data was a Trimble R8 GNSS Real-Time Kinematic (RTK) differential GPS system. The RTK GPS provides 8-inch accuracy. A base receiver was set up at a known location (base station) within the fenced IDW yard located north of MRP Site UXO1 and used to broadcast corrections to the rover receiver used in the field. The base receiver was connected to an external radio transmitter to increase the range and strength of the broadcasted signal.

For general surveying, establishing local base stations, and verification of GPS accuracy, the rover receiver was mounted on a 2-meter carbon fiber rod, and a Trimble TSC2 data collector was used to store GPS data. During the geophysical investigation, the rover receiver was placed on a tripod antenna mount on top of the EM61. The center of the antenna mount was positioned directly over the center of the EM61 coils for both the boat-towed and hand-towed configurations. The receiver antenna features an internal radio that received the remote base station corrections. The serial port on the receiver antenna was used to output a National Marine Electronics Association (NMEA) data stream directly into a field computer through a serial cable. This data stream consisted of corrected, geodetic GPS coordinates and GPS data statistics. The NMEA stream was integrated in real time into the EM61 data stream. The resultant output file is a combination of EM61 data and DGPS locations.

All GPS data were converted to California State Plane, North American Datum 1983 (NAD83), Zone VI (0406) in US survey feet using Corpscon 6.0.1 developed by the USACE. Photographs of the EM61 configuration and field data collection are in Appendix B. In addition to the RTK GPS used to measure the locations of EM61 data, the ChaduxTt project geophysicist used a sub-meter accuracy Trimble ProXRS DGPS during boat-towed EM61 data collection in the POLB Mitigation Pond to assess real-time coverage.

3.2.3.4 Land-Based Geophysical Technology Demonstration Design and Methods

ChaduxTt selected the land-based GTD test plot area approximately 150 feet west of MRP Site UXO1. The UXO team first visually inspected and screened the area with a Schonstedt GA-52Cx magnetic locator (magnetic gradiometer). After the UXO technicians swept the area, three 50-foot long transects spaced 10 feet apart were established over the area by laying out

rope and marking the corners with plastic pin flags. After the transects were screened and staked by the UXO technicians, Geovision surveyed the transects with the EM61 to determine if there were any anomalies related to suspect MEC or utilities that could mask anomalies associated with the seeded test items. This pre-seed survey was also conducted to establish background readings over the test plot area to be compared with the seeded GTD survey results. The sampling rate for the EM61 for the GTD was 10 readings per second.

The UXO team leader directed establishment of the GTD test plot according to the specifications provided by the ChaduxTt project geophysicist. The location and depth of each test plot item were documented along with the item identification number, type or size, and orientation. Based on a review of available site information, and to the extent practical, ChaduxTt UXO personnel seeded surrogate items similar in shape, size, and mass to MEC items suspected at MRP Site UXO1. After the pre-seed geophysical survey had been completed, four surrogate items were seeded along the GTD transects at varying depths and orientations. Two surrogate 40-mm cartridge casings were seeded 4 inches and 8 inches bgs and two surrogate bomb live unit (BLU)-36 bomblets were each seeded at 8 inches bgs. Pictures of the seed items used for the GTD are in Appendix B. Each seeded item was located using the RTK GPS to identify its position along the GTD transects. The center or ends of each seeded target were surveyed using the GPS. The surveyed target locations were used to establish the proximity of the target locations made by Geovision, documented on a Seeded Items Detection List, to the actual target locations. ChaduxTt reviewed the GTD Seeded Items Detection List and preliminary EM61 data maps and gave approval to proceed with the geophysical investigation at the Primer/Salvage Yard at MRP Site UXO1. After the geophysical survey had been completed at the Primer/Salvage Yard, the UXO team dug up seed items and backfilled the holes with the soil removed from the hole.

3.2.3.5 Marine Geophysical Technology Demonstration Design and Methods

ChaduxTt selected the marine GTD test plot area in the western portion of the POLB Mitigation Pond at MRP Site UXO1. The UXO team first visually inspected and screened the boat launch area with a Schonstedt magnetic gradiometer. After the UXO technicians had screened the boat launch area, Geovision surveyed along meandering transects with the EM61 to determine if there were any anomalies related to suspect MEC or utilities that could mask anomalies associated with the seeded test items. This pre-seed survey was also conducted to establish background readings over meandering transects in the test plot area to be compared with the seeded GTD survey results. The sampling rate for the EM61 for the marine GTD was 10 readings per second.

The UXO team leader directed establishment of the GTD test plot according to the specifications provided by the ChaduxTt project geophysicist. The location and depth of each test plot item were documented along with the item identification number, type, or size. Based on a review of available site information, and to the extent practical, ChaduxTt UXO personnel seeded surrogate items similar in shape, size, and mass to MEC items suspected at MRP Site UXO1. After the pre-seed geophysical survey was complete, four surrogate items were placed at the bottom of pond in the GTD area at varying depths and orientations. Two surrogate 40-mm cartridge casings were placed approximately 24.5 inches and 38 inches below the water surface and two surrogate BLU-36 bomblets were placed approximately 23 inches

and 37 inches below the water surface. Pictures of the seed items used for the GTD are in Appendix B. Rope with 20 to 30 feet of slack was attached to each seed item with a tennis ball tied at the end to allow for the items to be relocated and removed after the GTD area and the production area in the pond had been surveyed. The offset between the floating tennis balls and the seed item locations ensured the data acquisition team and the data analyst were blind to the GTD seed item locations during data collection, processing, and interpretation. Each seed item was located using the RTK GPS to identify its position in the GTD area. The center or ends of each seeded target were surveyed using the RTK GPS. The surveyed target locations were used to establish the proximity of the anomaly locations selected by Geovision, documented on a Seeded Items Detection List, to the actual target locations. ChaduxTt reviewed the GTD Seeded Items Detection List and preliminary EM61 data maps and gave approval to proceed with the geophysical investigation at the production area in the pond. After the geophysical survey had been completed at the POLB Mitigation Pond, the UXO team removed the seed items.

3.2.3.6 Geophysical Survey Design and Methods for MRP Site UXO1 Primer/Salvage Yard

Geophysical surveying was conducted over the Primer/Salvage Yard at MRP Site UXO1 using the EM61 with integrated RTK GPS. Transects were surveyed over accessible portions within and outside of the fenced area. Areas that contained overhead power lines and flagged locations of surface suspect MEC and MPPEH items were avoided to maximize subsurface target detections as well as to minimize surface metal debris clutter detection and background noise. Data were collected along meandering transects ranging from 20 to 330 feet apart with a sample rate of 10 readings per second. Survey transects were nominally spaced 2.5 feet apart (100 percent coverage) over the accessible southwestern portion of the Primer/Salvage Yard (the northwest embankment of the POLB Mitigation Pond) where multiple artillery cartridge casings were protruding from the embankment. A single hand-towed EM61 was pushed to survey all land-based transects.

A UXO technician swept in front of the EM61 operator during surveying along the transects. Suspected surface MEC sighted by the UXO team were marked with plastic pin flags before and during the geophysical survey and were avoided by the geophysical survey team. The ChaduxTt project geophysicist walked with a DGPS behind the UXO technician and in front of the EM61 operator during geophysical surveying to guide coverage across the site.

3.2.3.7 Geophysical Survey Design and Methods for MRP Site UXO1 POLB Mitigation Pond

Geophysical surveying was done over the northwest portion of the POLB Mitigation Pond at MRP Site UXO1 using the EM61 with integrated RTK GPS. The POLB Mitigation Pond survey area is just south and east of the northwest embankment where multiple artillery cartridge casings were protruding from the embankment. The EM61 was towed on an inflatable raft approximately 16 feet behind a Mercury Hypalon 430XD Inflatable Boat for the POLB Mitigation Pond survey. Data were collected along transects nominally spaced 5 feet apart and along meandering transects to fill in data coverage using a sample rate of 10 readings per second. A UXO technician swept the boat launch area using a Schonstedt magnetic gradiometer before surveying began. The ChaduxTt project geophysicist used a sub-meter accuracy Trimble

ProXRS DGPS during boat-towed EM61 data collection in the POLB Mitigation Pond to assess real-time coverage.

3.2.3.8 Geophysical Data Processing, Analysis, and Interpretation

This section summarizes data processing, analysis, and interpretation procedures for the geophysical data collected at the GTD test areas and MRP Site UXO1 survey areas. The data processing sequence and resulting data files are in Appendix B and are retained in project files. Additional details on data processing, analysis, and interpretation for the GTDs and UXO1 are also in Appendix B.

Geophysical data were collected using a hand-towed EM61 with RTK GPS control. GPS data were collected and merged with the EM61 data stream. Preprocessing these EM61 data included loading raw data files (with GPS control) into TrackMaker61MK2 software and exporting the files to geodetic files. Geovision's in-house software utility was used to screen the .ASC data file and document position dilution of precision (PDOP) ranges, number of satellite ranges, GPS quality ranges, distance between GPS measurements, and related information, to demonstrate that GPS dropouts did not occur during surveying. A time shift (0.35 second for boat towed and 0.30 second for hand towed) was applied to geodetic XYZ file in TrackMaker61MK2 to correct for GPS latency. Corpscon software was used to convert geodetic coordinates to state plane coordinates (NAD83, Zone VI [0406], U.S. survey feet). Data files were loaded into Geosoft Oasis montaj v7 software and placed in a dynamically linked database that was used to plot features to review data files and to document maximum background response for EM61 channels 1, 2, and 3 (CH1, CH2, CH3, and CH4 data).

Geovision used an in-house rolling statistics software utility to dedrift data files. Dedrifting was done with user-defined maximum backgrounds for CH2 and CH3, a 300-point filter, first quartile to represent drift, 25 percent of values in window below maximum background to calculate desired statistical parameters, and a 51-point smoothing filter applied to estimate the final drift curve. The dedrifted EM61 data files were merged into a single .XYZ data file. The EM61 channel data (CH2 and CH3 data) were then summed to optimize resolution of smaller anomalies associated with smaller GTD seed items and smaller MEC items (such as bomblets) observed at UXO1. Channels 1 and 4 were not used in the summation because they exhibited significant drift that could not be effectively corrected.

The summation of CH1 to CH3 data was gridded with a 0.5-foot grid cell size and 2.5-foot blanking distance (or interpolation radius). Color zone files describing the color for different data ranges were then generated.

The Blakely Test (Blakely algorithm) in Oasis montaj was used to automatically pick targets (EM61 response grid peaks) with an 8-mV threshold from the gridded EM61 data. This threshold was chosen considering the level of background noise in the EM61 data, because small MEC items could be present in the survey areas, and based on the anomaly responses evaluated during the GTD. After the anomalies had been selected or rejected, final maps were produced. All EM61 data were processed, gridded, and QC reviewed in Oasis Montaj by Geovision and by the ChaduxTt project geophysicist.

The offsets of the target picks to the known location of the seed items mapped with the GPS were reviewed to ensure GTD objectives were met for both land-based and marine GTDs. GTD data results were QC reviewed by the ChaduxTt project geophysicist using Oasis montaj software with UX-Detect to ensure all GTD objectives outlined in Section 3.2.3.2 were met before the geophysical surveys began in the land and pond production areas.

3.2.3.9 Geophysical Quality Control Procedures

Operational and test procedures were implemented to conform to the USACE QC test guidance. QC of the instruments' data was done daily by field testing and checking the sensor and navigation system against a known target to ensure that they were operating properly. Geophysical instruments and equipment used to gather and generate field data were calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of the results are consistent with applicable manufacturer's specifications. Data processing QC review was also done to assure data quality.

The following sections detail the quality assurance and quality control (QA/QC) measures implemented for the geophysical investigation. All QA/QC results are in Appendix B.

3.2.3.9.1 Equipment Standardization

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. Table 3-1 shows the tests, required frequencies, and the acceptance criteria. These tests plus the initial out-of-box tests are detailed below.

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 GTD test plot area began:

- Inventoried and inspected all equipment to confirm all 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 done more frequently, such as 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 caused by thermal stabilization. Most instruments need a few minutes to warm up before data collection begins. Manufacturer instructions were followed, and when necessary, data readings were observed until they stabilized. Acceptance Criterion: Equipment specific (typically 5 to 15 minutes). This test was done each time the EM61 was started.

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 surveys were repeatable. Acceptance Criterion: ±1 inch. This test was done 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 and explosives targets. All personnel who were to come near the EM61 during survey operations had to approach the sensor and have a second person monitor and record the results. Acceptance Criterion: EM61 ± 2 mV. This test was done 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 all 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 done at the beginning of each day.

Static Background and Static Spike (or Standard Response) Test. These tests were conducted to quantify EM61 background readings and electronic drift, locate potential interference spikes in the time domain, and determine impulse response and repeatability of the EM61 to a standard test item (a circular 5-pound weight). Improper instrument function, the presence of local sources of ambient noise (such as EM transmissions from high-voltage electric lines), and faulty equipment are all potential causes of inconsistent, non-repeatable readings. A minimum 3-minute static background test was done after instrument warm-up, followed by a 1-minute standard response test, followed by an additional 1-minute static background test. The Field Geophysicist reviewed the readings to confirm they were stable before the geophysical survey continued. Acceptance Criteria: Static background test EM61 ±2.5 mV; static response test EM61 ±20 percent of standard item response after background correction. These tests were done at the beginning and end of each day and often before the EM61 was turned off at any point in the day. Every time the EM61 was turned back on, it was warmed up and nulled again. Static-test base stations were established adjacent to each survey area before geophysical data acquisition began. These locations were screened by the EM61 and on-site UXO personnel using a magnetic gradiometer (Schonstedt) to ensure that there were no surface or buried metallic objects before any wooden stakes or ground impressions were advanced to provide standard response test item and EM61 wheel locations.

Pull-Away Test. This test was used to demonstrate the effects of the navigational equipment. During this test, all equipment was powered up and operated as it would be during the survey. Acceptance Criterion: Document the effects of the navigational equipment on the geophysical readings (effects were to be small).

The Pull Away Test or Personnel Test was performed while EM61 data were continuously collected. The operator initially started in the normal operating position. The operator was positioned at the handle of the EM61 for the hand towed setup. For the boat-towed configuration, the operator was in the boat. During data collection, the operator moved away from the EM61 by driving the boat or walking away from the EM61.

RTK GPS Positioning. Several survey monuments (109, 110, 111, and 112) in NAVWPNSTA Seal Beach were occupied with the RTK GPS system daily to verify that GPS positioning was within 8 inches. The RTK GPS was set up on 111 for the initial QC test using a fixed-height tripod and an external transmitter. The GPS rover receiver was used to occupy 109, 110, and 112 to document GPS accuracy. The GPS rover receiver was mounted on a 2-meter carbon fiber pole during QC testing. A temporary survey control point was established inside the fenced IDW yard. This location served as the base station.

The GPS coordinates were compared with the documented coordinates for the control points. Acceptance Criterion: Maximum ±8 inches.

Beginning of Each Day Tests

These tests were done at the beginning of each day. (Static background and static standard response tests were also done at the end of each day, and the equipment warm-up and instrument null for the EM61 were done each time the equipment was powered up.)

- Warm up equipment and electronics
- Record relative sensor positions
- Null the EM 61 before the remaining tests are performed
- Conduct personnel test
- Conduct cable shake test
- Conduct static background and static standard response (static spike) test.

3.3 MC INVESTIGATION

As part of the MC investigation for the SIs, soil samples were collected at each MRP site (UXO1, UXO2, UXO6, AOC1, and AOC2) and sediment and surface water samples were collected at MRP Site UXO1. The following provides a summary of the methodology, analysis, and QC procedures implemented for the MC sampling program.

3.3.1 MC Sampling Design

The investigation at the MRP sites was designed to characterize the soil, sediment, and surface water, to determine if COPCs or COPECs are present from historical disposal operations, and to assess whether munitions, MEC, and MC are present.

3.3.2 Sampling Method

In accordance with the work plan (ChaduxTt 2009a), the general sampling approach for the MRP sites involved the use of a combination of biased and random grid sampling methods. The random grid sampling provided adequate lateral coverage at the MRP sites where the presence or extent of contamination was unknown. The biased sampling method used sample locations where historical information, geophysical surveys, or detector-aided visual survey sweeps indicated evidence of suspect MEC and MC deposition and other practices involving MEC that would result in contamination. Surface and subsurface samples were collected from soil and sediment (at MRP Site UXO1 only) borings at these locations to evaluate the possible penetration of contaminants into the subsurface. In addition to soil and sediment sampling, the biased and random grid approaches were used for surface water sampling at MRP Site UXO1. The random grid sampling method supplemented the biased sampling by providing additional coverage of the sites. A numbered grid was established across each site for the random grid sampling, and unbiased grid cell locations were selected using a random number generator. The sampling locations were plotted on the work plan site map in the randomly selected grid cell. The DGPS coordinates of the sampling locations were extrapolated from the site map and used to locate the proposed sampling locations in the field.

The quantity and location of some of the biased and random soil, sediment, and water samples originally described in the work plan and depicted in the work plan figures were adjusted as necessary. These adjustments were based on field observations and conditions encountered during the MRP sampling efforts, detector-aided visual surveys, and geophysical surveys.

3.3.3 Soil Sampling Procedures

Land-based soil borings and discrete soil samples were obtained using a stainless steel hand auger. Two discrete soil samples (0 to 0.5 foot bgs and 1 to 1.5 feet bgs) were collected from each soil boring at a majority of the biased and random grid sampling locations. Refusal was encountered at two locations before the 1 to 1.5 feet bgs sampling interval had been reached, and alternative soil borings were advanced. The alternative soil borings were advanced to the 1 to 1.5 feet bgs sampling interval in the vicinity of the original soil boring to ensure the total quantity of samples was collected from each site. Before soil samples were collected at MRP Site AOC1, a test boring was advanced with a hand auger to an approximately 5 feet bgs in the location of the former settling basin. The soils cuttings from the test boring were logged to document the apparent thickness of tilled or disturbed soils. Soil samples at AOC1 were collected from the 0 to 0.5-foot and 1-to 1.5 foot depth intervals below the tilled or disturbed soil horizon.

Discrete surface soil samples were collected at the MRP sites from both biased and unbiased sampling locations. Soil borings were logged for lithology in accordance with the Unified Soil Classification System. Discrete soil samples collected from each sampling interval were homogenized in stainless steel bowls and placed in 8-ounce glass jars using stainless steel scoops. The stainless steel hand auger, bowls, and scoops were decontaminated after each use with a Liquinox and water solution, then triple-rinsed with distilled water. Soil sample containers were labeled, placed in a cooler with ice, and transported to EMAX Laboratories, Inc., under chain-of-custody protocol in accordance with the SI work plan.

3.3.4 Sediment Sampling Procedures

Twelve discrete sediment samples were collected from six sediment borings beneath the POLB Mitigation Pond (MRP Site UXO1) using a stainless steel hand auger. Two surface (0 to 0.5 foot below sediment surface [bss] and 1 to 1.5 feet bss) discrete sediment samples were collected from each sediment boring. Three biased and three unbiased sample locations were selected. Unbiased sample locations were selected from the sampling grid using a random number generator, and biased sample locations were selected adjacent to magnetic anomalies using anomaly avoidance techniques described in Sections 3.1.1 and 3.2.2.

The sediment boring locations were accessed from either the shoreline or by a 12-foot low-draft inflatable rowboat. Sediment borings were logged for lithology in accordance with the Unified Soil Classification System.

Discrete sediment samples collected from each sampling interval were homogenized in stainless steel bowls and placed in 8-ounce glass jars using stainless steel scoops. The stainless steel hand auger, bowls, and scoops were decontaminated after each use with a Liquinox and water mix, then triple-rinsed with distilled water. Sediment samples were labeled, placed in a cooler with ice, and transported to EMAX Laboratories, Inc., under chain-of-custody protocol in accordance with the SI work plan.

3.3.5 Water Sampling Procedures

Five surface water samples were collected from the bottom of the water column in the POLB Mitigation Pond (MRP Site UXO1) using a grab sampler. Two biased and three unbiased samples were collected. The two biased surface water samples were collected adjacent to magnetic anomalies using anomaly avoidance techniques described in Sections 3.1.1 and 3.2.2. The three unbiased surface water sample locations were determined by the random grid sampling method and unbiased grid cell locations were selected using a random number generator.

Water quality measurements were collected from each sampling location prior to collecting surface water grab samples using a portable, field-calibrated, hand-held YSI 556 water quality meter. Water quality parameters measured at each sampling location included hydrogen ion concentration (pH), conductivity, oxidation-reduction potential, dissolved oxygen, and temperature. Water quality measurements and surface water grab samples were collected prior to collecting sediment samples to ensure representative measurements and samples were collected.

The grab sampler consisted of a polyethylene beaker attached to the end of an adjustable length pole. The grab sampler was extended to the sample location from a 12-foot low-draft inflatable rowboat, lowered into the water, allowed to fill with water approximately 6 inches above the sediment surface, and then transferred to the appropriate sample containers. The grab sampler was decontaminated after each use with a Liquinox and water mix, then triple-rinsed with distilled water. All surface water samples were labeled, placed in a cooler with ice, and transported under chain of custody protocol in accordance with the SI work plan to EMAX Laboratories, Inc.

3.3.6 Analytical Methods

In accordance with the sampling and analysis plan (SAP), soil, sediment, and water samples collected from the MRP sites were analyzed for all or some of the following parameters, depending on historical site use and current conditions:

Parameter	Method Number
Explosives	EPA Method 8330
Picrate	EPA Method 8330
Metals	EPA Method 6010
Mercury	EPA Method 6010
Perchlorate	EPA Method 6850
TKN	EPA Method 351.2
Inorganic Nitrogen	EPA Method 300.0
Ammonia as Nitrogen	EPA Method 350.2

Chain-of-custody documentation and laboratory analytical reports are in Appendix E.

3.3.7 Quality Control Samples

In accordance with the work plan SAP, a surface water duplicate sample was collected; soil and sediment duplicate samples were not collected (ChaduxTt 2009b). It was determined that spatial variability information provided by field soil and sediment duplicates will be obtained during subsequent investigations at this site, if required. ChaduxTt collected additional soil, sediment, and surface water sample volumes from each site for matrix spike (MS) and matrix spike duplicate (MSD) samples for laboratory spiking and analysis. The percent recoveries were calculated for each of the spiked analytes and used to evaluate analytical accuracy. The relative percent difference (RPD) between spiked samples was calculated to evaluate precision. These calculations are described in detail in Appendix F.

All dedicated sampling tools (hand augers, bowls, scoops, etc.) were decontaminated in the field. One equipment rinsate sample was collected every day during soil and sediment sampling activities. Each equipment rinsate sample was collected by running distilled rinsate water over the hand auger used in the surface and subsurface sample collection after the equipment had been decontaminated. The equipment rinsate samples were collected to verify that the decontamination procedures were appropriately performed.

During data validation, the results for the equipment rinsate samples were used to evaluate the levels of analytes in the field samples collected during the sampling event and to qualify the data. One source-water blank was collected from the source of the distilled water used to prepare the equipment rinsate. During data validation, the results for the equipment rinsate and source blank samples were used to evaluate the concentrations of compounds in these solutions and qualify the data.

A temperature blank shows the temperature of water samples in a cooler. The temperature blank originated at the laboratory and was returned in shipping coolers with project samples. The temperature is recorded when it is received at the laboratory.

In addition to field QC, laboratory QC samples were analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures were conducted properly and that the quality of the data is known. The required frequencies for laboratory QC samples were included in the SAP (ChaduxTt 2009b). Laboratory analytical reports for QC samples are included as Appendix E.

3.4 GPS SURVEYING

Sample locations, suspect MEC, and site features were surveyed using a Trimble ProXRS DGPS with an average horizontal accuracy of one meter or less. Vertical measurements were not obtained.

3.5 DECONTAMINATION

All dedicated sampling tools (hand augers, bowls, scoops, etc.) were decontaminated by scrubbing in a solution of potable water and nonphosphate detergent (Liquinox), then double-rinsed with distilled water at the beginning of the day before sampling occurred, and between sample locations. Sampling tools that were not used immediately after decontamination were allowed to air dry on top of plastic sheeting.

3.6 MANAGEMENT OF INVESTIGATION DERIVED WASTE

All soil cuttings from borings were returned to the borehole after samples were collected. Since visual observations did not indicate contamination in any of the soil borings at the sites, none of the cuttings were containerized, and characterization samples were not obtained. Soil cuttings were returned to the borehole in a manner that conformed to the current grade.

Investigation-derived decontamination wastewater generated from each site was collected in one 55-gallon drum. The sample results showed the decontamination water was nonhazardous waste. A profile and waste manifest were prepared and were approved by the Navy. The nonhazardous waste liquid was picked up for transport and disposal, in accordance with applicable federal, state, and local laws and regulations. The waste was taken for disposal by PSC Environmental Services. Copies of the waste profile and manifest are in Appendix G. Personal protective equipment and miscellaneous waste from sampling (paper towels, nitrile gloves, and plastic sheeting) were placed in large garbage bags, sealed, and disposed of off-site in trash receptacles.

Table 3-1: Geophysical Equipment QC Tests

Naval Weapons Station Seal Beach, California

Test No.	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	1st Day of Project
1	Equipment Warm-up	Equipment Specific (typically 5 minutes)	X			
2	Record Sensor Positions	± 1 inch (2.54 cm)		X		
3	Personnel Test	EM61 ±2 mV p-p (Channel 3)		X		
4	RTK GPS Positioning	8-inch positional accuracy		X		
5	Vibration Test (Cable Shake)	Data Profile does not exhibit data spikes		X		
6	Static Background and Static Spike	Background: EM61 ± 2.5 mV p-p			X	
		Spike: ± 20% of standard item response, after background correction.			X	
7	Pull-Away Test	Navigation equipment should have minimal effect on readings				X

Notes:

cm	centimeter
mV	milliVolt
p-p	peak-to-peak
RTK	real time kinetmatic

4.0 DATA QUALITY REVIEW PROCESS

After samples were analyzed, a data review was done to evaluate whether analytical laboratory data were of acceptable technical quality for use in decision-making. The review began with data validation – comparing field and laboratory QA/QC data with prescribed acceptance criteria. The output of this review was a set of alphabetic flags such as "U," "J," "R" (defined below) or combinations thereof, that are assigned to individual results to document specific data quality issues. In addition to applying data qualifiers, the quality review assessed overall quality of the SI data sets relative to project DQOs, in terms of quantitative indicator parameters such as completeness, bias, precision, and sensitivity, as well as qualitative indicators such as comparability and representativeness.

4.1 DATA VALIDATION PROCESS

Laboratory Data Consultants, Inc., did third-party data validation. Data validation had two stages: (1) a cursory review of the analytical reports and the QA/QC information was done on 90 percent of the chemical data, and (2) a full review of the analytical reports, the QA/QC information, and the associated raw data was done on 10 percent of the chemical data. The cursory review evaluated the effect of the most critical QA/QC information, such as holding times, calibration requirements, and spiking accuracy. The full review evaluated additional QA/QC criteria and used the raw data to check calculations and analyte identifications. At each stage of validation, qualifiers were assigned to the results in the electronic database in accordance with the Tetra Tech's Data Validation Statement of Work (SOW) (Tetra Tech 2005) and the SAP (ChaduxTt 2009b).

Assignment of data qualification flags conformed to EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA 2004) and Tetra Tech's Data Validation SOW (Tetra Tech 2005). Data validation specifications require that various data qualifiers be assigned when a deficiency is detected or when a result is less than its quantitation limit (QL). If no qualifier is assigned to a result that has been validated, the data user is assured that no technical deficiencies were identified during validation. The qualification flags are defined as follows:

- U – Indicates that the chemical was not detected at the numerical QL (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

- UJ – Indicates that the chemical was not detected; however, the QL (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical QL is regarded as inaccurate or imprecise.

- J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

- R – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies (for example, a holding time missed by a factor of two times the specified time limit, severe calibration noncompliance, or extremely low analyte recovery in QC spike samples).

The preceding data qualifiers may be categorized as indicating major or minor problems. Major problems are defined as issues causing the rejection of data and qualification with R qualifiers. These data are considered invalid and are not used for decision-making unless they are used in a qualitative way and the use is justified and documented. Minor problems are defined as issues causing the estimation of data and qualification with U, J, and UJ qualifiers. Estimated analytical results are considered suitable for decision-making unless the data use requirements are stringent and the qualifier indicates a deficiency that is incompatible with the intended data use. A U qualifier does not indicate that a data deficiency exists because all non-detect values are flagged with the U qualifier regardless of whether a quality deficiency has been detected.

Laboratory Data Consultants, Inc., prepared data validation reports with qualification of the data, if necessary, and the rationale for assigning these qualifications. The net result was a data package that had been carefully reviewed for its adherence to prescribed technical requirements. These data validation reports are in Appendix E-5.

4.2 DATA QUALITY INDICATORS

The data validation process allowed further evaluations of overall data quality based on established data quality indicator (DQI) parameters. DQIs are general parameters monitored to help establish the quality of data generated during an investigation. Some of the DQIs are generated from analysis of field samples (such as field duplicates) and some are generated from the analysis of laboratory samples (such as laboratory duplicates). Data validation evaluates and qualifies individual analytical results based on associated QC results. Evaluation of field and laboratory DQIs provides further measures of the overall performance of the investigative operations (field or laboratory).

4.2.1 Completeness

The DQI of completeness is a measure of the number of valid samples or measurements available relative to the number of samples or measurements intended to be generated. For this project, completeness was measured on two different bases:

- Samples collected - measure of the usable samples collected compared with those intended to be collected.
- Laboratory measurements - measure of the amount of usable, valid laboratory measurements per matrix for each target analyte.

Usable valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to not have been disqualified for use through data validation or additional data review. Completeness was calculated using the following equation:

$$\%C = \frac{V}{T} \times 100$$

where:

%C	=	percent completeness
V	=	number of samples (or results) determined to be valid
T	=	total number of planned samples (or results)

The SAP established a data completeness objective of 95 percent for the SIs (ChaduxTt 2009b).

4.2.2 Sensitivity

The SAP established method sensitivity requirements for the SI in the form of project required reporting limits (PRRLs) and method detection limits (MDLs). Where possible, the SAP specified PRRLs and MDLs that were less than the risk screening criteria that were to be compared with the SI data. The data review process included evaluations of whether any reporting limits or detection limits actually achieved in the SI samples were elevated relative to the PRRLs and MDLs specific in the SAP. The review further evaluated the reasons for the elevated reporting limits (such as matrix effects or method QA/QC problems), and whether the evaluated values affected the risk screening for the SI.

4.2.3 Accuracy

Accuracy requirements for field measurements are typically ensured by controlling sample collection and handling, and routine instrument calibration. Field accuracies were monitored using blanks to detect cross-contamination, and monitoring adherence to procedures that prevent sample contamination or degradation. Equipment rinsate blanks and source blanks were collected during the SI to assess cross-contamination from sample collection equipment. The rinsate blanks were obtained under representative field conditions by collecting the rinse water by running deionized water over disposable equipment like that used to collect the samples. The rinsate blank was analyzed for the same chemical constituents as the associated environmental samples. In addition, one source-water blank was collected for each source of water (distilled or deionized) used to decontaminate the sampling equipment. The source-water blank sample verified that the water used for decontamination was analyte-free.

Accuracy in the laboratory was measured through the comparison of a spiked field sample (that is, an MS) or laboratory control sample (LCS) result to a known or calculated value and was expressed as a percent recovery (%R). It was also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods. LCSs were used to assess the accuracy of laboratory operations with minimal sample matrix effects. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCS and MS analyses were done at a frequency of 1 per 20 associated samples of like matrix. Laboratory accuracy was assessed by comparing calculated %R values with accuracy control limits specified by the laboratory using SW-846 methods.

Percent recovery is calculated using the following equation:

$$\%R = \frac{Ss - So}{S} \times 100$$

where:

%R	=	percent recovery
Ss	=	result of spiked sample
So	=	result of non-spiked sample
S	=	concentration of spiked amount.

The data validation reports (Appendix E-5) indicate any MSDs, LCS duplicate (LCSD), and surrogate recoveries that did not meet accuracy limits as specified by the laboratory.

4.2.4 Precision

Precision is a measure of the degree to which two or more measurements agree, and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions. Precision for chemical parameters is expressed as an RPD, which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs, typically expressed as percentages, are used to evaluate both field and laboratory duplicate precision and are calculated as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	relative percent difference
V1, V2	=	two results obtained by analyzing duplicate samples

The precision estimates obtained from QC field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

The data validation reports (Appendix E-5) indicate any field duplicate, LCS/LCSD, and MS/MSD RPDs that did not meet QC limits.

4.2.5 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (for example, among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods and standardized data reporting formats. Comparability of field data was ensured by following the SI SAP (ChaduxTt 2009b). Comparability of laboratory measurements was achieved primarily through use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with previous data and with current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the laboratory's QA plan.

4.2.6 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site. The SI SAP (ChaduxTt 2009b) and the use of standardized sampling, sample handling, sample analysis, and data reporting procedures were designed so that the final data would be accurate representations of actual site conditions. It is believed that all reported data are adequately representative of site conditions.

5.0 DEVELOPMENT OF UPDATED CONCEPTUAL SITE MODELS

A conceptual site model (CSM) describes the site and its environmental setting based on existing information, and it describes sources and receptors and the interactions that link them. The original CSMs for each site were included in the work plan (ChaduxTt 2009a) and were developed based on knowledge of historical site activities, the PSI (Malcolm Pirnie 2008), and initial SI activities, including site walk-throughs.

The updated CSMs for the MRP sites included in this SI report present information regarding: (1) MEC or MC known or suspected to be at the site, (2) current and future reasonably anticipated or proposed uses of the property; and (3) actual, potentially complete, or incomplete exposure pathways linking the MEC or MC to the receptors. Information from a variety of sources (in this case, the PSI, subsequent data review, and subsequent SI results) was compiled to develop the CSM and then integrated into an exposure pathway analysis to identify all actual, potentially complete, or incomplete source-receptor interactions for the site for both current and reasonable anticipated future land use.

A complete or potentially complete exposure pathway for MEC must include the following components: (1) a source (locations where MEC are expected to be found), (2) access (controlled or uncontrolled access, items on the surface or in the subsurface), (3) an activity (such as non-intrusive grounds maintenance or intrusive construction), and (4) receptors (for example, Navy personnel, construction workers, or authorized visitors). It is important to recognize that environmental mechanisms (such as erosion) or human intervention may reposition MEC.

A complete or potentially complete exposure pathway for MC must include the following components: (1) a source (locations where MC are expected to be found), (2) an exposure medium (such as surface soil), (3) an exposure route (for example, dermal contact or ingestion), and (4) receptors (such as Navy personnel, construction workers, trespassers, future residents, and mammals, reptiles, and birds). If the point of exposure is not at the same location as the source, the pathway may also include a release mechanism (for example, erosion) and a transport medium (such as surface water or bioaccumulation).

The potential interactions between the source and receptors are assessed differently for MEC and MC. For MC, interaction between the source and receptors involves a release mechanism for the MC, an exposure medium that contains the MC, and an exposure route that places the receptor into contact with the contaminated medium. For MEC, the receptor must have access to the source and must engage in some activity that results in contact with individual MEC items in the source area.

A graphical CSM and updated CSM information profile table for each site is included in the CSM section for each site.

6.0 HUMAN HEALTH AND ECOLOGICAL SCREENING METHODOLOGY

This section describes the methodology for the human health and ecological screening processes conducted for each site.

6.1 HUMAN HEALTH SCREENING CRITERIA AND METHODOLOGY

Based on the CSM developed for the sites (Section 5.0), chemicals in soil may present potential exposure to current users of the sites including Navy personnel and contractors (such as maintenance personnel), Navy-escorted visitors, environmental and ecological researchers, and farm workers and leaseholder farmers. There is limited public access to the NWR. It is unlikely that the current land use will change in the future. However, additional future use may include construction and expanded agriculture. The purpose of the SI is to screen chemicals detected in soil for concentrations or quantities that may pose a threat to human health or the environment, thus requiring further evaluation. Concentrations in soil at each site were compared with EPA Regional Screening Levels (RSL) for residential and industrial soils (EPA 2009a). The State of California Department of Toxic Substances Control (DTSC) recommended California-specific values were used for some chemicals (DTSC 2009). The concentrations in soil were also compared with background levels established at NAVWPNSTA Seal Beach (NAVFAC SW 1997). The following sections further discuss the human health criteria and methods used in screening chemicals detected in soil.

Sediment samples were collected from the POLB mitigation pond (Figure 7-7). All sediment samples were saturated (below the water surface). Direct exposure to saturated sediments (collected below the water surface) was not evaluated in this initial screening since the exposure pathways used to develop the soil screening criteria do not apply to submerged sediments.

Groundwater at NAVWPSTA Seal Beach is currently not used for drinking water. No current potential exposure to groundwater is likely except for perched groundwater or groundwater seepage that occurs during high tides at MRP Site AOC2. Groundwater use at the sites may change in the future. Sediment and surface water are also present at the POLB Mitigation Pond at MRP Site UXO1 and occasionally at the evaporation ponds at MRP Site UXO2. The surface water at the POLB Mitigation Pond is tidally influenced and contains saline to brackish water. Another important note is that the evaporation ponds at UXO2 are dry and do not contain water; they are heavily vegetated with trees and brush (not riparian vegetation). These ponds are on a flat surface with 3-foot-high earthen containment berms surrounding them. For water, the evaluation of potential human health concerns is characterized in terms of a chemical-specific drinking water criterion (California maximum contaminant levels, California notification levels, or the EPA tap water RSLs). Use of these criteria was not applicable to these sites because neither the groundwater nor the surface water will be used as a source of drinking water, so, potential exposure to groundwater or surface water was not evaluated.

6.1.1 Human Health Screening Criteria Selection

The human health screening criteria used in the soil screening were a combination of EPA's RSLs (EPA 2009a) and DTSC-recommended values (DTSC 2009). Per DTSC recommendation (2009) on selection of screening criteria, preference was given to the screening values published in DTSC 2009 over EPA's RSLs (EPA 2009a). These risk-based criteria were derived from standard equations using default exposure assumptions with chemical-specific toxicity values. The risk-based criteria were based on an incremental target cancer risk of 1×10^{-6} and hazard quotient of 1.0. The exposure pathways included in the current human health screening criteria for residential and industrial soils were direct ingestion of soil, dermal contact with soil, and inhalation of particulates and volatiles from soil in outdoor air. The revised California human health screening levels for lead published by the Office of Environmental Health Hazard Assessment in September 2009 and recommended by DTSC for use at NAVWPNSTA Detachment Fallbrook (ChaduxTt 2010a) were used. The residential and industrial screening criteria are in Table 6-1.

Toxicity criteria have not been developed for some chemicals. There are currently no published criteria for evaluating manganese in soil. The screening criteria for manganese in water were therefore used as a conservative estimate. Additional factors were considered in selecting screening criteria for chromium and mercury as discussed in the following subsections. A surrogate (substitute) was selected for chemicals with no available criteria for soil, as identified in Table 6-1.

6.1.1.1 Chromium

Chromium at these sites is anticipated to be associated with ammunition casings. The reduced form of chromium is expected at ranges and areas of munitions disposal because chromium alloys are found in some ammunition rounds. For the initial screening, the screening criterion used for chromium was based on insoluble salts of chromium (III), which is the stable form of chromium and is more likely found in soil at the sites.

6.1.1.2 Mercury

Any mercury from munitions would have resulted from the use of mercury fulminate as a primer. Although explosives and primers may contain mercury in organic form, the mercury deposited after ignition is in the inorganic form. Therefore, it is expected that mercury residues will be primarily inorganic at NAVWPNSTA Seal Beach, and the risk screening is based on toxicity values for inorganic mercury. However, mercury fulminate may also be present. A reproducible testing protocol for mercury fulminate is currently not commercially available. Total mercury was also screened against screening criteria for mercury in the organic form to consider the potential presence of mercury fulminate. The screening criteria for methyl mercury were used for this purpose.

6.1.2 Application of Human Health Screening Criteria

Chemical concentrations detected in soil at NAVWPNSTA Seal Beach were compared with soil screening criteria protective of residential and industrial receptors for an initial assessment of potential impact to human health. Chemicals with soil concentrations exceeding the human health screening criteria are recommended for further evaluation.

Background levels for metals in soil have been established at NAVWPNSTA Seal Beach. These background levels were also used in the screening and are in Table 6-2. If concentrations of chemicals in soil are within background levels, further evaluation is usually not warranted.

6.1.3 Data Evaluation

All chemicals detected in at least one sample in soil (except calcium, magnesium, potassium, and sodium that are known to be required human trace nutrients) were included in the screening. All data were validated and verified, as described in Section 4.0. The analytical results obtained from these samples are used in the comparison to risk-based screening values. Unvalidated, unverified, or rejected data were not used.

6.2 ECOLOGICAL BENCHMARK SCREENING METHODOLOGY

Site chemical concentrations in soil were compared with ecological toxicity benchmarks. This comparison is not an ecological risk assessment; all detected chemicals, whether they have exceeded criteria or not, will be evaluated in a screening-level ecological risk assessment conducted as part of a remedial investigation.

This comparison is based on the contaminant concentrations in soil and ecological risk-based benchmarks. The ecological toxicity benchmarks are based on conservative exposure assessments that assume full-time exposure and 100 percent bioavailability to the ecological receptors. The lowest available benchmark for each chemical was used in the comparison. The benchmarks used in this comparison were compiled from the following sources:

- **Soil:**
  - EPA Ecological Soil Screening Levels (Eco-SSLs) (EPA 2009b)
  - Oak Ridge National Laboratory (ORNL) Ecological Benchmarks for Plants and Invertebrates (Efroymson and others 1997a, 1997b)

EPA Eco-SSLs are risk-based concentrations of chemicals in soil that are protective of ecological receptors likely to come into contact with soil, either directly or through ingestion of biota that live in or on soil (EPA 2009b). Eco-SSLs are available for a limited number of chemicals, and each chemical may have been assigned up to four Eco-SSLs, one for each of the following receptor groups: plants, invertebrates, birds, and mammals. The lowest Eco-SSL is used in the risk screen. Eco-SSLs for plants apply to soils where the pH is greater than or equal to 4.0 and less than or equal to 8.5, with an organic matter content less than or equal to 10 percent (EPA 2009b). ORNL plant and invertebrate toxicity benchmarks represent concentrations of chemicals that correspond to the lowest observed effects concentration for

the 10th percentile of species tested (Suter 1993; Will and Suter 1995a, 1995b; Efroymson and others 1997a). The ORNL values are the best screening benchmarks currently available for chemicals that lack Eco-SSLs.

- **Sediment:**
  - Effects Range-Low (ER-L) (Long and others 1995 and Long and Morgan 1991)

The ER-L values (Long and others 1995 and Long and Morgan 1991) are based on chemical and biological effects data from a wide variety of studies on invertebrates in marine and estuarine sediments, including the National Oceanic and Atmospheric Administration (NOAA) database (NOAA 1991). The ER-L represents the lower 10^{th} percentile of the effects data. Concentrations below the ER-L represent levels at which direct adverse biological effects to invertebrates are rarely expected.

- **Surface Water:**
  - EPA National Recommended Water Quality Criteria for the Protection of Aquatic Life (EPA 2000c)
  - Lowest Observed Adverse Effect Level (Acute) (Water Board 2008)

The EPA National Recommended Water Quality Criteria for the protection of aquatic life in surface water are published pursuant to Section 304(a) of the Clean Water Act and provide guidance for states to use in adopting water quality standards (EPA 2009c). The criteria used in this comparison (except for silver and thallium) are the Criterion Continuous Concentrations (CCC), estimates of the highest concentration of a chemical in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect (EPA 2009c). The chronic values were used when available; however, no chronic criterion was available for silver, so the acute value was used. The EPA water quality criteria does not list a value for thallium. Therefore, the value for the lowest observed adverse effect level (acute) was used (Water Board 2008).

The complete lists of ecological screening benchmarks for soil, sediment, and surface water are in Tables 6-3, 6-4, and 6-5.

SECTION 6.0 TABLES

TABLE 6-1: HUMAN HEALTH SCREENING CRITERIA FOR SOIL

Naval Weapons Station Seal Beach, California

Matrix	Analyte Group	Analyte	CAS_NO	Surrogate	Surrogate CAS_NO	Residential Screening Level (mg/kg)	Industrial Screening Level (mg/kg)	Reference
SOIL	AMMONIA	AMMONIA (NH3-N)	7664-41-7			NA	NA	NA
SOIL	ANION	NITRATE/NITRITE-N	7727-37-9	Nitrite	14797-65-0	7.80E+03	1.00E+05	(1)
SOIL	EXP	PERCHLORATE	14797-73-0			2.90E+01	3.80E+02	(2)
SOIL	METAL	ALUMINUM	7429-90-5			7.70E+04	9.90E+05	(1)
SOIL	METAL	ARSENIC	7440-38-2			6.20E-02	2.50E-01	(2)
SOIL	METAL	BARIUM	7440-39-3			1.50E+04	1.90E+05	(1)
SOIL	METAL	BERYLLIUM	7440-41-7			1.60E+02	2.00E+03	(1)
SOIL	METAL	CADMIUM	7440-43-9			1.70E+00	7.50E+00	(2)
SOIL	METAL	CHROMIUM	7440-47-3	Chromium (III), Insoluble Salts	16065-83-1	1.20E+05	1.50E+06	(1)
SOIL	METAL	COBALT	7440-48-4			2.30E+01	3.00E+02	(1)
SOIL	METAL	COPPER	7440-50-8			3.10E+03	4.10E+04	(1)
SOIL	METAL	IRON	7439-89-6			5.50E+04	7.20E+05	(1)
SOIL	METAL	LEAD	7439-92-1			8.00E+01	3.20E+02	(3)
SOIL	METAL	MANGANESE	7439-96-5	Manganese, Water	7439-96-5W	1.80E+03	2.30E+04	(1)
SOIL	METAL	MERCURY - INORGANIC	7439-97-6	Mercury, Inorganic Salts		2.30E+01	3.10E+02	(1)
SOIL	METAL	MERCURY - ORGANIC	7439-97-6	Methyl Mercury	22967-92-6	7.80E+00	1.00E+02	(1)
SOIL	METAL	NICKEL	7440-02-0			1.50E+03	2.00E+04	(1)
SOIL	METAL	SELENIUM	7782-49-2			3.90E+02	5.10E+03	(1)
SOIL	METAL	SILVER	7440-22-4			3.90E+02	5.10E+03	(1)
SOIL	METAL	VANADIUM	7440-62-2	Vanadium and compounds	7440-62-2A	7.80E+01	1.00E+03	(2)
SOIL	METAL	ZINC	7440-66-6			2.30E+04	3.10E+05	(1)
SOIL	TKN	TOTAL KJELDAHL NITROGEN	10-07-1	Nitrate	14797-55-8	1.30E+05	1.60E+06	(1)

Notes:

mg/kg Milligram per kilogram

NA Not available

References:

(1) U.S. Environmental Protection Agency (EPA). 2009. “U.S. Environmental Protection Agency (EPA). 2009. “Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites.” RSL Table Update. December 7. Available online at http://www.epa.gov/region09/superfund/prg/

(2) California Department of Toxic Substances Control (DTSC). 2009. Human Health Risk Assessment Note Number 3 and Table 1. Office of Human and Ecological Risk. November 10. Available online at http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3.pdf and http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3_Table.pdf

(3) California Environmental Protection Agency. 2009. "Revised California Human Health Screening Levels for Lead." Office of Environmental Health Hazard Assessment. September. Available online at http://oehha.ca.gov/risk/pdf/LeadCHHSL091709.pdf

TABLE 6-2: Background Concentrations in Soil

Naval Weapons Station Seal Beach, California

Chemical	Soil ULBV (mg/kg)
Aluminum	36271
Antimony	NA
Arsenic	15.38
Beryllium	2.11
Cadmium	2.22
Total Chromium	46.24
Cobalt	NA
Copper	39.04
Lead	35.7
Manganese	1103
Mercury	0.3
Molybdenum	NA
Nickel	32.49
Selenium	0.44
Thallium	NA
Vanadium	85.95
Zinc	177.17
Nitrate	31.2
Nitrite	2.4

Notes:

mg/kg	milligram per kilogram
ULBV	Upper Limit Background Value

References:

Southwest Naval Facilities Engineering Command and Jacobs Engineering Group, Inc. 1997. Technical Memorandum, Stationwide Background Study, Phase II, Final. March 14.

TABLE 6-3: ECOLOGICAL SCREENING BENCHMARKS FOR SOIL

Naval Weapons Station Seal Beach, California

Chemical	Ecological Benchmark (mg/kg)	Source	Note
Aluminum	50	ORNL Plants	a
Antimony	0.27	EPA Eco-SSL Mammals	a
Arsenic	10	ORNL Plants	a
Barium	330	EPA Eco-SSL Invertebrates	a
Beryllium	10	ORNL Plants	a
Cadmium	0.36	EPA Eco-SSL Mammals	a
Chromium	0.4	ORNL Invertebrates	a
Cobalt	13	EPA Eco-SSL Plants	a
Copper	28	EPA Eco-SSL Birds	a
Iron	NA	NA	a
Lead	11	EPA Eco-SSL Birds	a
Manganese	220	EPA Eco-SSL Plants	a
Mercury	0.1	ORNL Invertebrates	a
Nickel	38	EPA Eco-SSL Plants	a
Selenium	0.52	EPA Eco-SSL Plants	a
Silver	4.2	EPA Eco-SSL Birds	a
Thallium	1	ORNL Plants	a
Vanadium	2	ORNL Plants	a
Zinc	46	EPA Eco-SSL Birds	a
1,3,5-Trinitrobenzene (1,3,5-TNB)	40	ORNL Invertebrates	b
2,4,6-Trinitrotoluene (2,4,6-TNT)	30	Plant Benchmark (Talmage 1999)	b
2-Amino-4, 6-dinitrotoluene(2-Am-DNT)	80	Plant Benchmark (Talmage 1999)	b
2,6-Dinitrotoluene (2,6-DNT)	40	Plant Benchmark (Talmage 1999)	b
Hexahydro-1,3,5-trinitro-1,3,5- triazine (RDX)	100	Plant Benchmark (Talmage 1999)	b
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	25	Plant Benchmark (Talmage 1999)	b
Nitrobenzene	40	ORNL Invertebrates	b

Notes:

a Ecological benchmarks for metals are based on EPA Eco-SSLs (EPA 2009) or ORNL toxicity benchmarks (Efroymson and others 1997a,b).

b Ecological benchmarks for explosives are from from ORNL RAIS (2009) or Talmage and others (1999). The benchmark for nitrobenzene was used as a surrogate for 1,3,5-TNB. The benchmark for 2,4,6-TNT was used as a surrogate for 2,6-DNT.

Eco-SSL Ecological Soil Screening Level
EPA U.S. Environmental Protection Agency
mg/kg milligram per kilogram
ORNL Oak Ridge National Laboratory
RAIS Risk Assessment Information System

References:

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision." Oak Ridge National Laboratory. Oak Ridge, Tennessee. ES/Gr/TM-85. 128 pages

Efroymson, R.A., M.E, Will, and G.W. Suter II. 1997b. "Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision." Oak Ridge National Laboratory, Oak Ridge TN. ES/ER/TM-126/R2.

EPA. 2009. Interim Ecological Soil Screening Levels. Available online at: http://www.epa.gov/ecotox/ecossl/

Talmage, S.S., D.M. Opresko, C.J. Maxwel, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel. 1999. Nitroaromatic munition compounds: Environmental effects and screening values. Revs. Environ. Contam. Toxicol. 161:1-156.

TABLE 6-4: ECOLOGICAL SCREENING BENCHMARKS FOR SEDIMENT

Naval Weapons Station Seal Beach, California

Chemical	Ecological Benchmark (mg/kg)
Antimony	2
Arsenic	8.2
Cadmium	1.2
Chromium	81
Copper	34
Lead	46.7
Mercury	0.15
Nickel	20.9
Silver	1
Zinc	150

Notes:

Eco screening concentrations for sediment are ER-L values from Long and others (1995) and Long and Morgan (1991).

ER-L	Effects-Range Low
mg/kg	milligram per kilogram

References:

Long, E.R., and L.G. Morgan. 1991. “The Potential for Biological Effects of Sediment-sorbed Contaminants Tested in the National Status and Trends Program.” National Oceanic and Atmospheric Administration.

Long, E.R. D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volumne 19, Number 1, Pages 81-97.

TABLE 6-5: ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE WATER

Naval Weapons Station Seal Beach, California

Chemical	Ecological Benchmark (µg/L)
Arsenic	36
Cadmium	8.8
Chromium	50
Copper	3.1
Lead	8.1
Mercury	1
Nickel	8.2
Selenium	71
Silver	1.9
Thallium	2,130
Zinc	81

Notes:

Eco screening concentrations for surface water are EPA National Ambient Water Quality Criteria (chronic) (EPA 2009), except for silver, which is an acute criterion, and thallium, which is a lowest observed adverse effect level (acute) (Water Board 2008). The EPA NAWQC benchmarks are the Criterion Continuous Concentrations, estimates of the highest concentration of a chemical in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect (EPA 2009).

µg/L	microgram per liter
EPA	U.S. Environmental Protection Agency
NAWQC	National Ambient Water Quality Criteria
Water Board	San Francisco Regional Water Quality Control Board

References:

EPA. 2009. "Revision of National Recommended Water Quality Criteria". FRL-OW-7431-3. December 27. Available Online: http://www.epa.gov/waterscience/criteria/wqctable/nrwqc-2009.pdf

Water Board. 2008. A Compilation of Water Quality Goals. July.

7.0 MRP SITE UXO1 (PRIMER/SALVAGE YARD AND POLB MITIGATION POND)

7.1 SITE DESCRIPTION AND HISTORY

MRP Site UXO1 (Primer/Salvage Yard and POLB Mitigation Pond) is located in the south-central portion of the installation (Figure 7-1). The approximately 48 acre Primer/Salvage Yard area is in the northern portion of UXO1. The 39 acre POLB Mitigation Pond is located immediately south of Slough Road and makes up the southern portion of UXO1 (Figure 7-1). The Primer/Salvage Yard has been known as the Lumber Yard, the Ordnance Storage/Salvage Yard, and the Can Yard. Malcolm Pirnie (2008) referred to the site as the Ordnance Storage/Salvage Yard. UXO1 is a known MEC area and is documented to have unreported disposal of munitions; there were certification errors in the classification of ordnance as inert or live during past operations.

From 1944 through the 1980s, the Primer/Salvage Yard was actively used for ordnance storage related to rocket and projectile segregation (such as segregating 20 mm projectiles from 40-mm), inspection, and repackaging, and bomb and rocket overhaul (for example, 2.75- and 7.2-inch rockets). The Primer/Salvage Yard received thousands of cleaned projectile casings and damaged ammunition, along with non-ordnance materials, such as lumber, batteries, wings, telemetry, circuitry, and other types of scrap (NEESA 1985). Based on the variety of past uses in the site, the SI approach for UXO1 focused on three primary areas: (1) the depriming area, where projectile primers were removed and smoke pots were filled with petroleum product; (2) the recovered live ammunition and grenades area, where live small-caliber ammunition and grenades were recovered by station personnel; and (3) the explosive ordnance disposal (EOD) safety demonstrations area that is now occupied by the POLB Mitigation Pond.

The Primer/Salvage Yard (former IRP Site 16) boundaries were initially defined in the IAS (NEESA 1985). The site encompasses an area south of Bolsa Avenue, east of 7th Street, and west of 9th Street and the Marshalling Yard. The southern boundary of the former Primer/Salvage Yard area is now the north bank of the POLB Mitigation Pond.

Three activities and locations of concern at the Primer/Salvage Yard were identified in the 1985 IAS. The first location, known as the depriming area, was used from 1944 through 1982. It was reported as an unpaved area 100 to 400 feet south of former Building 413 that was used as a smoke pot filling station. Reportedly, smoke pots were used as obscurants and filled with approximately 1 quart of a petroleum product, consisting primarily of kerosene, called “fog oil.” Some fog oil spilled, but the amount discharged to the soil is unknown. An estimated 10,000 smoke pots were filled with fog oil at this site (NEESA 1985). During the same period, the area was used for depriming ordnance projectiles. Primers, whose main MC was either smokeless powder or black powder, were removed from projectiles and placed in 5-gallon powder cans and shipped off-station or sent to the explosives burning ground (IRP Site 6) for disposal (NEESA 1985).

The second location of concern, the recovered live ammunition and grenades area, was northeast of the depriming area. Disposal of munitions is believed to have occurred about 100 feet east of former Building 413 at an unknown date. Reportedly, the disposal items were mixed with nonenergetic, inert material (such as empty metal canisters, wooden packing materials, and

electronics). Station personnel recovered unknown quantities of live small-caliber ammunition and grenades from this area at an unspecified date (NEESA 1985). The 1985 report recommended further action to address these items.

The third location of concern was an EOD demonstration area and a safety demonstration area (known as the EOD safety demonstrations area) that were reported to be 600 feet south of former Building 413. This area is currently occupied by the POLB Mitigation Pond.

Reportedly, munitions items stored at the Primer/Salvage Yard may have been buried. A former site employee reported that munitions were unofficially buried in the area now covered by the asphalt of the Primer/Salvage Yard (Malcolm Pirnie 2008). It was also reported that munitions (possibly live) were tossed into the area with willow trees outside the northern boundary of the currently fenced yard.

Active operations ceased at the Primer/Salvage Yard area in the late 1990s. Scrap metal storage operation at the Primer/Salvage Yard was terminated in the early 2000s (NAVFAC SW 2002). In 2000, it was reported that the Primer/Salvage Yard was poorly organized before it was cleaned up. Live ordnance items were found during cleanup of the yard (Malcolm Pirnie 2008). Several cases containing hundreds of bomblets were stored in the yard just east of the former Building 413 location, and broken cases may have released of hundreds of bomblets throughout the site (ChaduxTt 2010b). Over the years, during heavy rains, the bomblets and other munitions would sink in the soft soil, leaving some completely or partially buried. Reportedly, a metal shredder with a conveyor belt used to shred munitions items was located on a concrete pad on the eastern side of the paved area. Munitions demilitarized at Building 411 were reportedly taken to the Primer/Salvage Yard (Figure 7-1). When the Primer/Salvage Yard was operational, reportedly there were certification errors in the classification of ordnance as inert or live, and live munitions items may have been left in the Primer/Salvage Yard (Malcolm Pirnie 2008). According to records of past site practices and interviews with former personnel, a wide variety of munitions types could have been buried at UXO1.

During the PSI site visit in November 2007, numerous MEC items were observed (Malcolm Pirnie 2008). These items were reported to EOD Mobile Unit 3, and a detachment responded on December 14, 2007, with an emergency action that detonated in place four MEC items that were reported as unsafe to handle or move (Malcolm Pirnie 2008). Fifteen additional suspect MEC items were observed during the December 2009 SI. The installation explosives safety officer (ESO) was notified of the items and reported to the EOD, and a detachment responded on December 3, 2009, with an emergency action that detonated in place suspected MEC items.

The POLB Mitigation Pond area includes the former EOD and safety demonstration area (Figure 7-1). The POLB Mitigation Pond area was used from 1944 to 1982, in conjunction with the Primer/Salvage Yard, for explosive ordnance disposal and safety demonstrations at an unknown frequency. During previous detector-aided visual surveys, MPPEH was observed along the bank of the POLB Mitigation Pond (Malcolm Pirnie 2008). Reportedly, an area about 600 feet south of former Building 413 was used for EOD and safety demonstrations before the POLB Mitigation Pond was created in 1989 and 1990. EOD personnel detonated 1 pound or less

of Composition 4 (C4) explosive each time the site was used. The safety demonstrations consisted of igniting 1 ounce or less of black powder each time to demonstrate to station personnel the explosive properties of the products they were handling (NEESA 1985). Unreported disposal of munitions similar to those reported at the Primer/Salvage Yard is also documented at the EOD and safety demonstration area (for example, live, inert, and damaged 2.75-inch rockets; 20- to 40-mm projectiles; grenades; black and smokeless powders; primers; fuzes; small arms ammunition) (NEESA 1985).

During the previous IAS (NEESA 1985), investigators concluded that only residual quantities of MC from the EOD and the safety demonstrations would likely be present and that a confirmation study was not recommended for the area. They recommended that an EOD survey be conducted at the site to retrieve and properly dispose of any possible munitions related to the reported live small-caliber ammunition and grenades.

Nearly one-half of the Primer/Salvage Yard area is fenced and paved with asphalt or concrete. Based on the preliminary assessment (Malcolm Pirnie 2008) and historical aerial photo review, other grading may have been conducted at Site UXO1.

7.2 SITE UXO1 GEOLOGY AND HYDROGEOLOGY

The Primer/Salvage Yard is underlain by undocumented or debris fill, based on the abundance of surface and subsurface debris encountered (Figure 2-1). The fill consisted of a grayish brown fine to medium-grained silty sand with metal and wood debris. The fill material was not logged to its maximum depth since soil borings were advanced only to 1.5 feet bgs. Beneath the debris fill layer is native material of Qyfc that are Holocene and late Pleistocene in age and consist of mostly of poorly to moderately consolidated and poorly sorted silty sand and clay. Sediment underlying the POLB Mitigation Pond also consists of Qyfc.

Groundwater was not encountered in the borings completed to a maximum of 1.5 feet bgs. The depth to groundwater at the southern edge of the Primer/Salvage Yard area (or the central portion of MRP Site UXO1) is 4.5 feet bgs (Malcolm Pirnie 2008). Groundwater levels in the vicinity of the POLB Mitigation Pond (the southern portion of UXO1) range from 5 to 10 feet bgs. Depth to groundwater north of MRP Site UXO1 at nearby IRP Site 37 (Bolsa Avenue Storage Yard) is reported at 15 to 20 feet bgs (NAVFAC SW 1998b). Depth to groundwater varies in the Primer/Salvage Yard area and is tidally influenced by the presence of the POLB Mitigation Pond (NAVFAC SW 2002). The direction of groundwater flow in the shallow aquifer is reportedly to the northeast, away from the POLB Mitigation Pond (NAVFAC SW 1999). Because of saltwater intrusion, shallow groundwater at UXO1 is saline to brackish and is not used for drinking water. Lateral movement of groundwater in the moderately permeable shallow aquifer is estimated to be on the order of several hundred feet per year (NEESA 1985). Two monitoring wells are located north of Slough Road. Navy Well 3, about 700 feet northeast of UXO1, is 616 feet deep (screened at two different intervals starting at 548 feet bgs) and currently is used for agricultural irrigation (Malcolm Pirnie 2008).

7.3 MEC Field Investigation Results

This section has the results of the MEC investigation for MRP Site UXO1.

7.3.1 Detector-Aided Visual Survey Results

ChaduxTt UXO technicians did detector-aided visual survey transects before the geophysical surveys and sampling began. Detector-aided visual survey transects were completed from east to west, spaced approximately 40 feet apart, over the land area in the Primer/Salvage Yard on the northern portion of MRP Site UXO1. A magnetic gradiometer and Whites all-metal detector were used during the surveys. The surveys were done inside and outside the fenced Primer/Salvage Yard up to the site boundary. Suspect MEC and MPPEH items were marked with plastic pin flags, photographed, and mapped with the DGPS. Subsurface anomalies were also mapped. UXO technicians identified 441 subsurface anomalies with the hand-held detectors along the transects that were mapped with DGPS. Detailed results of the detector-aided visual survey are shown on Figures 7-1 through 7-3, in the photographs included in the back of this section, and the table in Appendix D-1.

Numerous suspect MEC and MPPEH were observed in the Primer/Salvage Yard. UXO technicians also confirmed the presence of several MPPEH items in intertidal areas and in shallow waters along the northern and western banks of the POLB Mitigation Pond, as previously observed by Malcolm Pirnie (2008). UXO technicians observed 15 suspect MEC items on land in the Primer/Salvage Yard. These items included suspect M-40 and BLU-36 bomblets, 75-mm cartridge casings, and a 40-mm cartridge casing. UXO technicians observed 91 MPPEH items throughout UXO1. Observed MPPEH in the Primer/Salvage Yard included bomblets (BLU-36 fragments and M-40 shell halves), cartridge casings (105-mm, 75-mm, and 20-mm), fuzes, a cartridge actuated device (CAD), primers, flash tubes, partially opened 81-mm mortar shipping containers, and small arms ammunition (including 30-caliber M-1 Garand, 50-caliber, 7.62-mm, and 5.56-mm cartridge casings). Two materials documented as safe (MDAS) items were observed including an ammo box lid and an empty 81-mm mortar shipping container.

ChaduxTt UXO technicians conducted detector-aided visual survey transects around the entire perimeter of the POLB Mitigation Pond. MPPEH observed in the pond and along the northern and western embankments included multiple suspect artillery cartridge casings, a 105-mm cartridge casing, and suspect 20-mm cartridge casings.

Detector-aided visual survey transects completed outside the fenced area of the Primer/Salvage Yard included the recovered live ammunition and grenade area, located east of the fenced area at UXO1. UXO technicians observed the following MPPEH items in the recovered live ammunition and grenade area: an area of 30 caliber M-1 Garand casings, flash tubes, approximately 10 ordnance shipping caps, and a pile of discarded 81-mm mortar shipping containers. Non-munitions related items observed in the debris pile included Marshall matting, that site personnel reportedly laid down across the unpaved portions of the site for vehicle access in soft soil areas (ChaduxTt 2010b). An area containing burnt wood debris fragments was found in a tilled portion of the site approximately 75 feet north of the recovered live ammunition and grenade area. Metal debris was not observed in the burnt wood debris area and, therefore, no

determination could be made as to whether the burnt debris was related to ordnance disposal practices or crop burning practices that occurred throughout the installation when UXO1 was operational.

ChaduxTt observed that the eastern edge of UXO1 was recently tilled for agriculture but fallow. During the 2009 SI, ChaduxTt interviewed the NAVWPNSTA Seal Beach farm supervisor, Mr. Roger Partida who stated that approximately 10 years ago his tilling equipment and operations were impeded by munitions-related items buried in the soil and that the EOD previously responded to the items and stacked some of the inert items in a pile on the site. Mr. Partida confirmed that the location of the pile of removed items is consistent with the location of the discarded debris and 81-mm mortar shipping containers the UXO technicians observed on the eastern edge of the site.

Non-munitions related debris found throughout UXO1 included wood debris, metal banding, carbon dioxide cartridges, bolts, railroad spikes, and miscellaneous scrap metal. Subsurface anomalies were more frequently observed on the periphery of the asphalt-paved area, consistent with visual survey observations of MPPEH and discarded metal banding material on the soil surface in adjacent areas. Based on the distribution of subsurface anomalies, MEC is likely buried beneath the asphalt-paved areas (Figure 7-2).

Structures identified at UXO1 included a scale, in the paved area, to weigh materials loaded on trucks and railroad cars, and a concrete pad that formerly supported a shredder with a conveyor belt that was used to shred munitions items.

7.3.2 Geophysical Survey Results

Geophysical surveys of accessible areas in the Primer/Salvage Yard and POLB Mitigation Pond of MRP Site UXO1 (Figure 7-4) were done using the EM61 with RTK GPS. Data were collected in the Primer/Salvage Yard along 16 meandering transects, spaced between 20 to 330 feet apart, with a sample rate of 10 readings per second. Survey lines were nominally spaced 2.5 feet apart (100 percent coverage) over the accessible flat southwestern portion of the Primer/Salvage Yard (the northwest embankment of the POLB Mitigation Pond) where multiple artillery cartridge casings were protruding from the embankment. Data for the POLB Mitigation Pond were collected along transects nominally spaced 5 feet apart and along meandering transects to fill in data coverage using a sample rate of 10 readings per second.

Figure 7-4 shows the EM61 response in terms of the summation of CH2 and CH3 response for the geophysical survey areas. The color scale on the data map indicates the amplitude of the summation response in mV. Blue represents low amplitudes or background and green to red represents high amplitudes or anomalies. The Blakely Test in Oasis montaj was used to pick anomalies in the data of 8 mV and higher. Selected anomalies or targets are indicated on Figures 7-1 through 7-4 and in the target dig lists in Appendix B. Noise was not found to be an issue in the EM61 data; however, several targets associated with gridding artifacts were identified and were assigned a “0” dig priority.

A total of 797 target anomalies were identified in the Primer/Salvage Yard and POLB Mitigation Pond. The Blakely Test selected several dig targets for large anomalies – more than one item can be associated with an individual dig target. Based on the distribution and amplitude responses of the anomaly picks and dig list targets, the Primer/Salvage Yard has a high anomaly density and the POLB Mitigation Pond has a low anomaly density (Figure 7-4). When biased soil and sediment sampling locations were selected, many of the anomalies detected with the EM61 were reacquired or confirmed by the UXO team with the hand-held magnetic gradiometer or Whites all-metals detector. No metal debris was removed from the ground surface of the geophysical survey areas but observed surface metal debris was avoided.

The apparent anomaly density estimate (number of anomalies per geophysical survey area) for MRP Site UXO1 (including the Primer/Salvage Yard and POLB Mitigation Pond) is 295 anomalies per acre. The Primer/Salvage Yard likely has a high MEC density based on the apparent anomaly density, detector-aided visual survey results, suspect MEC observed at the surface, and past site practices. The POLB Mitigation Pond is likely to exhibit a low MEC density based on the marine geophysical survey results, detector-aided visual survey results, MPPEH observations, and because that most munitions have already been removed through excavation of the pond.

7.3.3 MEC Findings

Suspect MEC, MPPEH, MDAS, and non-munitions related debris were observed at the ground surface throughout MRP Site UXO1. UXO technicians observed 15 suspect MEC items in UXO1, including suspect M-40 and BLU-36 bomblets, 75-mm cartridge casings, and a 40-mm cartridge casing. UXO technicians also observed 91 MPPEH items throughout UXO1, including bomblets (BLU-36 fragments and M-40 shell halves), cartridge casings (105-mm, 75-mm, and 20-mm), fuzes, a CAD, primers, flash tubes, and small arms ammunition (including 30-caliber M-1 Garand, 50-caliber, 7.62-mm, and 5.56-mm cartridge casings). Closed to partially opened 81-mm mortar shipping containers (MPPEH) were also observed at the site; however, their contents could not be verified. The locations of the suspect MEC, MPPEH, and inert munitions findings for UXO1 are shown on Figures 7-1 through 7-4. Pictures of the types of suspect MEC and MPPEH observed at UXO1 are shown in photographs at the back of this section.

MPPEH observed in the pond and along the northern and western embankments of the pond included multiple suspect artillery cartridge casings, a 105-mm cartridge casing, and suspect 20-mm cartridge casings.

The condition of many suspect munitions items could not be observed since they were at least partially buried. Per the scope of this SI, no items were picked up, moved, or destroyed. To maintain adequate safety, all suspect munitions items were treated as though they could pose risk. During the SI, the installation ESO was notified of the suspect MEC items and reported to the EOD. The EOD responded on December 3, 2009, with an emergency action that detonated in place suspect MEC items that were reported as unsafe to handle or move.

7.3.4 Deviations from the Work Plan

Four surrogate items rather than three were seeded and used for scoring for the land and marine GTDs to provide a more comprehensive evaluation of the detection capabilities of the EM61. Therefore, the detection objective of the GTDs was changed from detection of two of three seed items to detection of three of four seed items.

7.4 MC Sampling Locations and Depths

As shown on Figure 7-1, MRP Site UXO1, the Primer/Salvage Yard and POLB Mitigation Pond, is a large site (approximately 87 acres). UXO1 contains three main subareas based on historical use. These subareas are the depriming area, the recovered live ammunition and grenades area, and EOD safety demonstrations area. The depriming area is centrally located in UXO1, on the southern boundary of the Primer/Salvage Yard and on the northern boundary of the POLB Mitigation Pond. The recovered live ammunition and grenades area is located in the southeastern corner of the Primer/Salvage Yard. The EOD safety demonstrations area is centrally located in the POLB Mitigation Pond. ChaduxTt collected soil, sediment, and water samples at UXO1 following the sampling and MEC avoidance procedures previously described in Sections 3.1.1, 3.2.2, 3.3.3, 3.3.4, and 3.3.5. The locations of all sampling locations in UXO1 are shown in Figure 7-5.

7.4.1 Primer/Salvage Yard

Soil samples were collected at 14 biased sampling locations in the Primer Salvage Yard where evidence of munitions disposal and burial was found during geophysical and detector-aided visual surveying (Figure 7-6). One soil sampling location was selected in the depriming area and one in the recovered live ammunition and grenades area. These locations are described in Sections 7.4.2 and 7.4.3. Two discrete soil samples (from 0 to 0.5 foot bgs and 1 to 1.5 feet bgs) were collected from each of the 12 sample locations in the Primer Salvage Yard. Selection of all sample locations required using the MEC avoidance techniques described in Sections 3.1.1 and 3.2.2. The 24 discrete soil samples were collected from the soil borings, as described in Section 3.3.3, and analyzed for explosives, metals, total TKN, inorganic nitrogen, ammonia, and perchlorate.

Four biased soil borings (043UXO1SB001002, 043UXO1SB003004, 043UXO1SB005006, and 043UXO1SB009010) were advanced south of the Primer/Salvage Yard fenced area adjacent to target geophysical anomalies and one biased soil boring (043UXO1SB013014) was advanced adjacent to two buried suspect M-40 bomblets (suspect MEC) north of the Primer/Salvage Yard fenced area.

Seven biased soil borings were advanced in the Primer/Salvage Yard fenced area three biased soil borings (043UXO1SB015016, 043UXO1SB019020, and 043UXO1SB021022) were advanced adjacent to target geophysical anomalies and three biased soil borings (043UXO1SB023024, 043UXO1SB025026, and 043UXO1SB027028) were advanced in areas that contained M-40 bomblets (suspect MEC and MPPEH) and numerous target anomalies. Another biased soil boring (043UXO1SB017018) was advanced in the munitions debris area

containing several partially buried bomblets (M-40 and BLU-36), a 75-mm cartridge (suspect MEC), flash tubes (MPPEH), a 20-mm projectile practice tracer (MPPEH), and several 20-mm, 5.56-mm, 30-caliber, and 50-caliber cartridge casings (MPPEH) observed during the detector aided visual survey (Figure 7-6).

7.4.2 Depriming Area

One biased surface soil boring (043UXO1SB007008) was advanced adjacent to target anomalies in the depriming area, on the southern boundary of the Primer/Salvage Yard, north of Slough Road (Figure 7-6). The anomaly was detected during the detector-aided visual survey. Two discrete surface samples were collected from the sample location. The two discrete surface soil samples (from 0 to 0.5 foot bgs and 1 to 1.5 feet bgs) were collected from the soil boring, as described in Section 3.3.3, and analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate.

One biased sediment boring (043UXO1SDB009010) was advanced adjacent to several suspect 20-mm cartridge cases (MPPEH) in the depriming area, on the northern shore of the POLB Mitigation Pond (Figure 7-1). The suspect 20-mm cartridge casings (MPPEH) were observed during the detector-aided visual survey and were detected during the geophysical survey (EM61 survey) of the POLB Mitigation Pond. Two discrete sediment samples (0 to 0.5 foot bss and 1 to 1.5 feet bss) were collected from the sample location. Selection of the location required the MEC avoidance techniques described in Sections 3.1.1 and 3.2.2. The two discrete sediment samples were collected from the sediment boring, as described in Section 3.3.4, and were analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate.

Using a grab sampler, one biased surface water grab sample (043UXO1SW002) was collected just south of sediment boring 043UXO1SDB009010 from the bottom of the water column adjacent to several suspect 20-mm cartridge casings (MPPEH) in the depriming area, along the northern boundary of the POLB Mitigation Pond (Figure 7-1). The biased surface water sample was collected using the anomaly avoidance techniques described in Sections 3.1.1 and 3.2.2. The biased surface water grab sample was collected, as described in Section 3.3.5, and analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate.

7.4.3 Recovered Live Ammunition and Grenades Area

One biased surface soil boring (043UXO1SB011012) was advanced adjacent to an anomaly detected near the munitions debris pile in the recovered live ammunition and grenades area in the southeastern corner of the Primer/Salvage Yard (Figure 7-6). Two discrete surface samples (0 to 0.5 foot bgs and 1 to 1.5 feet bgs) were collected from the sample location. Selection of the location required the MEC avoidance techniques described in Sections 3.1.1 and 3.2.2. The two discrete surface soil samples were collected from the soil boring, as described in Section 3.3.3, and were analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate.

7.4.4 EOD Safety Demonstrations Area/POLB Mitigation Pond

Sediment samples were collected at three biased and three grid sampling locations in the POLB Mitigation Pond (Figure 7-7). Surface water grab samples were collected at two biased and three grid sampling locations at in the POLB Mitigation Pond. Unbiased samples were collected in areas where no subsurface anomalies or suspect MEC were observed, and biased samples were collected adjacent to anomalies using the MEC avoidance techniques described in Sections 3.1.1 and 3.2.2. The three unbiased sediment and three unbiased surface water sample locations were selected by the random grid sampling method, and the unbiased grid cell locations were selected using a random number generator. Two discrete sediment samples (0 to 0.5 foot bss and 1 to 1.5 feet bss) were collected from each sediment sample location. The 12 discrete surface sediment samples were collected from the sediment borings, as described in Section 3.3.4, and were analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate. The five surface water grab samples were collected from the bottom of the water column, as described in Section 3.3.5, using a grab sampler, and were analyzed for explosives, metals, TKN, inorganic nitrogen, ammonia, and perchlorate.

One biased sediment sampling location (043UXO1SDB009010) and one biased surface water grab sample location (043UXO1SW002) were selected in the depriming area near the northern shore of the POLB Mitigation Pond based on the findings of the geophysical and detector-aided visual surveys. The biased surface sediment sampling location (043UXO1SDB009010) and the biased surface water grab sample (043UXO1SW002) are described in Section 7.4.2.

One biased surface sediment sampling location (043UXO1SDB011012) and one biased surface water grab sample location (043UXO1SW001) were selected adjacent to several artillery cartridge casings (MPPEH) near the shore in the northeastern corner of the POLB Mitigation Pond. One biased surface sediment sampling location (043UXO1SDB007008) was selected adjacent to a suspect 20-mm cartridge casing observed along the western shore of the POLB Mitigation Pond.

Three grid surface sediment sampling locations (043UXO1SDB001002, 043UXO1SDB003004, and 043UXO1SDB005006) were selected by the random grid sampling method, and the unbiased grid cell locations were selected using a random number generator. Grid sediment sampling location 043UXO1SDB003004 was advanced in the EOD safety demonstration area in the POLB Mitigation Pond. Grid sediment sampling locations 043UXO1SDB001002 and 043UXO1SDB005006 were advanced in the southern and southeastern areas of the POLB Mitigation Pond.

Three grid surface water sampling locations (043UXO1SW003, 043UXO1SW004, and 043UXO1SW005) were selected by the random grid sampling method, and the unbiased grid cell locations were selected using a random number generator. Grid surface water sampling location 043UXO1SW004 was selected in the EOD safety demonstration area in the POLB Mitigation Pond. Grid surface water sampling locations 043UXO1SW003 and 043UXO1SW005 were selected in the eastern and southern areas of the POLB Mitigation Pond.

7.4.5 Deviations from the Work Plan

There was one deviation from the work plan (ChaduxTt 2009a) in regard to MC sampling at MRP Site UXO1. A hand auger was used to advance the sediment borings rather than a sediment gravity corer. Using the gravity corer was attempted but it provided poor sediment recovery because it was clogged by sea shells.

7.5 MC Field Investigation Results

This section provides a summary of the site inspection sampling results and analytical data quality review for MRP Site UXO1.

7.5.1 Soil Sampling Results

Twenty-eight soil samples were collected at MRP Site UXO1 (Primer/Salvage Yard and POLB Mitigation Pond). The suite of analytes for UXO1 includes metals, TKN, inorganic nitrogen, ammonia, perchlorate, and explosives. Soil sampling results are in Tables 7-1 and 7-2, and Appendix E-1. Seventeen metals were detected at the site, but not in every sample. Five of the 17 metals, cadmium, copper, lead, selenium, and zinc, exceeded background concentrations. Perchlorate was detected in 19 of the 28 samples, below human health screening criteria. Ammonia, nitrate/nitrite-N, and TKN were all detected below human health screening criteria. Explosives were not detected in any of the soil samples.

7.5.1.1 Human Health Screening for Soil

Analytical results for soil were compared with risk-based screening criteria to assess potential impacts on human health from exposure to chemicals in soils at MRP Site UXO1 under a residential and an industrial land use scenario. All chemicals detected from the sampled soil depth intervals of 0 to 0.5 foot bgs and 1 to 1.5 feet bgs were included in the screening, except for calcium, magnesium, potassium, and sodium that are known to be required human trace nutrients. Section 6.1 describes the selection procedure used to identify the residential and industrial soil screening criteria for the chemicals in soils.

The screening results including detected chemicals in soil, detection frequency, minimum and maximum detected concentrations, range of reporting limits; residential, industrial, and background screening criteria used; and number of samples with concentrations exceeding each criteria, are in Table 7-1. The list of chemicals exceeding the screening criteria is in Table 7-2. Table 7-2 also has information on location (point) and sample identification (ID) for the analyte that exceeded the criteria, sample depth, sample collection date, detected concentration, laboratory reporting limit, residential and industrial screening criteria, and background screening level for each analyte. The analytical results for soil are in Appendix E-1.

All the metals analyzed were detected at least once in site soil at MRP Site UXO1, with the majority of the metals being detected in all of the samples collected at the site (Table 7-1). Concentrations of detected metals were below human health and background screening criteria, except for cadmium and lead. All analytical results for arsenic were below background screening criteria (Table 7-1). For cadmium, 4 of the 28 samples exceeded the residential screening criterion of 1.7 mg/kg and background screening criterion of 2.2mg/kg. One cadmium sample (043UXO1SB021) exceeded the industrial screening criterion of 7.5 mg/kg. The three samples that exceeded residential criteria and background level for cadmium were 043UXO1SB019, 043UXO1SB023, and 043UXO1SB027 (Figure 7-5). Two of the 28 samples (043UXO1SB019 and 043UXO1SB023) exceeded background screening criteria for lead. Sample 043UXO1SB019 also exceeded the residential criteria of 80 mg/kg for lead. This sample, collected from 0 to 0.5 foot bgs, contained the maximum detected concentration for lead of 81.9 mg/kg and exceeded the background level for lead of 35.7 mg/kg. Based on the density of target anomalies in the Primer/Salvage Yard where cadmium and lead exceeded human health and background screening criteria, the sources are likely buried metals that could be MEC, MPPEH, or non-munitions related debris.

As discussed in Section 6.0, mercury was screened against both inorganic and organic mercury criteria since uncertainty is associated with the presence of mercury fulminate. Mercury was detected in 3 of 28 samples collected. The detected concentration for mercury was less than residential and industrial screening criteria for both inorganic and organic mercury (Table 7-1).

None of the perchlorate, nitrate/nitrite-N, and total Kjeldahl nitrogen concentrations detected in soil at MRP Site UXO1 exceeded the screening criteria (Table 7-1). No screening criteria were available for ammonia.

The human health screening criteria used to compare the analytical results in soil at MRP Site UXO1 are based solely on general residential and industrial use scenarios. Therefore, the screening results in this report are applicable only under the assumptions inherent in the residential and industrial criteria used and the data available at the time of the evaluation.

7.5.1.2 Ecological Screening for Soil

Concentrations of chemicals in soil at MRP Site UXO1 were compared with ecological benchmarks. Detected concentrations of five metals in soil at UXO1 (cadmium, copper, lead, selenium, and zinc) exceeded the corresponding ecological benchmarks and background screening criteria (Table 7-1). A background concentration for cobalt was not established. No ecological screening benchmarks were available for iron and perchlorate. The remaining chemicals either did not exceed the ecological benchmarks and background or were detected at concentrations less than the laboratory reporting limit. The results of the comparison are as follows:

Chemical	Detection Frequency	Maximum Concentration in Soil (mg/kg)	Background Screening Criteria (mg/kg)	Ecological Screening Benchmark (mg/kg)	Number of Detections Greater than Background and Ecological Screening Criteria
Cadmium	23/28	8.6	2.2	0.36	4
Cobalt	28/28	14.1	NA	13	2
Copper	28/28	224	39.0	28	2
Lead	28/28	81.9	35.7	11	2
Selenium	6/28	0.89	0.44	0.52	6
Zinc	28/28	1,620	177	46	6

Notes:
mg/kg Milligram per kilogram
NA No background concentration available

7.5.2 Sediment Sampling Results

Twelve sediment samples were collected from in the POLB Mitigation Pond at MRP Site UXO1. The suite of analytes for the sediment samples included metals, TKN, inorganic nitrogen, ammonia, perchlorate, and explosives. Sediment sampling results are in Tables 7-3 and 7-4, and Appendix E-2. Sixteen metals were detected in sediment, but not in every sample. Seven metals detected, arsenic, cadmium, copper, lead, mercury, nickel, and zinc, exceeded the corresponding ecological benchmarks. Explosives and perchlorate were not detected in any of the sediment samples. Ammonia and TKN were detected in all the sediment samples, but nitrate/nitrite-N was detected in only two of the 12 samples.

Concentrations of chemicals in sediment at UXO1 were compared with ecological benchmarks. Detected concentrations of seven metals in sediment at UXO1 (arsenic, cadmium, copper, lead, mercury, nickel, and zinc) exceeded the corresponding ecological benchmarks (Table 7-3). The remaining chemicals did not exceed the ecological benchmarks, did not have a benchmark or were detected at concentrations below the laboratory reporting limit. The results of the comparison are as follows:

Chemical	Detection Frequency	Maximum Concentration in Sediment (mg/kg)	Ecological Screening Benchmark (mg/kg)	Number of Detections Greater than Ecological Screening Criteria
Arsenic	12/12	9	8.2	1
Cadmium	7/12	1.5	1.2	1
Copper	12/12	44	34	4
Lead	12/12	957	46.7	4
Mercury	2/12	0.71	0.15	2
Nickel	12/12	24.1	20.9	3
Zinc	12/12	208	150	1

Note:
mg/kg Milligram per kilogram

7.5.3 Surface Water Sampling Results

Five surface water samples were collected from the POLB Mitigation Pond at MRP Site UXO1. Concentrations of chemicals in surface water at MRP Site UXO1 were compared with ecological benchmarks. The suite of analytes for the surface water samples included metals, TKN, inorganic nitrogen, ammonia, perchlorate, and explosives. Surface water sampling results are in Tables 7-5 and 7-6, and Appendix E-3.

Only barium and zinc were detected in surface water. Zinc was detected in one of the five samples at a concentration of 43.4 micrograms per liter (µg/L), less than the ecological screening benchmark of 81 µg/L (Table 7-5). No ecological benchmark screening criterion was available for barium.

7.5.4 Data Quality Review

A final review of the analytical data set against EPA data quality parameters indicated the data are of overall high quality. The data quality review found that QA/QC objectives for bias and precision were met for most analytical results for MRP Site UXO1 with the following exceptions:

- MS/ MSD recoveries resulted in qualification of results as estimated (J) for antimony, barium, manganese, and zinc in multiple samples. Approximately 6.6 percent of the sediment data and 0.8 percent of the soil sample data were affected.
- MS/MSD recoveries resulted in qualification of results as estimated (J) for ammonia in multiple samples. Approximately 10 percent of the data for ammonia in soil were affected. One soil sample result was qualified as estimated (J) for tetryl, an explosive compound.
- Interference check sample (ICS) values caused qualification of results as estimated (J) for cadmium and thallium in a few samples. High concentrations of calcium and iron resulted in qualification of 0.7 percent of the sediment data, 0.02 percent of the soil data, and 0.2 percent of the water data.
- Several sample results were estimated because they were reported at concentrations between the MDL and the QL. The analytical instrument can make reliable qualitative identification of analytes greater than the MDL but below the QL; detected results below the QL are considered quantitatively uncertain.

A complete summary the data quality review is in Appendix F. The supporting data validation reports are in Appendix E-5. Chain-of-custody forms were used to trace possession of the samples from field collection to the analytical laboratory. The completed chain-of-custody forms are in Appendix E-4.

7.6 MRP SITE UXO1 UPDATED CONCEPTUAL SITE MODEL

The CSM for MRP Site UXO1 was updated, based on the results of the 2009 SI, to include the types of munitions observed, the anticipated MEC density based on geophysical and detector-aided visual survey results, the observed site structures, MC sampling results, and information gathered from interviews with former site personnel (ChaduxTt 2010b). Farmers were added as potential receptors in the CSM since the eastern border of the site was observed to be tilled for agricultural use, and interviews with the NAVWPNSTA Seal Beach farm supervisor indicated tilling equipment and operations had been previously impeded by munitions-related items buried in the soil (ChaduxTt 2009c).

The updated CSM profile for UXO1 is in Table 7-7. Figures 7-8 and 7-9 provide a graphical representation of the current understanding of the exposure pathways that could enable site receptors to come in contact with, or be affected by, MEC and MC at MRP Site UXO1. Potentially complete exposure pathways for human or ecological receptors exist for MEC in the subsurface (Figure 7-8).

The graphical CSM for MEC from the PSI (Malcolm Pirnie 2008) shows complete MEC exposure pathways for Navy personnel, contractor, visitors, and biota for walking on the site. The CSM from the PSI also shows potentially complete MEC exposure pathways for these receptors for intrusive activities (for example, digging, drilling, or construction) and incomplete MEC exposure pathways for the farmers for walking on the site and intrusive activities. Based on the locations and density of suspect MEC and MPPEH observed during the 2009 SI, the updated graphical CSM (Figure 7-8) has been revised to include potentially complete MEC exposure pathways for all receptors and activities since any of the receptors could come in contact with MEC.

The updated graphical CSM for MC (Figure 7-9) shows different exposure pathways than the PSI (Malcolm Pirnie 2008) based on the 2009 SI MC soil, sediment, and surface water sampling results.

7.7 MRP SITE UXO1 CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations for MRP Site UXO1.

7.7.1 Potential or Existing MEC Hazards

MRP Site UXO1 was visually inspected during the PSI (Malcolm Pirnie 2008), during the site walk for the MRP SI project kickoff meeting (July 25, 2008), and during the 2009 SI field activities. Evidence of suspect MEC, MPPEH and inert munitions was observed during the visual inspection done during the 2009 SI field effort. Numerous target geophysical anomalies identified throughout the site imply significant munitions burial. Based on visual evidence and past practices and the nature, extent, and distribution of geophysical anomalies mapped at the site, the MEC risk and hazard at MRP Site UXO1 are anticipated to be high in the Primer/Salvage Yard and low to medium in the POLB Mitigation Pond.

Based on the types and density of suspect MEC and MPPEH at UXO1, TCRA for surface MEC is recommended for the Primer/Salvage Yard and around the embankment of the POLB Mitigation Pond. Because of the high density of target anomalies detected during geophysical and UXO detector-aided visual surveys, the TCRA should be followed by an RI/FS for MEC.

7.7.2 Potential or Existing MC Hazards

No concentrations of explosives or propellants were detected in soils, sediment, or surface water at MRP Site UXO1. Perchlorate, ammonia, nitrate/nitrite-N, and TKN were detected at concentrations less than the human health and ecological benchmark screening criteria in soil. Cadmium and lead were detected in soil at concentrations greater than the human health and background screening criteria. Detected concentrations of five metals in soil (cadmium, copper, copper, lead, selenium, and zinc) exceeded the corresponding ecological benchmarks and background. Detected concentrations of seven metals in sediment (arsenic, cadmium, copper, lead, mercury, nickel, and zinc) exceeded the corresponding ecological benchmarks. All detected chemicals in surface water were less than the ecological benchmark screening criteria.

Because of the high density of target anomalies, suspect MEC, MPPEH (potential sources of MC) throughout the site, and the SI soil and sediment sampling results exceeding screening criteria, the recommended TCRA for MRP Site UXO1 should be followed by a RI/FS for MC.

SECTION 7.0 PHOTOS – MRP SITE UXO1

Photo 1: View looking southeast at MRP Site UXO1.

Photo 2: View looking east inside fenced area at MRP Site UXO1.

Photo 3: View looking east between fenced area and POLB Pond at MRP Site UXO1.

Photo 4: View looking southeast at POLB Pond at MRP Site UXO1.

Photo 5: Partially buried BLU-36 bomblet (suspect MEC) found inside fenced area at MRP Site UXO1.

Photo 6: Partially buried M-40 bomblet (suspect MEC) found inside fenced area at MRP Site UXO1.

Photo 7: Partially buried 75-mm cartridge casing (suspect MEC) found inside fenced area at MRP Site UXO1.

Photo 8: M-40 bomblet half (MPPEH) found on the paved area inside fenced area at MRP Site UXO1.

Photo 9: BLU-36 half found inside fenced area at MRP Site UXO1.

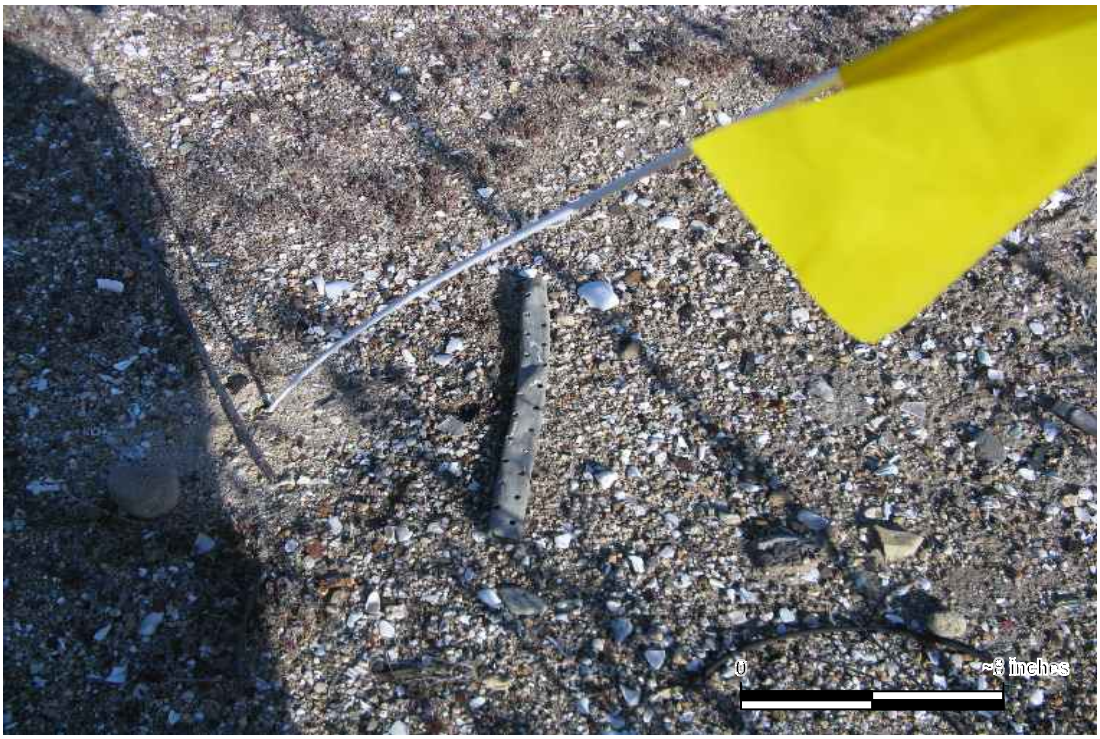


Photo 10: Flash tube (MPPEH) found inside fenced area at MRP Site UXO1.

Photo 11: 20-mm cartridge casing (MPPEH) found inside fenced area at MRP Site UXO1.

Photo 12: M-1 Garand cartridge casings (MPPEH) found inside the fenced area at MRP Site UXO1.

Photo 13: 20-mm projectile practice tracer (MPPEH) found inside the fenced area at MRP Site UXO1.

Photo 14: Navy round shipping cap (MPPEH) found within the recovered live ammunition and grenades area outside the fenced area at MRP Site UXO1.

Photo 15: M-1 Garand cartridge casing (MPPEH) found outside the fenced area at MRP Site UXO1.

Photo 16: 81-mm mortar shipping container (MPPEH) found outside the fenced area at MRP Site UXO1.

Photo 17: Pile of Marshall matting, munitions shipping container end caps, and 81-mm mortar shipping containers (MPPEH) found within the recovered live ammunition and grenades area outside the fenced area at MRP Site UXO1.

Photo 18: Flash tube (MPPEH) found outside the fenced area at MRP Site UXO1.

Photo 19: Suspect 20-mm cartridge casings (MPPEH) found along the northern bank of the POLB Pond.

Photo 20: Suspect 20-mm cartridge casings (MPPEH) found submerged along the northern edge of the POLB Pond.

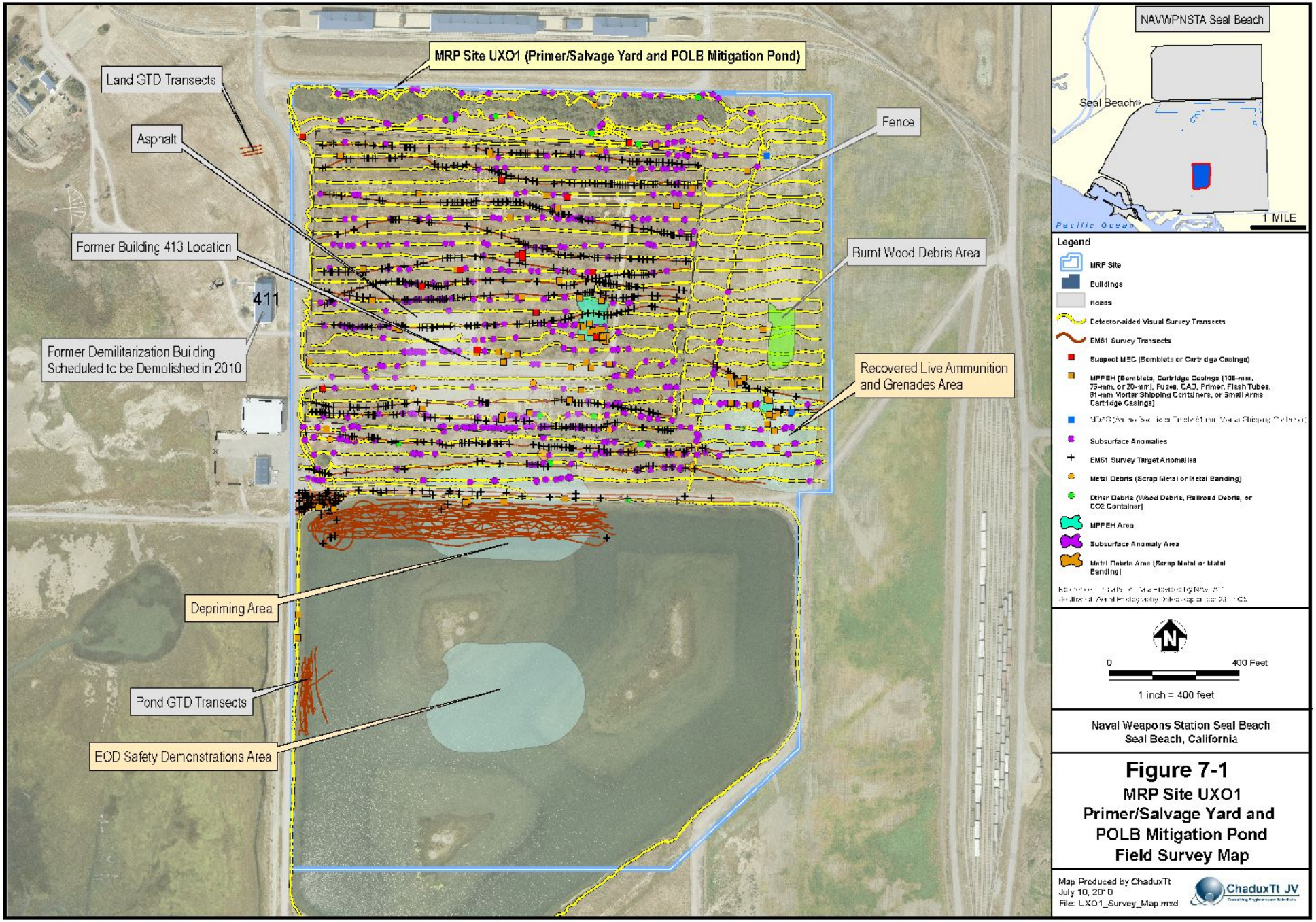
Photo 21: Multiple artillery cartridge casings (MPPEH) found along the northwest bank of the POLB Pond.

Photo 22: Artillery cartridge casings (MPPEH) found submerged along the northern edge of the POLB pond.

Photo 23: Boat towed EM61-MKII configuration within the POLB Mitigation Pond.

Photo 24: EM61-MKII data collection within the GTD test area.

SECTION 7.0 FIGURES – MRP SITE UXO1



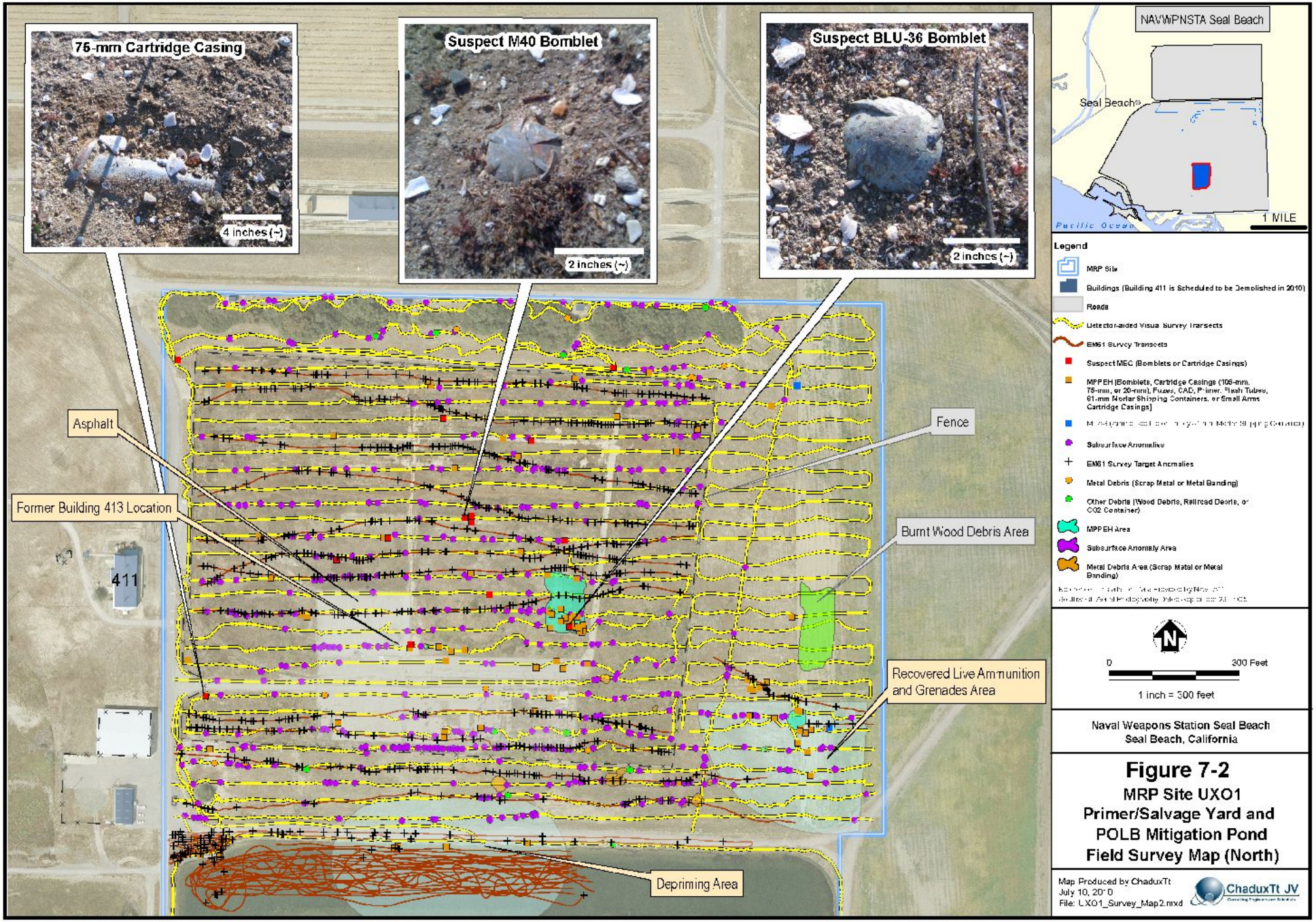
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-1

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond Field Survey Map

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Survey_Map.mxd

ChaduxTt JV



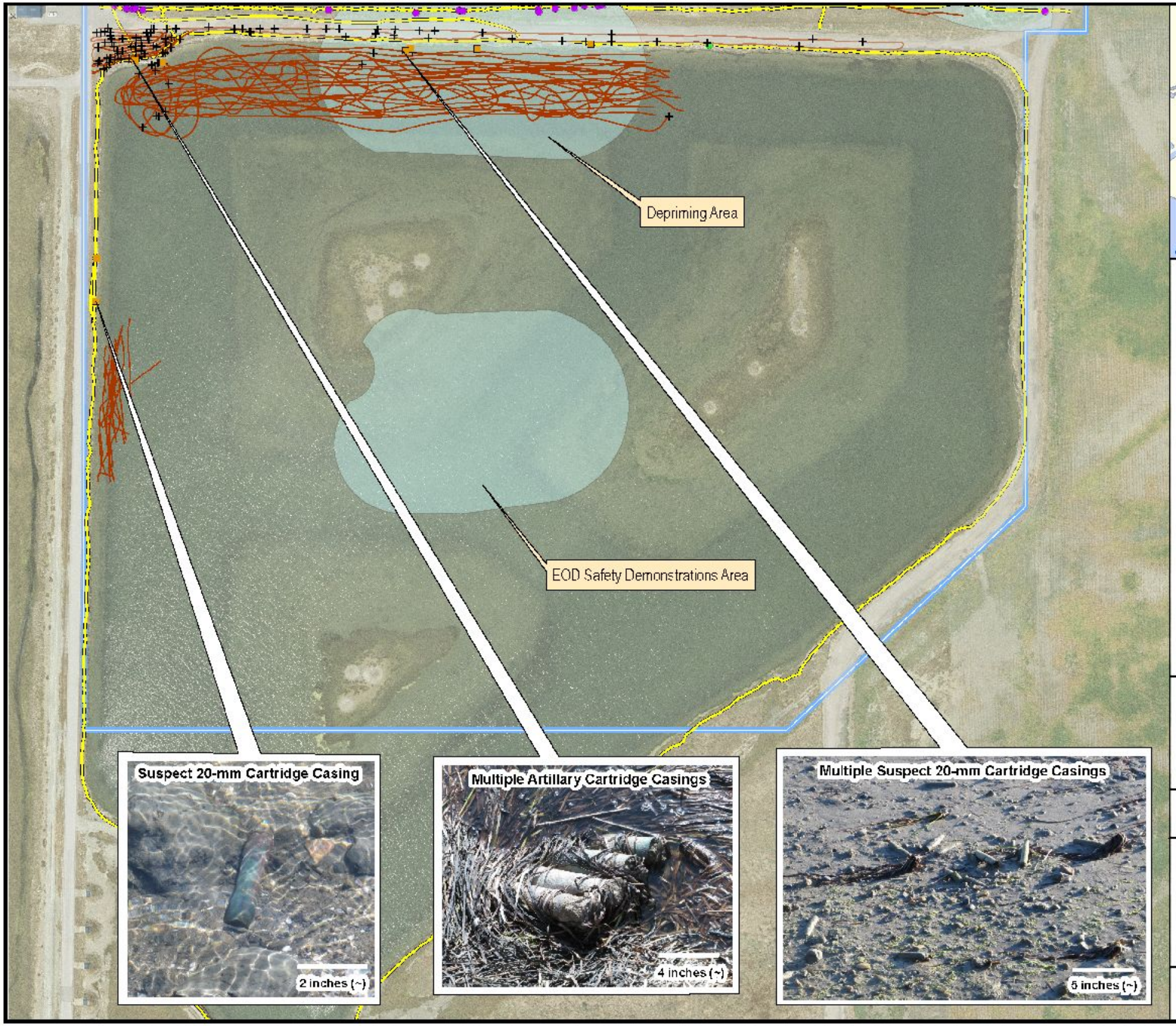
Naval Weapons Station Seal Beach
Seal Beach, California

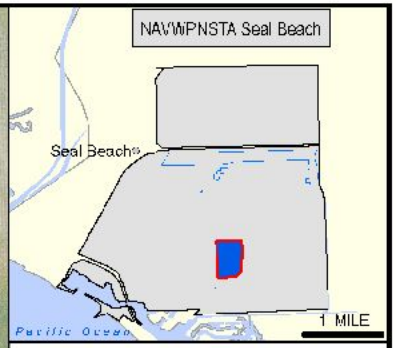
Figure 7-2

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond Field Survey Map (North)

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Survey_Map2.mxd

ChaduxTt JV





Legend

- MRP Site
- Buildings
- Roads
- Detector-aided Visual Survey Transects
- EM61 Survey Transects
- MPPEH (Artillary Cartridge Casings, 105-mm Cartridge Casing, Suspect 20-mm Cartridge Casings, or Suspect 50-Caliber Cartridge Casings)
- Other Debris (Wood Debris)
- Subsurface Anomalies
- EM61 Survey Target Anomalies

0 240 Feet

1 inch = 240 feet

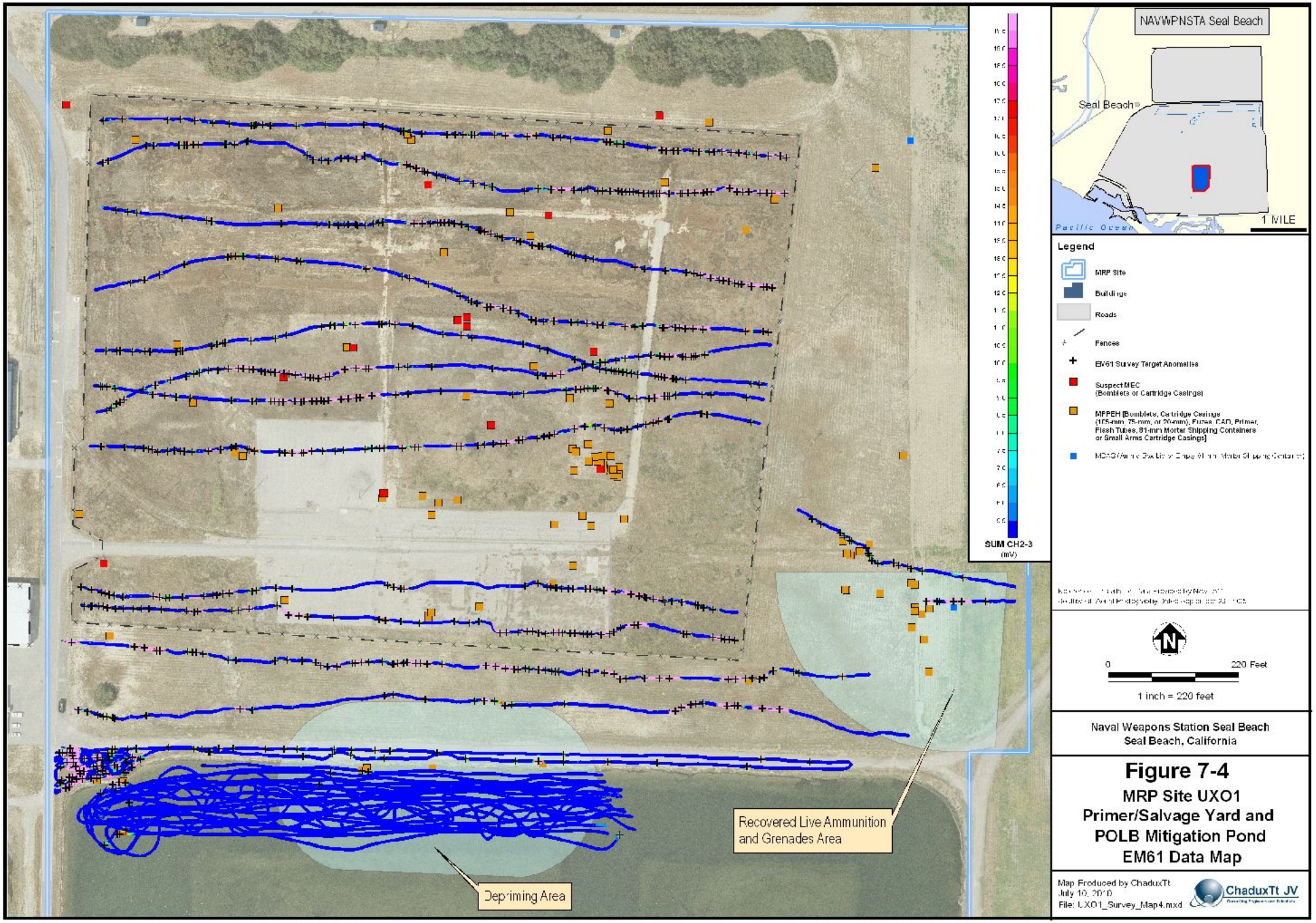
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-3

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond Field Survey Map (South)

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Survey_Map3.mxd

ChaduxTt JV



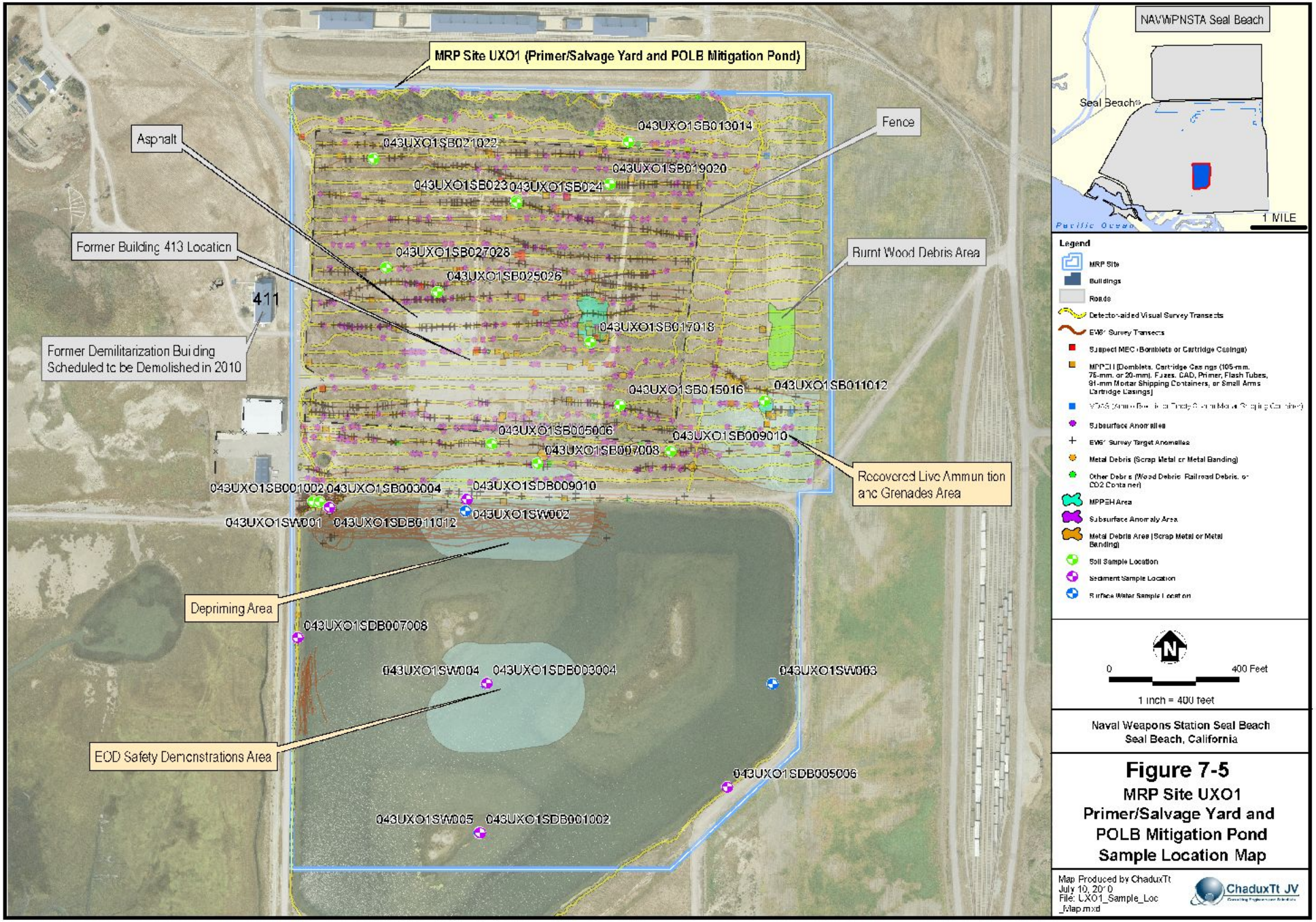
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-4

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond EM61 Data Map

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Survey_Map4.mxd

ChaduxTt JV



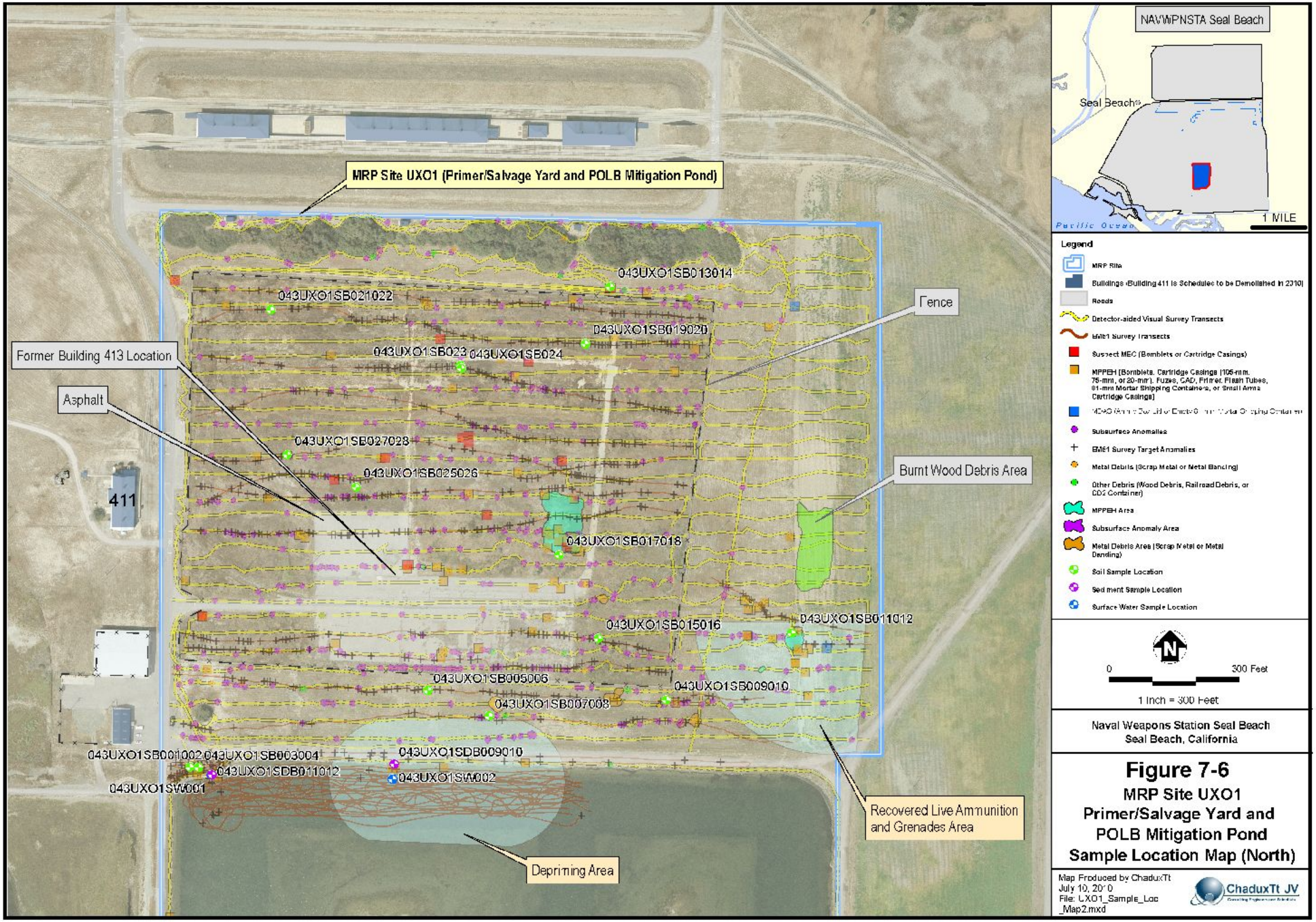
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-5

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond Sample Location Map

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Sample_Loc_Map.mxd

ChaduxTt JV



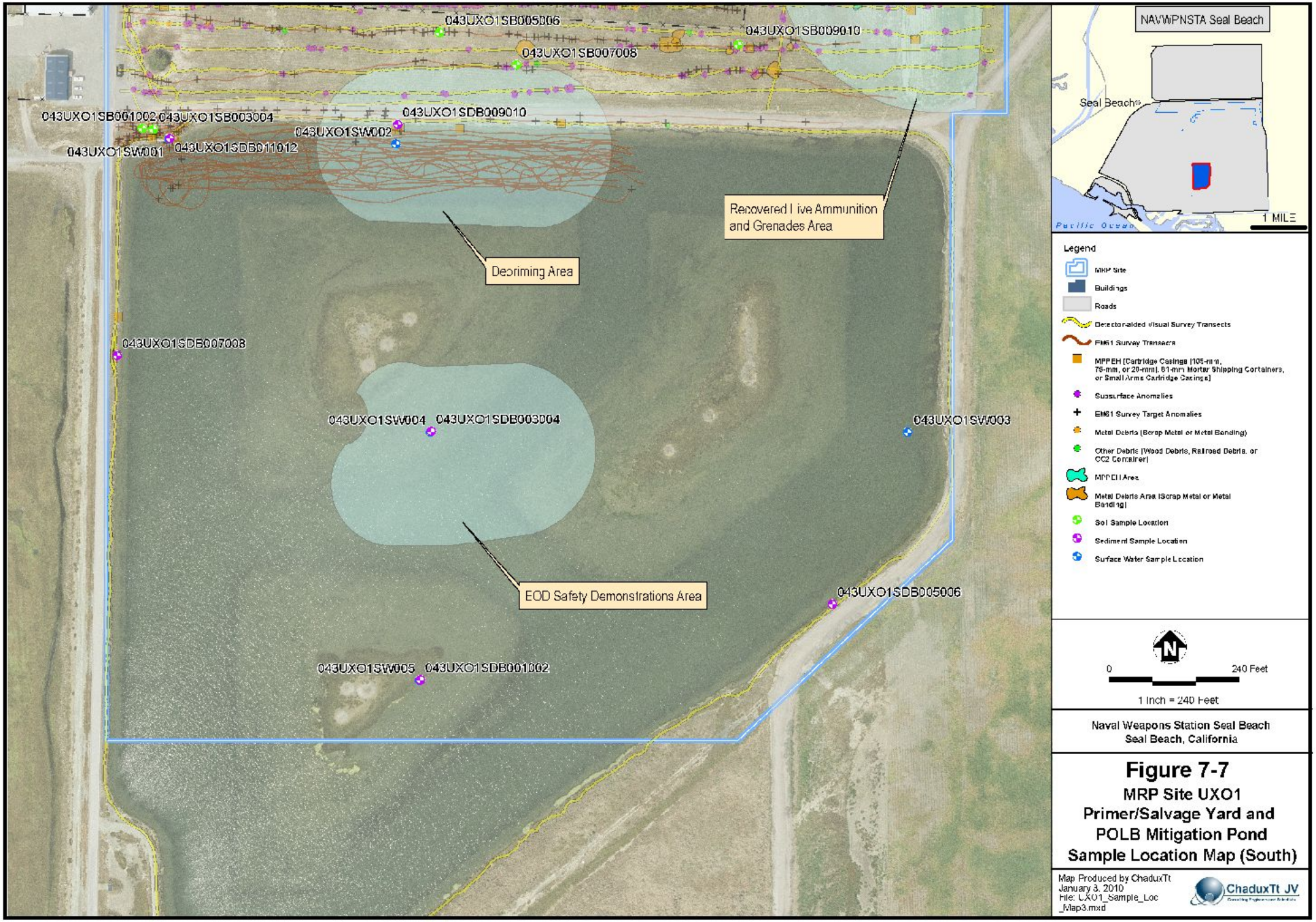
Naval Weapons Station Seal Beach
Seal Beach, California

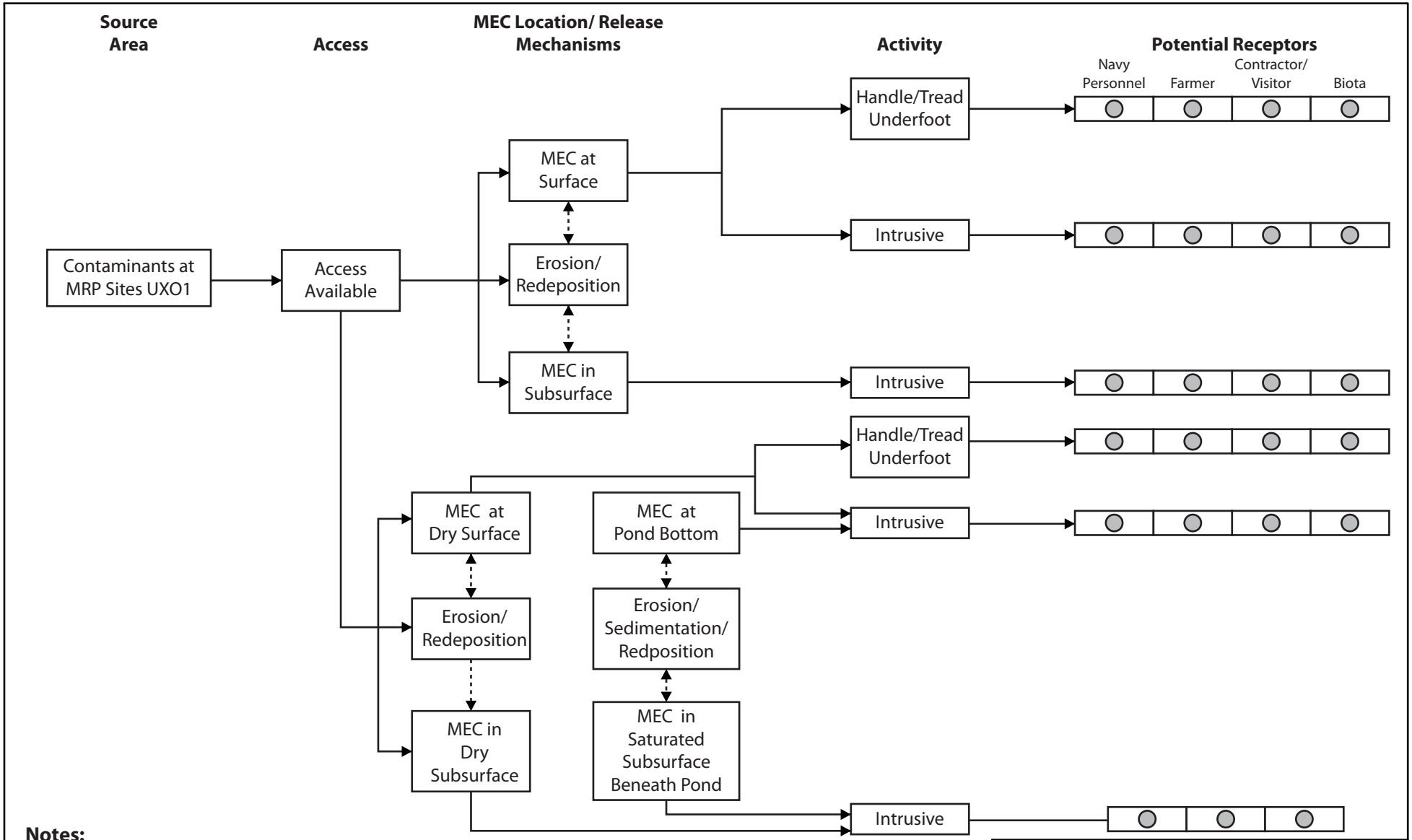
Figure 7-6

MRP Site UXO1 Primer/Salvage Yard and POLB Mitigation Pond Sample Location Map (North)

Map Produced by ChaduxTt
July 10, 2010
File: UXO1_Sample_Loc_Map2.mxd

ChaduxTt JV


043UXO1SB005006
043UXO1SB009010
043UXO1SB007008
043UXO1SB001002
043UXO1SB003004
043UXO1SDB009010
043UXO1SW002
043UXO1SW001
043UXO1SDB011012
Recovered Live Ammunition and Grenades Area
Deriming Area
043UXO1SDB007008
043UXO1SW004
043UXO1SDB003004
043UXO1SW003
EOD Safety Demonstrations Area
043UXO1SDB005006
043UXO1SW005
043UXO1SDB001002
NAVWPNSTA Seal Beach
Seal Beach
Pacific Ocean
1 MILE
Legend
MRP Site
Buildings
Roads
Detector-aided Visual Survey Transects
EM61 Survey Transects
MPPEH (Cartridge Casings (105-mm, 75-mm, or 20-mm), 81-mm Mortar Shipping Containers, or Small Arms Cartridge Casings)
Subsurface Anomalies
EM61 Survey Target Anomalies
Metal Debris (Scrap Metal or Metal Banding)
Other Debris (Wood Debris, Railroad Debris, or CO2 Container)
MPPEH Area
Metal Debris Area (Scrap Metal or Metal Banding)
Soil Sample Location
Sediment Sample Location
Surface Water Sample Location
N
0
240 Feet
1 Inch = 240 Feet
Naval Weapons Station Seal Beach
Seal Beach, California
Figure 7-7
MRP Site UXO1
Primer/Salvage Yard and
POLB Mitigation Pond
Sample Location Map (South)
Map Produced by ChaduxTt
January 3, 2010
File: UXO1_Sample_Loc
_Map3.mxd
ChaduxTt JV



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MEC - Munitions and Explosives of Concern

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

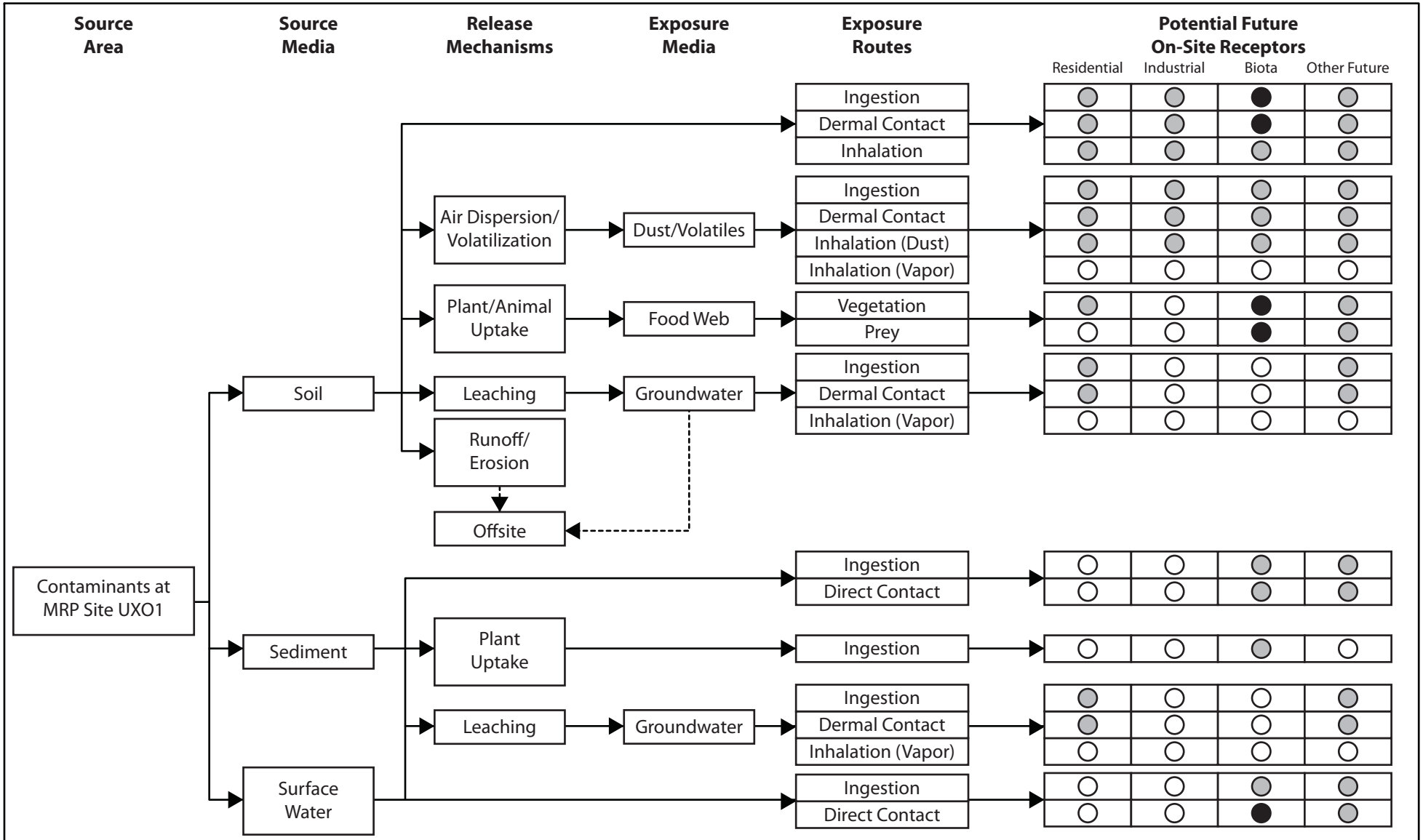
○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-8

MRP Site UXO1
Graphical Updated Conceptual Site Model for MEC
Site Inspection Report



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 7-9

MRP Site UXO1
Graphical Updated Conceptual Site Model
for MC
Site Inspection Report

SECTION 7.0 TABLES – MRP SITE UXO1

TABLE 7-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Screening Criteria	Number of Detections Above Residential Screening Criteria	Industrial Screening Criteria	Number of Detections Above Industrial Screening Criteria	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria	Back-ground Screening Level	Number of Detections Above Background Screening Level
Metals (mg/kg)													
ALUMINUM	28/28	1,750	24,900	043UXO1SB019020	20.1 - 22.3	77,000	0	990,000	0	50.0	**28**	36,300	0
ARSENIC	28/28	1.3	7.2	043UXO1SB021022	1.0 - 1.1	0.062	**28**	0.25	**28**	10.0	0	15.4	0
BARIUM	28/28	10.2 J	158 J	043UXO1SB019020	1.0 - 1.1	15,000	0	190,000	0	330	0	NC	-
BERYLLIUM	17/28	0.21 J	0.90 J	043UXO1SB021022	1.0 - 1.1	160	0	2,000	0	10.0	0	2.1	0
CADMIUM	23/28	0.14 J	8.6	043UXO1SB021022	1.0 - 1.1	1.7	**5**	7.5	**1**	0.36	**12**	2.2	**4**
CHROMIUM	28/28	2.8	31.3	043UXO1SB019020	1.0 - 1.1	120,000	0	1,500,000	0	0.40	**28**	46.2	0
COBALT	28/28	1.3	14.1	043UXO1SB019020	1.0 - 1.1	23.0	0	300	0	13.0	**2**	NC	-
COPPER	28/28	2.0	224	043UXO1SB005006	1.0 - 1.1	3,100	0	41,000	0	28.0	**4**	39.0	**2**
IRON	28/28	3,330	30,200	043UXO1SB019020	20.1 - 22.3	55,000	0	720,000	0	NC	-	NC	-
LEAD	28/28	1.4	81.9	043UXO1SB019020	1.0 - 1.1	80.0	**1**	320	0	11.0	**16**	35.7	**2**
MANGANESE	28/28	43.0 J	732 J	043UXO1SB019020	1.0 - 1.1	1,800	0	23,000	0	220	**12**	1,100	0
MERCURY-INORGANIC	3/28	0.042 J	0.057 J	043UXO1SB021022	0.10 - 0.11	23.0	0	310	0	0.10	0	NC	-
MERCURY-ORGANIC	3/28	0.042 J	0.057 J	043UXO1SB021022	0.10 - 0.11	7.8	0	100	0	0.10	0	NC	-
NICKEL	28/28	2.2	23.6	043UXO1SB019020	1.0 - 1.1	1,500	0	20,000	0	38.0	0	32.5	0
SELENIUM	6/28	0.54 J	0.89 J	043UXO1SB023024	1.0 - 1.1	390	0	5,100	0	0.52	**6**	0.44	**6**
SILVER	1/28	1.7	1.7	043UXO1SB023024	1.0 - 1.0	390	0	5,100	0	4.2	0	NC	-
VANADIUM	28/28	6.7	63.8	043UXO1SB019020	1.0 - 1.1	78.0	0	1,000	0	2.0	**28**	86.0	0
ZINC	28/28	8.7	1,620	043UXO1SB019020	1.0 - 1.1	23,000	0	310,000	0	46.0	**21**	177	**6**
Explosives (mg/kg)													
PERCHLORATE	19/28	0.00027 J	0.0032 J	043UXO1SB001002, 043UXO1SB021022	0.0050 - 0.0056	29.0	0	380	0	NC	-	NC	-
Ammonia (mg/kg)													
AMMONIA (NH3-N)	28/28	5.7	83.1	043UXO1SB003004	2.4 - 13.3	NC	-	NC	-	NC	-	NC	-
Anions (mg/kg)													
NITRATE/NITRITE-N	25/28	0.64 J	18.4	043UXO1SB009010	1.0 - 1.1	7,800	0	100,000	0	NC	-	NC	-
Total Kjeldahl Nitrogen (mg/kg)													
TOTAL KJELDAHL NITROGEN	28/28	20.7	2,000	043UXO1SB019020	1.1 - 111	130,000	0	1,600,000	0	NC	-	NC	-

TABLE 7-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Notes:

1. Data shown includes detected analytes in all soil samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).
4. "Total" metals were measured at the Site. Given the uncertainties, total mercury was screened by use of inorganic and organic mercury human health screening criteria.

-	Not applicable
J	Estimated value
mg/kg	Milligrams per kilogram
MRP	Munitions response program
NC	No criteria
QC	Quality control
UXO	Unexploded ordinance

TABLE 7-2: METALS RESULTS FOR SOIL SAMPLES EXCEEDING BACKGROUND CONCENTRATIONS FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	Background Screening Level
Metals (mg/kg)										
CADMIUM	043UXO1SB019020	043UXO1SB019	0.00 - 0.50	12/03/09	4.9	1.1	**1.7**	7.5	**0.36**	**2.2**
CADMIUM	043UXO1SB021022	043UXO1SB021	0.00 - 0.50	12/04/09	8.6	1.0	**1.7**	**7.5**	**0.36**	**2.2**
CADMIUM	043UXO1SB023024	043UXO1SB023	0.00 - 0.50	12/04/09	5.3	1.0	**1.7**	7.5	**0.36**	**2.2**
CADMIUM	043UXO1SB027028	043UXO1SB027	0.00 - 0.50	12/04/09	3.2	1.0	**1.7**	7.5	**0.36**	**2.2**
COPPER	043UXO1SB005006	043UXO1SB005	0.00 - 0.50	11/30/09	224	1.0	3,100	41,000	**28.0**	**39.0**
COPPER	043UXO1SB019020	043UXO1SB019	0.00 - 0.50	12/03/09	42.2	1.1	3,100	41,000	**28.0**	**39.0**
LEAD	043UXO1SB019020	043UXO1SB019	0.00 - 0.50	12/03/09	81.9	1.1	**80.0**	320	**11.0**	**35.7**
LEAD	043UXO1SB023024	043UXO1SB023	0.00 - 0.50	12/04/09	77.2	1.0	80.0	320	**11.0**	**35.7**
SELENIUM	043UXO1SB019020	043UXO1SB019	0.00 - 0.50	12/03/09	0.68 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO1SB019020	043UXO1SB020	1.00 - 1.50	12/03/09	0.59 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO1SB021022	043UXO1SB021	0.00 - 0.50	12/04/09	0.54 J	1.0	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO1SB021022	043UXO1SB022	1.00 - 1.50	12/04/09	0.76 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO1SB023024	043UXO1SB023	0.00 - 0.50	12/04/09	0.72 J	1.0	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO1SB023024	043UXO1SB024	1.00 - 1.50	12/04/09	0.89 J	1.1	390	5,100	**0.52**	**0.44**
ZINC	043UXO1SB013014	043UXO1SB013	0.00 - 0.50	12/03/09	204	1.0	23,000	310,000	**46.0**	**177**
ZINC	043UXO1SB017018	043UXO1SB017	0.00 - 0.50	12/03/09	374	1.0	23,000	310,000	**46.0**	**177**
ZINC	043UXO1SB019020	043UXO1SB019	0.00 - 0.50	12/03/09	1,620	1.1	23,000	310,000	**46.0**	**177**
ZINC	043UXO1SB021022	043UXO1SB021	0.00 - 0.50	12/04/09	783	1.0	23,000	310,000	**46.0**	**177**
ZINC	043UXO1SB023024	043UXO1SB023	0.00 - 0.50	12/04/09	304	1.0	23,000	310,000	**46.0**	**177**
ZINC	043UXO1SB025026	043UXO1SB025	0.00 - 0.50	12/04/09	421	1.0	23,000	310,000	**46.0**	**177**

Notes:
1. Exceeded screening criterion is shown in bold.
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
MRP Munitions response program
UXO Unexploded ordinance

TABLE 7-3: SUMMARY OF SEDIMENT ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria
Metals (mg/kg)							
ALUMINUM	12/12	8,200	27,700	043UXO1SDB007008	25.2 - 31.3	NC	-
ARSENIC	12/12	2.4	9.0	043UXO1SDB001002	1.3 - 1.6	8.2	**1**
BARIUM	12/12	53.4	307 J	043UXO1SDB005006	1.3 - 1.6	NC	-
BERYLLIUM	12/12	0.27 J	0.98 J	043UXO1SDB007008	1.3 - 1.6	NC	-
CADMIUM	7/12	0.15 J	1.5	043UXO1SDB011012	1.3 - 1.4	1.2	**1**
CHROMIUM	12/12	11.6	40.9	043UXO1SDB005006	1.3 - 1.6	81.0	0
COBALT	12/12	6.0	14.2	043UXO1SDB001002	1.3 - 1.6	NC	-
COPPER	12/12	6.8	44.0	043UXO1SDB005006	1.3 - 1.6	34.0	**4**
IRON	12/12	13,300	31,800	043UXO1SDB007008	25.2 - 31.3	NC	-
LEAD	12/12	3.0	957	043UXO1SDB005006	1.3 - 1.6	46.7	**4**
MANGANESE	12/12	169 J	1,050	043UXO1SDB001002	1.3 - 1.6	NC	-
MERCURY	2/12	0.21	0.71	043UXO1SDB005006	0.14 - 0.15	0.15	**2**
NICKEL	12/12	8.8	24.1	043UXO1SDB007008	1.3 - 1.6	20.9	**3**
SELENIUM	2/12	0.81 J	0.87 J	043UXO1SDB005006	1.4 - 1.6	NC	-
VANADIUM	12/12	26.0	64.8	043UXO1SDB001002	1.3 - 1.6	NC	-
ZINC	12/12	38.7	208	043UXO1SDB005006	1.3 - 1.6	150	**1**
Explosives (mg/kg)							
None Detected	0/ 12	ND	ND	-	-	-	-
Ammonia (mg/kg)							
AMMONIA (NH3-N)	12/12	8.0	84.8	043UXO1SDB005006	3.2 - 14.7	NC	-
Anions (mg/kg)							
NITRATE/NITRITE-N	2/12	0.91 J	1.8	043UXO1SDB011012	1.4 - 1.4	NC	-
Total Kjeldahl Nitrogen (mg/kg)							
TOTAL KJELDAHL NITROGEN	12/12	64.9	1,810	043UXO1SDB005006	12.4 - 280	NC	-

TABLE 7-3: SUMMARY OF SEDIMENT ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Notes:

1. Data shown includes detected analytes in all sediment samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).
4. Lake sediment samples with approximate sample depth 0 to 1.5 feet below ground surface

-	Not applicable
J	Estimated value
mg/kg	Milligrams per kilogram
MRP	Munitions response program
NC	No criteria
ND	None detected
QC	Quality control
UXO	Unexploded ordinance

TABLE 7-4: SEDIMENT ANALYTICAL RESULTS EXCEEDING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Analyte	Point ID	Sample ID	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Ecological Screening Criteria
Metals (mg/kg)						
ARSENIC	043UXO1SDB001002	043UXO1SDB001	12/02/09	9.0	1.4	8.2
CADMIUM	043UXO1SDB011012	043UXO1SDB011	12/02/09	1.5	1.4	1.2
COPPER	043UXO1SDB001002	043UXO1SDB001	12/02/09	34.9	1.4	34.0
COPPER	043UXO1SDB005006	043UXO1SDB005	12/03/09	44.0	1.4	34.0
COPPER	043UXO1SDB005006	043UXO1SDB006	12/03/09	34.3	1.5	34.0
COPPER	043UXO1SDB007008	043UXO1SDB007	12/03/09	42.1	1.6	34.0
LEAD	043UXO1SDB005006	043UXO1SDB005	12/03/09	957	1.4	46.7
LEAD	043UXO1SDB005006	043UXO1SDB006	12/03/09	183	1.5	46.7
LEAD	043UXO1SDB007008	043UXO1SDB007	12/03/09	124	1.6	46.7
LEAD	043UXO1SDB007008	043UXO1SDB008	12/03/09	62.8	1.5	46.7
MERCURY	043UXO1SDB005006	043UXO1SDB005	12/03/09	0.71	0.14	0.15
MERCURY	043UXO1SDB005006	043UXO1SDB006	12/03/09	0.21	0.15	0.15
NICKEL	043UXO1SDB001002	043UXO1SDB001	12/02/09	21.8	1.4	20.9
NICKEL	043UXO1SDB007008	043UXO1SDB007	12/03/09	24.1	1.6	20.9
NICKEL	043UXO1SDB007008	043UXO1SDB008	12/03/09	21.0	1.5	20.9
ZINC	043UXO1SDB005006	043UXO1SDB005	12/03/09	208	1.4	150

Notes: 1. Screening criteria sources are presented in Sections 6.2 (ecological).

ID Identification
mg/kg Milligrams per kilogram
MRP Munitions response program
NC No criteria
UXO Unexploded ordinance

TABLE 7-5: SUMMARY OF SURFACE WATER ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO1

Naval Weapons Station Seal Beach, California

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria
Metals (µg/L)							
BARIUM	5/5	10.3 J	14.2 J	043UXO1SW001	50.0 - 50.0	NC	-
ZINC	1/5	43.4 J	43.4 J	043UXO1SW001	50.0 - 50.0	81.0	0
Explosives (µg/L)							
None Detected	0/ 5	ND	ND	-	-	-	-
Ammonia (mg/L)							
AMMONIA (NH3-N)	5/5	0.17	0.22	043UXO1SW001	0.10 - 0.10	NC	-
Anions (mg/L)							
None Detected	0/ 5	ND	ND	-	-	-	-
Total Kjeldahl Nitrogen (mg/L)							
TOTAL KJELDAHL NITROGEN	5/5	0.23	0.40	043UXO1SW005	0.10 - 0.10	NC	-

Notes:

1. Data shown includes detected analytes in all water samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

- Not applicable
J Estimated value
mg/L Milligrams per liter
MRP Munitions response program
NC No criteria
ND None detected
QC Quality control
UXO Unexploded ordinance

Table 7-6: Surface Water Quality Parameter Results for MRP Site UX01

Site Inspections Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1, and AOC2
Naval Weapons Station Seal Beach, California

Sample ID	Date	Time	DO (mg/L)	Temperature (°C)	Conductivity (uS/cm)	pH	ORP (mV)
043UXO1SW001	12/1/2009	11:30 AM	-14.65	17.27	47.03	7.05	241.1
043UXO1SW002	12/1/2009	2:00 PM	646.52	17.42	47.43	8.16	150.6
043UXO1SW003	12/1/2009	2:50 PM	484.31	16.40	46.69	8.19	138.2
043UXO1SW004	12/1/2009	3:40 PM	85.45	15.86	47.02	8.21	137.4
043UXO1SW005	12/1/2009	4:10 PM	401.42	15.37	47.2	8.12	152.2

DO - Dissolved oxygen

ORP - Oxidation reduction potential

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information	Installation Name	NAVWPNSTA Seal Beach
	Site Name	MRP Site UXO1 (Primer/Salvage Yard and POLB Mitigation Pond)
	Site Area and Layout	UXO1 occupies approximately 87 acres, approximately 24 acres of which are fenced.
	Site Structures	A scale is located within the paved area, which was formerly used to weigh materials loaded on trucks and railroad cars. A concrete pad is located just southeast of the paved area that formerly supported a shredder with a conveyor belt that was used to shred munitions items. No buildings are currently located within the site boundary. Former Buildings 412 and 413 were located in a currently fenced area within the site.
	Site Boundaries	A line of brush lies just south of the northern boundary of MRP Site UXO1. Bolsa Road lies just north of the site. The NAVWPNSTA Seal Beach installation boundary, which borders the City of Seal Beach, lies roughly 2 miles north of the site. The southern portion of UXO1 includes the 40-acre 7th Street POLB Mitigation Pond, which is part of the Seal Beach NWR. The NAVWPNSTA Seal Beach installation boundary lies roughly 0.6 mile south of UXO1, bordering the city of Huntington Beach. Beyond the installation boundary is the Orange County Flood Control Channel, which flows into Anaheim Bay and then to the Pacific Ocean. The western boundary of UXO1 is 7th Street. IRP Site 74 (Old Skeet Range) is located about 600 feet west of UXO1. The installation boundary, which is bordered by the City of Seal Beach, lies roughly 1.75 miles west. Just east of UXO1 lies low grasses, railroad sidings, and agricultural fields. The Marshalling Yard is located 600 feet of the site to the east. The installation boundary is 1 mile east, bordered by the Cities of Westminster and Huntington Beach.

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information (continued)	Site Security	MRP Site UXO1 is located on NAVWPNSTA Seal Beach, which is a fenced and guarded installation. Security Forces personnel are responsible for maintaining law and order and for implementing access control policies and procedures. Access to UXO1 from within NAVWPNSTA Seal Beach is controlled by vehicular security patrol. About half of the northern portion of UXO1 (the Primer/Salvage Yard area) is fenced and secured by a locked gate with signs warning of unexploded ordnance (UXO) hazards. The area outside of the fenced area is open to personnel. Limited public access is granted to the POLB Mitigation Pond (the southern portion of UXO1) within Seal Beach NWR, by permission only.
Munitions/ Release Profile	Munitions Types	Types of munitions disposed of at UXO1 likely included, but are not limited to, live, inert or damaged submunitions (such as BLU-36 and M-40 bomblets), projectiles and cartridge casings (for example, 105-mm, 81-mm, 75-mm, 40-mm, 20-mm), fuzes, cartridge actuated devices (CADs), propellant actuated devices (PADs), primers, flash tubes, rockets (2.75- and 7.2-inch), grenades, obscurants (fog oil), black and smokeless powders, and small arms ammunition (NEESA 1985). Suspect 20-mm cartridge casings, a base plate with live primer, and numerous artillery cartridge casings have been observed lying within or along the northern bank of the POLB Mitigation Pond (the southern portion of UXO1). Munitions potentially present within the pond also include munitions attributed to the adjacent Primer/Salvage Yard.
	Maximum Probability Penetration Depth	Penetration from munitions use within the Primer/Salvage Yard area is not expected, and the maximum depth of munitions would be related to burial. It is also suspected that munitions observed along the northern bank of the POLB Mitigation Pond likely extend under Slough Road and to the north. The maximum depth of munitions within the POLB Mitigation Pond would likely be related to burial. Soil at the southern portion of UXO1 (the POLB Mitigation Pond) was excavated to roughly 6 feet bgs to create the POLB Mitigation Pond. Munitions debris is still emerging from the banks of the pond, indicating that additional MEC may be present below the water or ground surface.

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)	MEC Density	Density of MEC at UXO1 is anticipated to range from high (greater than 40 items per acre) within the Primer/Salvage Yard to very low (1 to 2 items per acre) within portions of the POLB Mitigation Pond. The density was based on reported use of the Primer/Salvage Yard and reported munitions buried as well as observed items potentially related to discarded or buried MEC during the 2009 SI field investigation.
	MEC Field Observations	Based on the PSI (Malcolm Pirnie 2008) and 2009 SI kickoff site walks (July 25, 2008), various munitions or munitions-related items were observed within the northern portion of UXO1 (the Primer/Salvage Yard area). These items included a 2.75-inch high-explosive style warhead, point detonating point detonating (PD) fuzes, and powder train time fuzes (PTTFs). In addition, numerous half shells from M30 or M40 series submunitions (golf ball size) and 5.56-mm and 50-caliber casings were observed. These items were mostly scattered within the fenced Primer/Salvage Yard area, other than a few cartridge casings south of the fence and a missile fin located north of the fence. During the 2009 SI field investigation, a total of 15 suspect MEC items were observed within the Primer/Salvage Yard, including suspect M-40 and BLU-36 whole bomblets, two 75-mm cartridge casings, and a 40-mm cartridge casing. Three of the suspect MEC items (suspect M-40 bomblets) were found just north of the fenced area. A total of 91 MPPEH items were also observed throughout the Primer/Salvage Yard during the 2009 SI field investigation. These items include M-40 bomblet shell halves, BLU-36 bomblet fragments, cartridge casings (105-mm, 75-mm, and 20-mm), fuzes, a CAD, primers, flash tubes, partially opened 81-mm mortar shipping containers, and small arms munitions (30-caliber M-1 Garand, 50-caliber, 7.62-were observed which included an ammo box lid and an 81-mm empty shipping container. Multiple suspect artillery cartridge casings, a 105-mm cartridge casing, and multiple suspect 20-mm cartridge casings were observed within and along the northern and western banks of the POLB Mitigation Pond (the southern portion of UXO1).

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)	Munitions Constituents	According to previous SI results for IRP Site 16 (NAVFAC SW 1998b), concentrations of copper and zinc in soil and groundwater are greater than the upper level background values (ULBVs) for soil and conservative chronic values in groundwater within the Primer/Salvage Yard area (SWRCB 2001). In addition, total inorganic nitrogen inside the currently fenced Primer/Salvage Yard area was detected at concentrations greater than are typical for unfertilized soils and possibly indicates explosives or explosives residue (NAVFAC SW 1998b). MCs related to removing primers from projectiles and placing them in 5-gallon cans includes black powder (for example, potassium nitrate) and smokeless powder (for example, nitrocellulose, nitroglycerin, and nitroguanidine) (NEESA 1985). Metals of concern related to black and smokeless powder include antimony, arsenic, copper, nickel, and zinc. Small arms typically fire projectiles composed of lead cores that are typically 85 percent by weight, with copper alloy jackets. The presence of explosives (for example, RDX, HMX, and TNT) and perchlorate related to rockets is also possible, according to the site history. In addition, the obscurant fog oil (kerosene/mineral oil) was reportedly spilled at the site in unknown quantities. Based on the IRP Site 16 SI results (NAVFAC SW 1998b) and results of the 2009 SI, MC likely include metals, ammonia, and TKN within the POLB Mitigation Pond. Black powder (potassium nitrate) and C4 explosives (RDX) were reportedly used during EOD and safety demonstrations at the POLB Mitigation Pond area. Explosive MC related to cartridges likely include double base powders (nitrocellulose and nitroglycerin). MC related to removal of primers from projectiles at the adjacent Primer/Salvage Yard area include black powder and smokeless powder (nitrocellulose, nitroglycerin, and nitroguanidine) and may be present within the POLB Mitigation Pond area. Metallic MC related to black and smokeless powder (antimony, arsenic, copper, nickel, and zinc) may also be present within the pond area. In addition, the obscurant fog oil reportedly was spilled in the vicinity, which may include part of the POLB Mitigation Pond.

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)		Soil, sediment, and surface water samples were collected from the Primer/Salvage Yard, the POLB Mitigation Pond, and the adjacent areas within MRP Site UXO1 during the 2009 SI field investigation. These samples were analyzed for metals, TKN, inorganic nitrogen (nitrate/nitrite-N), ammonia, perchlorate, and explosives. A total of 17 metals were detected in the soil samples, but not in every soil sample collected. Of these 17 metals, five were detected above background concentrations, including cadmium, copper, lead, selenium, and zinc. Perchlorate was detected in 19 of the 28 samples, but all detections were below human health screening criteria. In addition, ammonia, nitrate/nitrite-N, and TKN were detected, but were below human health screening criteria. Explosives were not detected in any of the samples collected during the SI field investigation. A total of 16 metals were detected in the sediment samples collected from the POLB Mitigation Pond, but not in every sample. Seven metals detected were above corresponding ecological benchmarks, including arsenic, cadmium, copper, lead, mercury, nickel, and zinc. Ammonia and TKN were detected in all the sediment samples collected, but nitrite/nitrate-N was detected in only two of the 12 samples. Explosives and perchlorate were not detected in any of the sediment samples. Barium and zinc were the only analytes detected in the surface water samples collected. No screening criteria was selected for barium. Zinc was below the ecological benchmark screening criteria.
	Migration Routes/Release Mechanisms	Natural migration (for example, soil erosion) of MEC within the Primer/Salvage Yard area (the northern portion of MRP Site UXO1) is not suspected given the low erosion capability of soils in this area. Earthmoving associated with future construction, excavation, and maintenance at the site is a mechanism that would physically redistribute both MEC

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)		and MC in soil at the surface and to the subsurface. Surface migration of MC may occur naturally through surface soil erosion and by wind or mechanically driven dust generation. MC that may be present in surface soil can also be bioaccumulated by biota. MC potentially can leach through soil to groundwater in the shallow alluvial aquifer. Migration or reposition of known MEC within the POLB Mitigation Pond area may occur through surface soil erosion of the pond banks or tidal changes. Intrusive earth moving, including future excavation related to maintenance or dredging of the pond, could redistribute MC or MEC to surface or subsurface soil. In addition, MC can leach from MEC and bioaccumulate in biota in water. MC can also leach from MEC to surface and subsurface soils.
Physical Profile	Climate	The climate at NAVWPNSTA Seal Beach is typical of the maritime subclimate within the California Mediterranean climate, which includes mild winters, cool summers, high relative humidity, and frequent early morning clouds that lead to afternoon sunshine. The annual average temperature is 74°F. Summer average high temperatures range from 77 °F to 84 °F, and average lows range from 60°F to 65°F. Winters temperatures tend to be moderate, with highs typically 67 °F and average lows ranging from 45 °F to 47 °F. Yearly precipitation averages 13 inches; February, the wettest month, averages 3 inches, and July, the driest, averages 0.02 inch (WRCC, undated). Periodically, the region experiences El Niño conditions, which tend to bring wetter winters to the area through heavy storms. The prevailing winds are westerly with an average velocity of 10 knots. Strong, dry northeasterly winds occasionally descend the mountain slopes in the fall, winter, and early spring (NAVFAC SW 1979). The strongest winds that occur within the region are associated with the winter and spring storms off the Pacific Ocean (NAVFAC SW 2005).

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Topography	The Primer/Salvage Yard (the northern portion of UXO1) terrain is flat and ranges in elevation from 7 feet above sea level (asl) at its northern extent to 4 feet asl at its southern extent (NAVFAC SW 2002). The POLB Mitigation Pond (the southern portion of UXO1) is an artificial pond dug to a depth of 6 feet with three islands. The elevation of the POLB Mitigation Pond ranges from 3.5 feet asl to roughly 3 feet below sea level within the pond. The pond is bounded by flat terrain.
	Geology	The surficial geology within the Primer/Salvage Yard is characterized by undocumented or debris fill based on the abundance of surface and subsurface debris encountered (Figure 2-1). The fill consisted of grayish brown fine- to medium-grained silty sand with metal and wood debris. The fill material was not logged to its maximum depth since soil borings were advanced to only 1.5 feet bgs. Beneath the debris fill layer is native material of young alluvial deposits (Qyfc), which are Holocene and late Pleistocene in age and consist of mostly of poorly to moderately consolidated and poorly sorted silty sand and clay. Sediment underlying the POLB Mitigation Pond also consists of young alluvial deposits.
	Soil	Soil at the MRP Site UXO1 Primer/Salvage Yard is characterized as debris fill consisting of a grayish brown fine- to medium-grained silty sand with some metal and wooden debris. Underlying the debris fill layer is young alluvial fan and valley deposits (Qyfc). The IAS and Integrated Natural Resources Management Plan (INRMP) indicate the site is characterized by drained Bolsa silty clay loam, which occurs on large alluvial fans and is moderately to slowly permeable (NEESA 1985; NAVWPNSTA Seal Beach 2007). Runoff is slow over bare level soil, and the erosion hazard is slight. The soil within UXO1 is moderately alkaline and calcareous to a depth of approximately 49 inches (NEESA 1985).

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Hydrogeology	The depth to groundwater at the southern edge of the Primer/Salvage Yard area (or center of MRP Site UXO1) is 4.5 feet bgs. Groundwater levels in the vicinity of the POLB Mitigation Pond (the southern portion of UXO1) range from 5 to 10 feet bgs. Depth to groundwater north of MRP Site UXO1 at nearby IRP Site 37 (Bolsa Avenue Storage Yard) is reported at 15 to 20 feet bgs (NAVFAC SW 1998b). Depth to groundwater within the Primer/Salvage Yard area varies and is tidally influenced by the presence of the POLB Mitigation Pond, the southern portion of UXO1 (NAVFAC SW 2002). Shallow groundwater flow is reportedly to the northeast, away from the POLB Mitigation Pond (NAVFAC SW 1999). Because of saltwater intrusion, shallow groundwater at UXO1 is saline to brackish and is therefore not used for drinking water. Lateral movement of groundwater in the moderately permeable shallow aquifer is estimated to be on the order of several hundred feet per year (NEESA 1985). Two monitoring wells are located north of Slough Road. Navy Well 3, located roughly 700 feet northeast of UXO1, is 616 feet deep (screened at two different intervals starting at 548 feet bgs) and currently is used for agricultural irrigation (Malcolm Pirnie 2008).
	Hydrology	Surface water generally flows southwest toward the POLB Mitigation Pond and then through channels in the Seal Beach NWR to Anaheim Bay and the Pacific Ocean. Surface water on the site flows generally southwest, following the topography of the installation, toward the Pacific Ocean (NAVFAC SW 2002). The POLB Mitigation Pond is tidally connected with the Seal Beach NWR, Anaheim Bay, and the Pacific Ocean to the south.
	Vegetation	Vegetation in the Primer/Salvage Yard area consists of non-native annual grasses. Along the northern boundary of the site is a dense row of southern willow scrub trees, dominated by several *Salix* species. To the immediate east is nonagricultural area with low sparse grasses, beyond which are agriculture lands (NAVWPNSTA Seal Beach 2007).

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)		The POLB Mitigation Pond is primarily a coastal salt marsh habitat that is typically dominated by cordgrass (*Spartina* spp.) and pickleweed (*Salicornia* spp.). In addition, the POLB Mitigation Pond also has become increasingly important eelgrass (*Zostera marina*) habitat (NAVWPNSTA Seal Beach 2007). Vegetation above the banks of the POLB Mitigation Pond is characterized by non-native annual grasses (NAVFAC SW 1999; NAVWPNSTA Seal Beach 2007).
Land Use and Exposure Profile	Current Land Use	The Primer/Salvage Yard is no longer in use. Agricultural land use occurs north and east of the Primer/Salvage Yard. The adjacent Seal Beach NWR to the south and west provides wetland habitat. The POLB Mitigation Pond is part of the Seal Beach NWR and provides protected habitat for migratory birds and for other endangered, threatened, and sensitive species. Since the area is a known MEC site, no intrusive maintenance is conducted at the site.
	Current Human Receptors	Navy personnel and contractors (including maintenance personnel), Navy-escorted visitors, and environmental and ecological researchers are current human receptors. In addition, farm workers and leaseholder farmers are receptors since the eastern boundary of the site is tilled and used for agriculture. Only limited public access is granted to the NWR.
	Current Activities (Frequency, Nature of Activity)	The Primer/Salvage Yard area (northern portion UXO1) is no longer in use. No ground maintenance is conducted since the area is a known MEC site. Known current activities at the POLB Mitigation Pond (the southern portion of UXO1) include site visits to conduct environmental and ecological surveys and research. Historically, rowboats have been used infrequently in the pond for ecological research (for example, species counting).
	Potential Future Land Use	Potential future land uses within the Primer/Salvage Yard area include storage and unused land. In addition, agriculture is a potential future land use if the MEC hazard is eliminated. However, future land uses are expected to be the same as current uses for the POLB Mitigation Pond.

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile (continued)	Potential Future Human Receptors	Future receptors are expected to be the same as current receptors.
	Potential Future Land Use-Related Activities	Navy personnel and contractors potentially may use the Primer/Salvage Yard area for storage. In addition, construction for repaving the cracked and decomposing asphalt within the Primer/Salvage Yard may occur. Future site activities may also include environmental and ecological surveys or reseeding with native grasses (NAVWPNSTA Seal Beach 2007). Agriculture is also a potential future land use within the Primer/Salvage Yard area. However, these activities will only be allowed if the MEC hazard is eliminated. Future land uses within the southern portion of MRP Site UXO1 (the POLB Mitigation Pond) are expected to be the same as current uses. Additional potential future activities include environmental work (for example, field research surveys and soil sampling) and construction related to maintenance and dredging of the pond.
	Zoning/Land Use Restrictions	Because of the reported presence of MEC, roughly one-half of the Primer/Salvage Yard area is fenced, with access restricted to authorized personnel only. However, suspect MEC (for example, suspect M-40 bomblets) and MPPEH have also been observed outside of the fenced area, but there are no physical land restrictions to this area. The POLB Mitigation Pond is federally protected within the Seal Beach NWR.
	Demographics/Zoning	NAVWPNSTA Seal Beach has a combined workforce of 150 military personnel and 600 civilian personnel. Population data include the following (U.S. Census, 2000): • City of Seal Beach: 24,154 • City of Westminster: 88,207 • City of Huntington Beach: 189,594 • Orange County: 2,846,289

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile (continued)	Beneficial Resources	The Seal Beach NWR, which encompasses the southern portion of MRP Site UXO1 (Figure 1-1), is adjacent to the southern installation border and provides habitat for federally and state listed threatened and endangered species. The INRMP lists the site as an area used by the burrowing owl (*Athene cunicularia*), merlin (*Falco columbarius*), and Cooper's hawk (*Accipiter cooperii*) (NAVWPNSTA Seal Beach 2007). The POLB Mitigation Pond area is a tidally influenced wetland with islands that provide protected habitat for migratory birds and other endangered, threatened, and sensitive species (NAVWPNSTA Seal Beach 2007).
	Habitat Type	The habitat occupied by UXO1 consists of low non-native grasses to barren land and coastal salt marsh.
	Degree of Disturbance	Nearly one-half of the Primer/Salvage Yard area is fenced and paved with asphalt or concrete. The remainder of this area is undisturbed open land. The POLB Mitigation Pond area is part of the Seal Beach NWR and is undisturbed. Environmental research is the only known activity at the site and is considered low impact based on the nature of the work.
	Ecological Receptors	
	General	Mammals reported at the installation include various species of pocket gophers, voles, shrews, and ground squirrels, Audubon's cottontail rabbit (*Sylvilagus audubonii*), and brush rabbit (*Sylvilagus bachmani*). Nineteen species of raptors are known to occur within NAVWPNSTA Seal Beach, nine of which nest on the station. These species include red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), great-horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), common raven (*Corvus corax*), and American crow (*Corvus brachyrhynchos*). The avian wildlife forages over a large

Table 7-7: MRP Site UXO1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile (continued)		area and would spend relatively little time on site. Aquatic ecological receptors within the POLB Mitigation Pond area include marine invertebrates and fish such as the tidewater goby (*Eucyclogobius newberryi*), which also inhabits the Anaheim Bay (NAVFAC SW 2005; NAVWPNSTA Seal Beach 2007). Federally threatened and endangered aquatic species including the green sea turtle have also been found within the POLB Mitigation Pond. Migrant or resident bird species listed as threatened or endangered by federal or state agencies (or both) include the following: • Bald eagle (*Haliaeetus leucocephalus*) • Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) • California least tern (*Sterna antillarum browni*) • Golden eagle (*Aquila chrysaetos Canadensis*) • Light-footed clapper rail (*Rallus longirostris levipes*) • Western snowy plover (*Charadrius alexandrinus nivosus*) The breeding season for these salt marsh and shorebird species extends from approximately late January to mid-September. The California least tern occupies the Seal Beach NWR only during the breeding season, with most of its food supply coming from the Seal Beach NWR during that period (NAVFAC SW 2005).
	Relationship of Contaminant Sources to Habitat and Potential Receptors	Ecological receptors may come into direct contact with MEC or MC in soil. It is unlikely that ecological receptors would come into contact with MEC and create an explosive hazard, but the possibility should be considered where threatened or endangered species may be present. Receptors may be exposed to MC that could have been incorporated into the food chain (for example, bioaccumulated in plants and animals). Sensitive species such as the light-footed clapper rail nest near the site and may consume fish that have been affected by MC. Various mammals and other animals that inhabit the site may come into contact with MC while burrowing, foraging, or nesting. In addition, they may also consume plants and prey in which MC has bioaccumulated.

8.0 MRP SITE UXO2 (FORMER BUILDINGS 101 AND 102 EVAPORATION PONDS)

8.1 SITE DESCRIPTION AND HISTORY

MRP Site UXO2 is located south of Westminster Street at 8th Street. The site comprises five unlined evaporation ponds, a former concrete settling basin, and a former settling pond associated with Buildings 101, 102, and 98 (Figure 8-1). The Evaporation Ponds were formerly known as IRP Site 2; the wash water settling pond was formerly known as IRP Site 3; and Building 98 was formerly referred to as IRP Site 36 (NEESA 1985).

The complex operated from 1945 through the mid-1950s, in 1962, and in 1971 to demilitarize 5-inch projectiles. When the projectiles were retired, Explosive D (ammonium picrate) was drilled out of the casing. The initial drillout procedure did not remove all the Explosive D from the casing, and the remaining portion was removed by rinsing with warm water and steam.

During peak production periods (1945 to 1947 and 1953 to 1955), an estimated average of 250, 5-inch projectiles were drilled out each working day (NEESA 1985, 1990). Wash water that contained Explosive D from final steam and warm water washout of projectile casings was discharged for primary settling and cooling from a tank in Building 98 into a series of 10-foot by 10-foot baffled concrete settling basins located on the south side of the building. Based on an engineering diagram (Appendix A), there were originally four 2.5-foot-deep concrete basins with concrete floors in a two-by-two matrix configuration. In the late 1950s, the two northern concrete basins were filled with compacted soil and capped with a concrete slab during expansion of the southern portion of Building 98 (Malcolm Pirnie 2008). Building 98 had a 4-foot-square by 5-foot-deep pit on the western side of the building that was used for an unknown purpose until it was filled with soil when Building 98 was expanded (Malcolm Pirnie 2008).

Once the wash water containing Explosive D went through the concrete primary settling basins, it drained through a 2-foot-deep, 150-foot-long concrete trench into a series of five connected evaporation ponds that totaled approximately 2.3 acres. Reportedly, the ponds were connected by 6-inch-diameter pipes (NEESA 1985; NAVFAC SW 1990). From 1945 to the mid-1950s, approximately 13 tons of Explosive D mixed with wash water drained into the Evaporation Ponds for evaporation and settling. In 1962, an additional 32 tons of Explosive D was drained into the ponds. In 1971, 5 pounds was drained into the ponds. The ponds were occasionally allowed to dry by draining and evaporation and then burned to control surface accumulation of Explosive D. Treatment in the ponds consisted only of the controlled burns that were done while the ponds were in operation. It is reported that in 1948 the ponds detonated rather than burned. The last controlled burn was in 1962 (NEESA 1985; NAVFAC SW 1990; Naval Surface Warfare Center [NSWC] Indian Head 2003). The facilities ceased operation in 1972 and have been inactive since then.

In addition to Building 98-related operations, the floors in Buildings 101 and 102 periodically were washed down, and the contaminated wash water exited through floor drains and discharged to a 50- by 50-foot settling pond located on the eastern side of Buildings 101 and 102. Reportedly, an estimated 520 pounds of Explosive D mixed with wash water was discharged into this pond (NEESA 1985).

A 1990 SI investigated the Evaporation Ponds and analyzed soil samples at 0.5, 2.0, and 3.5 feet bgs for Explosive D breakdown products, including ammonia as nitrogen, picric acid, and picramic acid. The only analyte detected was ammonia as nitrogen, at low concentrations that were attributed to background or agricultural practices. The report recommended an additional investigation be conducted to determine if other breakdown products of Explosive D should be investigated, whether MC migrated to groundwater, and whether other areas not investigated (such as Buildings 101 and 102) were affected.

The previous SI (NAVFAC SW 1998a) sampled the evaporation ponds at approximately 0.5 and 1.75 feet bgs and the earth-filled concrete settling basin behind Building 98 (IRP Site 36) at 0.4 and 2.5 feet bgs. Samples were analyzed for explosives (naphthalic acid, nitrocellulose, nitroglycerine, nitroguanidine, and picric acid) and nitrogen compounds (ammonia-N, nitrate-N, and TKN). The SI reported that no explosive compounds were detected and that no nitrogen compounds were detected in soil at concentrations of concern. The SI report noted that impacts to ecological receptors would be addressed under a separate study (NAVFAC SW 1998b). During the PSI (Malcolm Pirnie 2008), Malcolm Pirnie reviewed the sampling methodology for the IRP final SI. During the review, historical engineering diagrams, aerial photographs, and many concerns with sampling methodology were identified. It was found that the samples were not analyzed for a full explosives suite, including RDX. In addition, background concentrations for the identified COPCs were from samples (Borings 02_H06 and 02_H06A) collected in an area that was possibly used for site drainage south of Building 98. It was also found that, contrary to the SI report results section, low unquantifiable concentrations (greater than the MDL, but below the reporting limit) of explosives including naphthalic acid, nitrocellulose, nitroglycerine, nitroguanidine, and picric acid were detected at IRP Site 2.

In February 2009, Buildings 101 and 102 and associated drain lines were demolished and removed from MRP Site UXO2. ChaduxTt field personnel accompanied the Navy and demolition contractor personnel to observe demolition. A sub-meter accuracy DGPS was used to map the locations of drain inlets and drain lines before and during removal (Figure 8-2). There are no known records to indicate any other surface soil disturbances or placement of clean fill material at Site UXO2.

8.2 SITE UXO2 GEOLOGY AND HYDROGEOLOGY

MRP Site UXO2 is underlain by native material of young alluvial deposits (Qyf), which are Holocene and late Pleistocene in age and consists of mostly of poorly to moderately consolidated and poorly sorted grayish brown silty sand and clay.

Groundwater was not encountered in the borings completed to a maximum depth of 1.5 feet bgs within the site. Groundwater in the vicinity of UXO2 is approximately 10 feet bgs and is reported to generally flow to the northeast (NAVFAC SW 1999). Groundwater is no longer used for drinking water at NAVWPNSTA Seal Beach, although parts of the station use groundwater for agricultural irrigation (NAVWPNSTA Seal Beach 2007). No wells are reported in the vicinity of the site. Lateral groundwater movement in the moderately permeable shallow aquifer is estimated to be on the order of several hundred feet per year (NEESA 1985).

8.3 MEC Field Investigation Results

This section provides the results of the MEC investigation for MRP Site UXO2.

8.3.1 Detector-Aided Visual Survey Results

ChaduxTt UXO technicians conducted detector-aided visual surveys before soil sampling began. Detector-aided visual survey transects were completed from east to west over the accessible portions of MRP Site UXO2. The surveys were conducted over graded areas in the former locations of Buildings 98, 101, and 102 and in the former Evaporation Ponds and settling pond areas. Portions of UXO2 in the vicinity of the Evaporation Ponds were covered by dense vegetation, impeding access and survey coverage. All pertinent site features encountered were noted, photographed, and mapped with the DGPS. Detailed results of the detector-aided visual survey are shown on Figure 8-1, in the photographs included in the back of this section, and the table presented in Appendix D-2.

During the survey, excavations were observed associated with the former concrete drainage trenches leading to the northernmost three evaporation ponds and the earthen containment berms associated with the evaporation ponds (Figure 8-1). UXO technicians did not observe any suspect MEC (such as explosives residue in soil) or MPPEH during the detector-aided visual survey. Findings of the detector-aided visual survey include metal debris (scrap metal, drain pipe debris, metal banding, chains, cables, a disc plow, and sign posts), construction debris (concrete and wood debris), and other debris (miscellaneous wood debris). The majority of these findings were located around the perimeter of the Evaporation Ponds. A total of 19 subsurface magnetic anomalies were detected with the hand-held magnetic gradiometer during the survey and mapped with the DGPS. Seventeen of the anomalies were detected in the northern graded portion of the site and are likely associated with buried building debris left over from demolition, based on-site observations. Anomalies detected around the Evaporation Ponds may be associated with disposal of non-munitions related metal debris such as the items described above.

8.3.2 MEC Findings

MRP Site UXO2 contains evaporation ponds that were formerly used for disposal of wash water containing Explosive D; it also contained a former projectile demilitarization facility and is not a known or suspected MEC area based on site observations. Evidence of MEC or MPPEH was not discovered during detector-aided visual surveys at the site.

8.3.3 Deviations from the Work Plan

There were no deviations from the work plan in regard to MEC sampling at MRP Site UXO2.

8.4 MC Sampling Locations and Depths

Site UXO2 consists of three areas: the former drainage trenches and evaporation ponds on the western portion of the site; former Buildings 98, 101, and 102 locations and associated

subsurface drainage pipes and settling basin once located on the site; and the settling pond formerly located on the eastern portion of UXO2 (Figure 8-2). Two soil samples (0 to 0.5 foot bgs and 1 to 1.5 feet bgs) were collected from each soil boring advanced at the UXO2 site. Soil samples were analyzed for picrate, TKN, inorganic nitrogen, ammonia, and explosives.

A sampling grid was established across the southern portion of MRP Site UXO2 that contained the largest Evaporation Pond. The southwest evaporation pond occupies 1.75 acres. Fourteen discrete soil samples (043UXO2SB037 to 043UXO2SB050) were collected from seven soil borings that were advanced in randomly selected grid cells as non-biased locations to provide adequate lateral coverage. Four discrete soil samples (043UXO2SB031 to 043UXO2SB034) were collected from two soil borings that were advanced in biased locations in two primary evaporation ponds at discharge locations of the former concrete drainage trench west of the former Building 98 location. Two discrete soil samples were collected from one biased soil boring located along the former concrete drainage trench location. Four discrete soil samples (043UXO2SB027, 043UXO2SB028, 043UXO2SB035, and 043UXO2SB036) were collected from two biased locations along a suspected former drainage trench location leading to a possible unreported pond mentioned in the PSI (Malcolm Pirnie 2008). The soil sampling locations are shown on Figure 8-2.

Before Buildings 101 and 102 were demolished and removed, associated floor drain lines were mapped with a DGPS in February 2009. ChaduxTt used a DGPS to relocate the former drain line locations during the SI soil sampling event and advanced eight soil borings along the former joints and discharge points of the former drain line location. A total of 16 discrete soil samples (043UXO2SB001 to 043UXO2SB012 and 043UXO2SB015 to 043UXO2SB018) were collected along the former drain lines previously located underneath former Buildings 101 and 102. Six of the discrete soil samples (043UXO2SB009 to 043UXO2SB012, 043UXO2SB017, and 043UXO2SB018) were collected at former drain line discharge locations east and south of Buildings 101 and 102 (Figure 8-2). Soil samples 043UXO2SB009 to 043UXO2SB012 were collected just south of the former Building 103 location, at the discharge locations in the former settling pond that appears in a historical aerial photograph (Appendix A). Two discrete soil samples (043UXO2SB013 and 043UXO2SB014) were collected from one soil boring advanced in a biased location at the former concrete settling basin location adjacent to and south of Building 98.

Eight discrete soil samples were collected from the eastern portion of UXO2 in the undeveloped area east of Buildings 101 and 102. The soil samples (043UXO2SB019 to 043UXO2SB26) were collected from four soil borings advanced in biased locations where topographically low areas or significant desiccation cracks were identified.

8.4.1 Deviations from the Work Plan

There were no deviations from the work plan in regard to MC sampling at MRP Site UXO2.

8.5 MC SOIL INVESTIGATION RESULTS

This section provides a summary of the site inspection sampling results and analytical data quality review for MRP Site UXO2.

8.5.1 Soil Sampling Results

Fifty soil samples were collected at MRP Site UXO2 (Buildings 101 and 102 and Associated Evaporation Ponds). The suite of analytes for UXO2 includes picrate, TKN, inorganic nitrogen, ammonia, and explosives. The soil sampling results for MRP Site UXO2 is in Tables 8-1 and Appendix E-1. Explosives were not detected in any of the soil samples. Nitrate/nitrite-N and TKN were detected at concentrations below human health screening criteria. Ammonia was also detected, but no screening criteria was available.

8.5.2 Human Health Screening Results

Analytical results for soil were compared with risk-based screening criteria to assess potential impacts on human health from exposure to chemicals in soils at MRP Site UXO2 under a residential and an industrial land use scenario. All chemicals detected from the sampled soil depth intervals of 0 to 0.5 foot bgs and 1 to 1.5 feet bgs were included in the screening. Section 6.1 describes the selection procedure used to identify the residential and industrial soil screening criteria for the chemicals in soils.

No explosives were detected in the 50 soil samples analyzed (Table 8-1).

None of the nitrate/nitrite-N and total Kjeldahl nitrogen concentrations detected in soil at MRP Site UXO2 exceeded the screening criteria (Table 8-1). No screening criteria were available for ammonia.

The human health screening criteria used to compare the analytical results in soil at MRP Site UXO2 are based solely on general residential and industrial use scenarios. Therefore, the screening results presented in this report are applicable only under the assumptions inherent in the residential and industrial criteria used and the data available at the time of the evaluation.

8.5.3 Ecological Screening Results

Soil samples were analyzed for picrate, TKN, inorganic nitrogen, ammonia, and explosives at MRP Site UXO2, but no explosives were detected. Therefore, UXO2 is not recommended for further evaluation in a screening-level ecological risk assessment.

8.5.4 Data Quality Review Findings

The data quality review found that QA/QC objectives for bias and precision were met for most analytical results, with the following exceptions:

- MS recoveries resulted in qualification of results as estimated (J) for ammonia in multiple samples. Approximately 15 percent of the data for ammonia in soil were affected.
- Several sample results were estimated because they were reported at concentrations between the MDL and the QL. The analytical instrument can make reliable qualitative identification of analytes MDL but below the QL; however, detected results below the QL are considered quantitatively uncertain.

A complete summary the data quality review is included in Appendix F. The supporting data validation reports are included in Appendix E-5. Chain-of-custody forms were used to trace possession of the samples from field collection to the analytical laboratory. The completed chain-of-custody forms are in Appendix E-4.

8.6 MRP Site UXO2 Updated Conceptual Site Model

The CSM for MRP Site UXO2 was updated based on the results of the 2009 SI field activities that include detector-aided visual survey results, a summary of MC sampling results, and observed site structures such as earthen containment berms and drainage trenches associated with the former Evaporation Ponds. The CSM was also updated to reflect current changes in the site conditions caused by demolition and removal of Buildings 101 and 102 and associated drain lines.

The updated CSM profile for UXO2 is provided as Table 8-2. Figures 8-3 and 8-4 provide a graphical representation of the current understanding of the exposure pathways for MEC and MC. The updated graphical CSM shows there are incomplete exposure pathways for both MEC and MC at MRP Site UXO2 as where the graphical CSM from the PSI (Malcolm Pirnie 2008) shows potentially complete MC exposure pathways for some receptors.

8.7 MRP Site UXO2 Conclusions and Recommendations

This section provides conclusions and recommendations for MRP Site UXO2.

8.7.1 Potential or Existing MEC Hazards

MRP Site UXO2 is not a known or suspected MEC area. No evidence of MEC (such as explosives residue in soil) or MPPEH was discovered during detector-aided visual surveys at the site; therefore, MEC risk and hazard are not anticipated at the site. Based site observations and given explosives were not detected in soil, no further action (NFA) for MEC is recommended for UXO2.

8.7.2 Potential or Existing MC Hazards

No explosives or picrate was detected in soil, and nitrate/nitrite-N and TKN (breakdown products) were detected below the residential and industrial human health screening criteria. This infers there could have been significant natural attenuation of ammonium picrate at the site or that previous burning of the ponds could have resulted in attenuation. Ammonium picrate can have significant natural attenuation under certain soil conditions (Tan and others 2006).

However, to date no clear correlation has been found between the degree of degradation and grain size, clay content, organic content, carbonate content. Because soil samples were collected from the potential source areas (drain lines, evaporation ponds, the former concrete settling basin, and the former settling pond), and given explosives or picrate were not detected and associated breakdown products were detected below human health screening criteria, no NFA for MC is recommended for MRP Site UXO2.

SECTION 8.0 PHOTOS – MRP SITE UXO2

Photo 1: View looking north at the former Building 101 and Building 102 area on the northern portion of MRP Site UXO2.

Photo 2: View looking east at the undeveloped area located just east of former Buildings 101 and 102 at MRP Site UXO2.

Photo 3: View looking west at the former Building 99 location on the northern portion of MRP Site UXO2.

Photo 4: View looking west at the exposed drain line during building demolition and removal on the northern portion of MRP Site UXO2.

Photo 5: View looking at the drain line condition prior to building and drain line removal at MRP Site UXO2.

Photo 6: View looking west at the excavation associated with the former concrete drainage trench located on the western portion of MRP Site UXO2.

Photo 7: View looking west at a fork in the excavation associated with the former concrete drainage trench located on the western portion of MRP Site UXO2.

Photo 8: View looking southwest at the former evaporation ponds area of MRP Site UXO2.

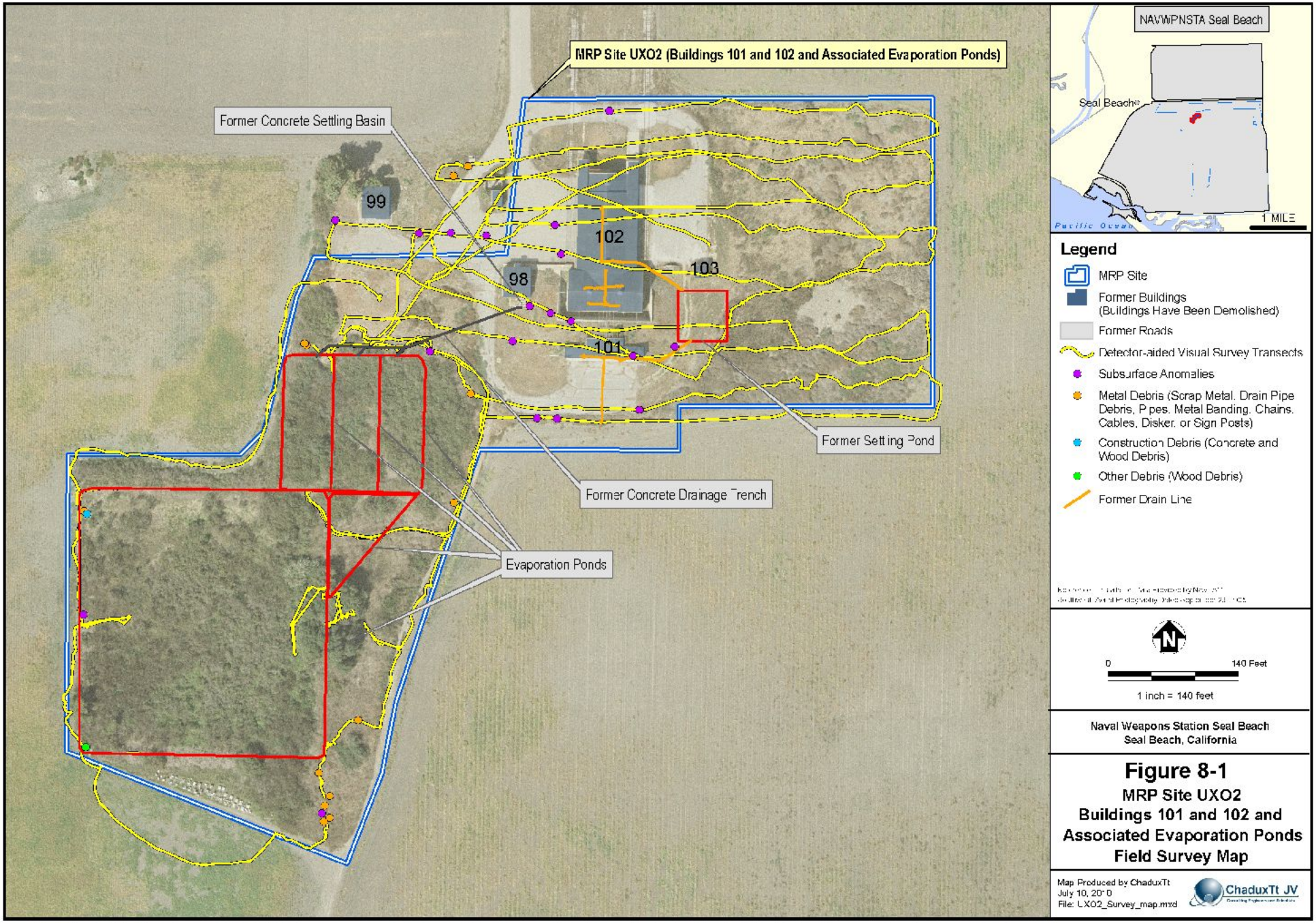
Photo 9: View looking northeast at the former evaporation ponds area on the southwest portion of MRP Site UXO2.

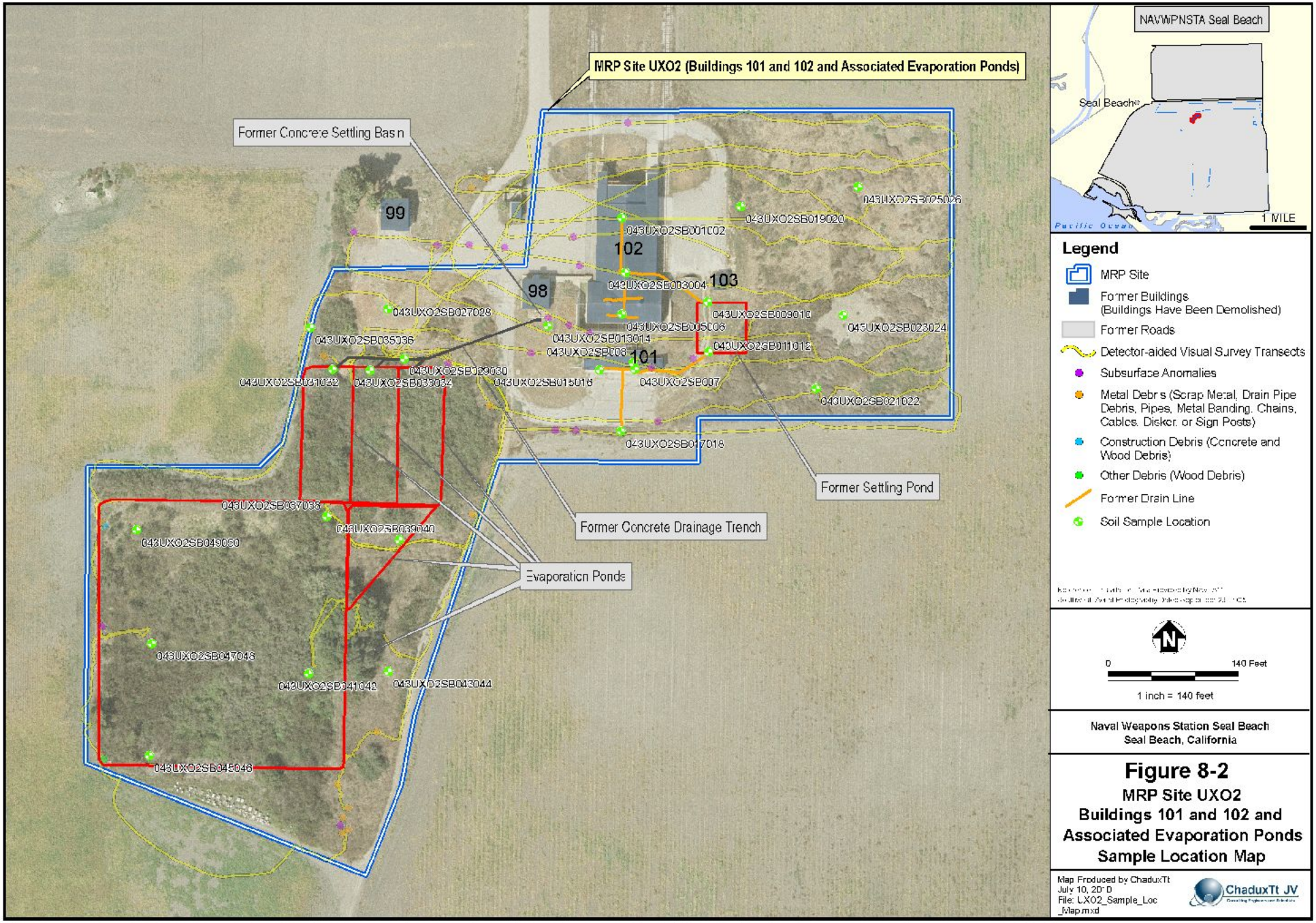
Photo 10: View looking south at an earthen berm of the triangle shaped evaporation pond and staked soil sampling location on the southwestern portion of MRP Site UXO2.

Photo 11: View looking north at an earthen berm of an evaporation pond located on the southwestern portion of MRP Site UXO2.

Photo 12: Wood debris located on the southwestern portion of MRP Site UXO2.

SECTION 8.0 FIGURES – MRP SITE UXO2


MRP Site UXO2 (Buildings 101 and 102 and Associated Evaporation Ponds)
Former Concrete Settling Basin
99
98
102
103
101
Former Setting Pond
Former Concrete Drainage Trench
Evaporation Ponds
NAVWPNSTA Seal Beach
Seal Beach
Pacific Ocean
1 MILE
Legend
MRP Site
Former Buildings
(Buildings Have Been Demolished)
Former Roads
Detector-aided Visual Survey Transects
Subsurface Anomalies
Metal Debris (Scrap Metal, Drain Pipe Debris, Pipes, Metal Banding, Chains, Cables, Disker, or Sign Posts)
Construction Debris (Concrete and Wood Debris)
Other Debris (Wood Debris)
Former Drain Line
N
0
140 Feet
1 inch = 140 feet
Naval Weapons Station Seal Beach
Seal Beach, California
Figure 8-1
MRP Site UXO2
Buildings 101 and 102 and
Associated Evaporation Ponds
Field Survey Map
Map Produced by ChaduxTt
July 10, 2010
File: UXO2_Survey_map.mxd
ChaduxTt JV



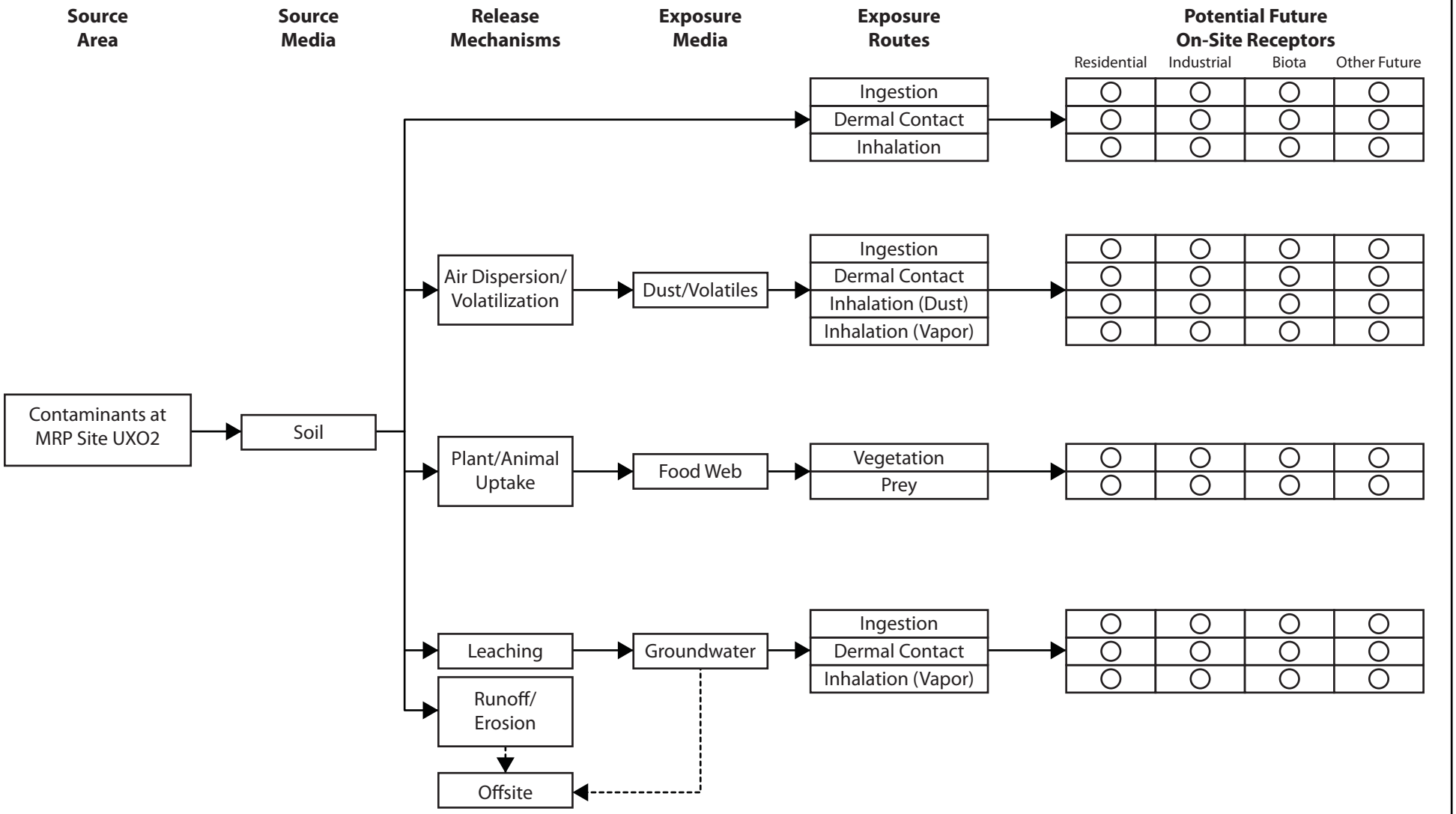
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 8-2

MRP Site UXO2
Buildings 101 and 102 and Associated Evaporation Ponds
Sample Location Map

Map Produced by ChaduxTt
July 10, 2010
File: UXO2_Sample_Loc_Map.mxd

ChaduxTt JV



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

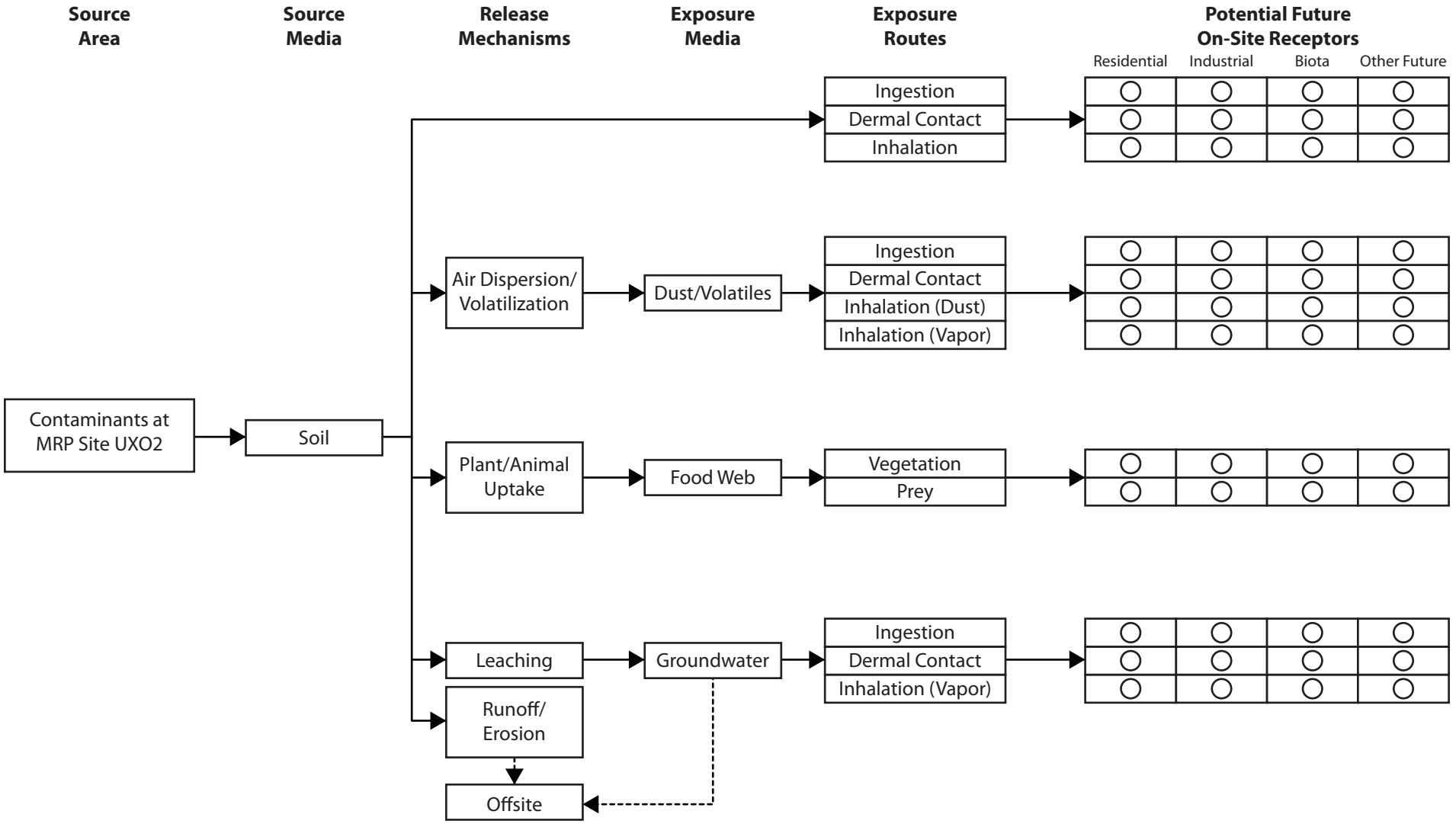
MRP - Munitions Response Program

- ● Complete Pathway
- ◍ Potentially Complete Pathway
- ○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 8-3
MRP Site UXO2
Graphical Updated Conceptual Site Model
for MEC
Site Inspection Report



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 8-4

MRP Site UXO2
Graphical Updated Conceptual Site Model
for MC
Site Inspection Report

SECTION 8.0 TABLES – MRP SITE UXO2

TABLE 8-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO2

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Screening Criteria	Number of Detections Above Residential Screening Criteria	Industrial Screening Criteria	Number of Detections Above Industrial Screening Criteria	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria	Back-ground Screening Level	Number of Detections Above Background Screening Level
Explosives (mg/kg)													
None Detected	0/ 50	ND	ND	-	-	-	-	-	-	-	-	-	-
Ammonia (mg/kg)													
AMMONIA (NH3-N)	50/50	6.3	95.4 J	043UXO2SB007008	5.2 - 11.9	NC	-	NC	-	NC	-	NC	-
Anions (mg/kg)													
NITRATE/NITRITE-N	50/50	0.58 J	584	043UXO2SB009010	1.0 - 11.5	7,800	0	100,000	0	NC	-	NC	-
Total Kjeldahl Nitrogen (mg/kg)													
TOTAL KJELDAHL NITROGEN	50/50	191	5,150	043UXO2SB031032	10.9 - 475	130,000	0	1,600,000	0	NC	-	NC	-

Notes:
1. Data shown includes detected analytes in all soil samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

- Not applicable
J Estimated value
mg/kg Milligrams per kilogram
MRP Munitions response program
NC No criteria
ND None detected
QC Quality control
UXO Unexploded ordinance

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information	Installation Name	NAVWPNSTA Seal Beach
	Site Name	MRP Site UXO2 (Former Buildings 101 and 102 and Associated Evaporation Ponds)
	Site Area and Layout	The UXO2 site footprint encompasses approximately 8 acres. The five evaporation ponds, which are bounded by earthen containment berms, occupy 2.3 acres. The former settling pond associated with Buildings 101 and 102 was located on the eastern portion of the site. The former concrete settling basin is roughly 10 feet by 10 feet and was located just south of former Building 98 (Figure 8-1)
	Site Structures	Currently, there are no standing site structures at MRP Site UXO2. Several structures that formerly existed on the site were used during operations associated with demilitarization of 5-inch projectiles. Former Building 98 was the Explosive D Steam-Out Building. Former Buildings 101 and 102 are the vacuum dust removal and ammunition rework buildings. Former Building 99 housed a generator, and Former Building 103 was used for paint and flammable storage. Former Building 104 was a small locked magazine. In February 2009, the buildings and associated drain lines were demolished and removed.
	Site Boundaries	To the north, unused land and the Westminster POLB Fill Area lie between MRP Site UXO2 and the fenced installation boundary at Westminster Avenue, 0.25 mile to the north. Agricultural fields are south of UXO2. The Case Road POLB Mitigation Pond is 0.5 mile southwest of the site. In addition, the installation boundary is located roughly 1.75 miles to the south bordering the City of Huntington Beach. Beyond the installation boundary is an Orange County flood control channel, which flows into Anaheim Bay, and then the Pacific Ocean, as is the City of Huntington Beach.

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information (continued)		Agricultural fields extend 0.3 mile west of UXO2; beyond them are active installation offices and the cantonment area. The installation boundary, which borders the City of Seal Beach, is located roughly 1.25 miles away. East of UXO2 are agricultural fields and magazines. The Cities of Westminster and Huntington Beach border the installation roughly 1 mile away.
	Site Security	MRP Site UXO2 is located on NAVWPNSTA Seal Beach, which is a fenced and guarded installation. Security personnel are responsible for maintaining law and order and for implementing access control policies and procedures. Access to the site from within NAVWPNSTA Seal Beach is controlled by vehicular security patrol; the site is unfenced.
Munitions/ Release Profile	Munitions Types	The function of the facility was to demilitarize 5-inch projectiles. No munitions were processed or disposed of outside of the buildings or in the evaporation ponds. However, wash water with Explosive D was discharged from the complex of Buildings 101 and 102 into evaporation ponds (NEESA 1985; NAVFAC SW 1990; NAVFAC 2003). In addition, RDX has been detected in Buildings 101 and 102 at concentrations that present an explosive hazard. Wash water with MC, which was disposed of in the ponds, could create explosive soil conditions (explosive MC concentrations greater than 10 percent) in the subsurface.
	Maximum Probability Penetration Depth	Explosive MC concentrations could exist in soil within the evaporation ponds.
	MEC Density	UXO and discarded military munitions (DMM) are not suspected or known to be present at UXO2. However, explosive soils (MC concentrations in soil greater than 10 percent) could exist within the evaporation ponds.
	MEC Field Observations	MEC are not known or suspected to be present and were not observed during this SI.

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information (continued)	Munitions Constituents	Explosive D (ammonium picrate) and associated breakdown products, which may include picric acid and picramic acid, were disposed of with the wash water and drained into evaporation ponds associated with MRP Site UXO2. In addition, RDX has been identified in Buildings 101 and 102. During the 2009 SI field investigation, 50 soil samples were collected at MRP Site UXO2 and analyzed for picrate, TKN, inorganic nitrogen, ammonia, and explosives. No explosives or picrate were detected. Ammonia, nitrate/nitrite-N, and TKN were detected, but were at concentrations below human health screening criteria.
	Migration Routes/Release Mechanisms	MEC are not known or suspected to be present. Based on the findings of the 2009 SI field investigation there are incomplete exposure pathways for both MEC and MC at MRP Site UXO2.
Physical Profile	Climate	The climate at NAVWPNSTA Seal Beach is typical of the maritime subclimate within the California Mediterranean climate, which includes mild winters, cool summers, high relative humidity, and frequent early morning clouds that lead to afternoon sunshine. The annual average temperature is 74°F. Summer average high temperatures range from 77°F to 84°F, and average lows range from 60°F to 65°F. Winter temperatures tend to be moderate, with highs typically 67°F and average lows ranging from 45°F to 47°F. Yearly precipitation averages 13 inches; February, the wettest month, averages 3 inches, and July, the driest, averages 0.02 inch (WRCC undated). Periodically, the region experiences El Niño conditions, which tend to bring wetter winters to the area through heavy storms. The prevailing winds are westerly with an average velocity of 10 knots. Strong, dry northeasterly winds occasionally descend the mountain slopes in the fall, winter, and early spring months (NAVFAC SW 1979). The strongest winds that occur within the region are associated with the winter and spring storms off the Pacific Ocean (NAVFAC SW 2005).

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continud)	Topography	MRP Site UXO2 has flat terrain and is at an elevation of approximately 10 feet asl. Earthen containment berms surrounding the evaporation ponds are about 3 feet high. NAVWPNSTA Seal Beach is located on flat alluvial deposits that slope southwest from approximately 20 feet asl to sea level at the NWR. The highest topographic feature on the installation is Landing Hill (50 feet asl), on the southwest side of the facility (DTSC 2003).
	Geology	MRP Site UXO2 is underlain by native material of young alluvial fan and valley deposits (Qyf), which are Holocene and late Pleistocene in age and consist of gently sloping, slightly dissected alluvial fan deposits.
	Soil	Soil at MRP Site UXO2 consists mostly of poorly to moderately consolidated and poorly sorted grayish brown silty sand and clay layers. The IAS and INRMP note the site is characterized by drained Bolsa silty clay loam, which occurs on large alluvial fans and is moderately to slowly permeable (NEESA 1985; NAVWPNSTA Seal Beach 2007). Runoff is slow over bare level soil. In addition, the erosion hazard for the soil at UXO2 is considered slight. The soil within the site is moderately alkaline and calcareous to a depth of approximately 49 inches (NEESA 1985).
	Hydrogeology	Groundwater in the vicinity of MRP Site UXO2 is approximately 10 feet bgs and is reported to generally flow to the northeast (NAVFAC SW 1999). Groundwater is no longer used for drinking water at NAVWPNSTA Seal Beach, although parts of the station use groundwater for agricultural irrigation (NAVWPNSTA Seal Beach 2007). An agriculture well is located approximately 0.4 miles to the east. Lateral groundwater movement in the moderately permeable shallow aquifer is estimated to be on the order of several hundred feet per year (NEESA 1985).

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Hydrology	Runoff is expected to be slow over level terrain, and surface water is expected to only intermittently pond and to infiltrate to groundwater. The site is flat, and there are 3-foot high containment berms around the evaporation ponds. Thick vegetation and trees grow within the ponds, and there is no riparian vegetation within the ponds. Site-specific surface water flow is unknown, although surface water generally flows southwest, following the topography of the installation (NAVFAC SW 2002). Surface water flow is anticipated to pond intermittently and infiltrate to groundwater. In general, runoff at NAVWPNSTA Seal Beach either ponds or flows overland through man-made channels, natural ditches, or tidal sloughs. Flow is intermittent in channels and ditches and depends on rainfall and excess landscape irrigation runoff (NAVWPNSTA Seal Beach 2007).
	Vegetation	Vegetation at Buildings 101 and 102 evaporation ponds is characterized by southern willow scrub. However, vegetation in the vicinity of MRP Site UXO2 is primarily agricultural crops of lima beans and barley (NAVWPNSTA Seal Beach 2007).
Land Use and Exposure Profile	Current Land Use	The evaporation ponds and associated buildings within MRP Site UXO2 are no longer in use. The east side of UXO2 is being used to raise honeybees, and nearby surrounding land is used for agriculture or is unused. IRP Site 2 evaporation ponds are maintained by NAVWPNSTA Seal Beach as part of a riparian corridor to the Seal Beach NWR (NAVWPNSTA Seal Beach 2007).
	Current Human Receptors	Current human receptors include Navy personnel, contractors (including maintenance personnel), and Navy-escorted visitors. In addition, farm workers and leaseholder farmers are potential receptors.
	Current Activities (Frequency, Nature of Activity)	All evaporation ponds at MRP Site UXO2 are inactive and no longer in use. Current activities on site include site visits to conduct environmental and ecological surveys and raising honeybees. Current activities adjacent to the site are primarily agricultural.
	Potential Future Land Use	Agricultural land use in the vicinity of MRP Site UXO2 is likely to continue.

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile (continued)	Potential Future Human Receptors	Future receptors are expected to be the same as current receptors.
	Potential Future Land Use-Related Activities	Future activities at the site potentially include environmental and ecological surveys and riparian restoration projects by Navy personnel and contractors. In addition, crop cultivation by leaseholders is anticipated.
	Zoning/Land Use Restrictions	MRP Site UXO2 is part of a secure and active Navy base. The scrub willow habitat at the IRP Site 2 Evaporation Pond is maintained as part of a wildlife corridor to the Seal Beach NWR (NAVWPNSTA Seal Beach 2007). No other known land use restrictions have been identified.
	Demographics/Zoning	NAVWPNSTA Seal Beach has a combined workforce of 150 military personnel and 600 civilian personnel. Population data are as follows (U.S. Census 2000): • City of Seal Beach: 24,154 • City of Westminster: 88,207 • City of Huntington Beach: 189,594 • Orange County: 2,846,289
	Beneficial Resources	The IRP Site 2 Evaporation Ponds are part of a riparian corridor to the Seal Beach NWR, which provides protected habitat for migratory birds and for other endangered, threatened, and sensitive species (NAVWPNSTA Seal Beach 2007).
Ecological Profile	Habitat Type	The IRP Site 2 Evaporation Ponds and a small area to the south are characterized as riparian woodland of southern willow scrub (NAVWPNSTA Seal Beach 2007). MRP Site UXO2 is bordered on three sides by agricultural land. To the north of the site are Westminster Street and MRP Site UXO6 (Westminster POLB Fill Area), which is characterized by dredged fill soil from the POLB Mitigation Pond and has sparse grass and pickleweed (*Salicornia app.*) cover.

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Ecological Profile (continued)	Degree of Disturbance	MRP Site UXO2 was formerly used for activities related to the Buildings 101-102 complex evaporation ponds. However, the buildings at the site have been demolished and removed and the site is presently unused.
	Ecological Receptors	
	General	Mammals reported at the installation include various species of pocket gophers, voles, shrews, and ground squirrels, Audubon's cottontail rabbit *(Sylvilagus audubonii)*, and brush rabbit *(Sylvilagus bachmani)*. Nineteen species of raptors are known to occur within NAVWPNSTA Seal Beach, nine of which nest on the station. These species include red-tailed hawk *(Buteo jamaicensis)*, Swainson's hawk *(Buteo swainsoni)*, great-horned owl *(Bubo virginianus)*, burrowing owl *(Athene cunicularia)*, loggerhead shrike *(Lanius ludovicianus)*, American kestrel *(Falco sparverius)*, great blue heron *(Ardea herodias)*, common raven *(Corvus corax)*, and American crow *(Corvus brachyrhynchos)*. The avian wildlife forages over a large area and would spend relatively little time on site. Aquatic ecological receptors within the POLB Mitigation Pond area include marine invertebrates and fish such as the tidewater goby *(Eucyclogobius newberryi)*, which also inhabit Anaheim Bay (NAVFAC SW 2005; NAVWPNSTA Seal Beach, 2007). Migrant or resident bird species listed as threatened or endangered by federal or state agencies (or both) include the following: • Belding's savannah sparrow *(Passerculus sandwichensis beldingi)* • California least tern *(Sterna antillarum browni)* • Light-footed clapper rail *(Rallus longirostris levipes)* • Western snowy plover *(Charadrius alexandrinus nivosus)* The breeding season for these salt marsh and shorebird species extends from approximately late January to mid-September. The California least tern occupies the Seal Beach NWR only during the breeding season, with most of its food supply coming from the Seal Beach NWR during that period (NAVFAC SW 2005).

Table 8-2: MRP Site UXO2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Ecological Profile (continued)	Relationship of Contaminant Sources to Habitat and Potential Receptors	Because MEC and MC were not observed or detected during the 2009 SI field investigation there are likely incomplete exposure pathways for both MEC and MC at MRP Site UXO2.

9.0 MRP SITE UXO6 (WESTMINSTER POLB FILL AREA)

9.1 SITE DESCRIPTION AND HISTORY

MRP Site UXO6, Westminster POLB Fill Area, is located south of Westminster Avenue and along the Westminster railroad spur (Figure 9-1). The site is estimated to be 1.75 miles long and 715 feet wide; it encompasses 180 acres. In 1989 and 1990, the site was approved to be used to place approximately 3 to 5 feet of fill that had been excavated from the POLB Mitigation Pond (the southern portion of the current MRP Site UXO1), a known MEC area. A calculated 330,000 cubic yards of soil from the 7th Street POLB Mitigation Pond, excavated to an average depth of 5 feet bgs (based on a required average depth of 3 feet below the mean lower low water tide), was possibly spread in the Westminster POLB Fill Area. The exact quantity and location of the excavated material is unknown. During excavation of the 7th Street POLB Mitigation Pond, it was reported that 3-inch rounds were seen falling out of trucks, and that EOD responded to these incidents (Malcolm Pirnie 2008). The potential munitions concern at the POLB Mitigation Pond was documented in a 1989 POLB memorandum before the pond was excavated (POLB 1989). ChaduxTt interviewed the lease owner of the farm operation on the south side of the station, Mr. Roy Pursche, in December 2009 (ChaduxTt 2009e). Mr. Pursche indicated that fill was excavated from UXO1 and taken to UXO6 and that some debris was removed from the fill while it was being placed at the site. However, it is unknown whether or not the debris removed was munitions related.

Suspected munitions at the POLB Mitigation Pond that may have been transported to the Westminster POLB Fill Area include live, inert, or damaged submunitions (for example, BLU-36 and M-40 bomblets), projectiles and cartridge casings (such as 105-mm, 75-mm, 40-mm, and 20-mm), fuzes, CADs, propellant actuated devices (PADs), primers, flash tubes, 81-mm mortars, rockets (for example, 2.75- and 7.2-inch), grenades, obscurants (fog oil), black and smokeless powders, and small arms ammunition. A CAD and an artillery cartridge casing, which were both MPPEH items observed at UXO1, were also observed at UXO6 during the 2009 SI.

9.2 SITE UXO6 GEOLOGY AND HYDROGEOLOGY

MRP Site UXO6 (Westminster POLB Fill Area) is underlain by undocumented or debris fill in the fill areas between the roads and railroad spurs based on the detector-aided visual survey results and an interview with Mr. Roy Pursche (the current lease owner of the site) in December 2009 (ChaduxTt 2009e). The fill consisted of olive brown to grayish brown fine to medium-grained silty sand. The fill material was not logged to its maximum depth since soil borings were advanced only to 1.5 feet bgs Beneath the debris fill layer is suspected to be native material of young alluvial deposits (Qyf) which are Holocene and late Pleistocene in age and consist mostly of poorly to moderately consolidated and poorly sorted silty clay and sand (Figure 2-1).

Groundwater was not encountered in the borings completed to a maximum depth of 1.5 feet bgs within the site. Groundwater in the vicinity of UXO6 is approximately 20 feet bgs and reportedly flows to the northeast (NAVFAC SW 1999). Shallow groundwater is not used for drinking water or agricultural irrigation in the vicinity of the site; however, production wells on the

installation extend to depths greater than 600 feet bgs. The closest reported well to UXO6 is located near the Contractors Gate, and is screened at a depth of about 670 feet bgs (NAVFAC SW 1998a). Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985).

9.3 MEC Field Investigation Results

This section provides the results of the MEC investigation for MRP Site UXO6.

9.3.1 Detector-Aided Visual Survey Results

Detector-aided visual survey transects were conducted by the ChaduxTt UXO technicians before soil sampling began. Detector-aided visual survey transects were completed from east to west and spaced approximately 60 feet apart. A magnetic gradiometer and Whites all-metals detector were used during the surveys. All suspect MEC or MPPEH items were marked with plastic pin flags, photographed, and mapped with the DGPS. Subsurface anomalies were also mapped during the detector-aided visual surveys. UXO technicians identified 119 subsurface anomalies throughout the site with the hand-held metal detectors along transects and mapped with the DGPS. Detailed results of the detector-aided visual survey are shown on Figures 9-1 through 9-3, in the photographs included in the back of this section, and the table presented in Appendix D-3.

UXO technicians identified two MPPEH items at UXO6 that included a CAD on the western portion of the site and an artillery cartridge casing on the eastern portion of the site (Figures 9-2 through 9-3). Both types of MPPEH items were also observed at UXO1 during the 2009 SI. Metal and rubber debris possibly associated with munitions shipping containers that were observed at MRP Site UXO1 were also observed by UXO technicians at MRP Site UXO6. Wood debris and some burnt metal debris were also noted at the surface in some locations at the site.

During the detector-aided visual survey, ChaduxTt observed that the eastern edge of the MRP Site UXO6 site had been tilled for agriculture. Additionally, ChaduxTt observed landscapers mowing the low-lying seasonal vegetation that covers the majority of the site.

Per the scope of this SI, no items were picked up, moved, or destroyed. All suspect munitions items were treated as though they could pose risk to maintain the safety of personnel.

9.3.2 MEC Findings

MPPEH was observed by UXO technicians, including a CAD and an artillery cartridge casing (Figures 9-2 through 9-3). The CAD was at the ground surface but the artillery cartridge casing was partially buried. Both types of MPPEH items were also observed at MRP Site UXO1 during the 2009 SI field activities. Metal and rubber debris possibly associated with munitions shipping containers that were observed at MRP Site UXO1 were also observed at MRP Site UXO6 by UXO technicians. However, since the debris was scattered and partially buried, it could not be positively identified as MPPEH.

9.3.3 Deviations from the Work Plan

There were no deviations from the work plan were during the MEC investigation at MRP Site UXO6.

9.4 MC Sampling Locations and Depths

A combination of biased and grid soil sampling was conducted at MRP Site UXO6 (Figure 9-4). Two surface soil samples (0 to 0.5 feet bgs and 1 to 1.5 feet bgs) were collected from each soil boring advanced at the site. A sampling grid was established over the entire site, and 20 soil boring locations were randomly selected from the grid to provide adequate horizontal coverage. A total of 40 discrete random soil samples were collected from the grid locations. Soil samples were analyzed for metals, picrate, perchlorate, and explosive compounds. Soil sampling locations are shown on Figures 9-4 through 9-6.

Two biased soil boring locations were selected based on the two MPPEH items discovered during the detector-aided visual survey. Soil samples 043UXO6SB015 and 043UXO6SB016 were collected adjacent to an artillery cartridge casing (MPPEH), and soil samples 043UXO6SB055 and 043UXO6SB056 were collected adjacent to a CAD (MPPEH). Eight biased soil boring locations were selected based on the presence of subsurface anomalies and debris areas. Five biased soil boring locations were adjacent to subsurface anomalies, and three biased soil borings (043UXO6SB029030, 043UXO6SB031032, and 043UXO6SB047048) were in areas that contained metal debris, wood debris, and rubber debris possibly associated with munitions shipping containers.

9.4.1 Deviations from the Work Plan

Samples were collected from MRP Site UXO6 area according to the work plan SAP (ChaduxTt 2009a), and there were no deviations from the work plan during the MC investigation.

9.5 MC Soil Investigation Results

This section provides a summary of the site inspection sampling results and analytical data quality review for MRP Site UXO6.

9.5.1 Soil Sampling Results

The soil sampling results for MRP Site UXO6 are provided in Tables 9-1 and 9-2, as well as in Appendix E-1. Sixteen metals were detected at the site but not in every sample. Three out of the 16 metals detected exceeded background concentrations and included arsenic, lead, and selenium. Explosives were not detected in any of the samples. Perchlorate was detected in 53 of the 60 samples.

9.5.2 Human Health Screening Results

Analytical results for soil were compared with risk-based screening criteria to assess potential impacts on human health from exposure to chemicals in soils at MRP Site UXO6 under a residential and an industrial land use scenario. All chemicals detected in at least one sample from the sampled soil depth intervals of 0 to 0.5 foot bgs and 1 to 1.5 feet bgs were included in the screening, except for calcium, magnesium, potassium, and sodium that are known to be required human trace nutrients. Section 6.1 describes the selection procedure used to identify the residential and industrial soil screening criteria for the chemicals in soils.

The screening results including detected chemicals in soil, detection frequency, minimum and maximum detected concentrations, range of reporting limits; residential, industrial, and background screening criteria used; and number of samples with concentrations exceeding each criteria, are presented in Table 9-1. The list of chemicals exceeding the screening criteria is shown in Table 9-2. Table 9-2 also has information on location (point) and sample ID for the analyte that exceeded the criteria, sample depth, sample collection date, detected concentration, laboratory reporting limit, residential and industrial screening criteria, and background screening level for each analyte. The analytical results for soil are included in Appendix E-1.

All of the metals analyzed were detected at least once in site soil at MRP Site UXO6, with the majority of the metals detected in all of the samples collected at the site (Table 9-1). Detected metals were below screening criteria and background levels except for arsenic and lead. The maximum detected concentration for arsenic was 16.2 mg/kg at 043UXO6SB060 (Figures 9-4 and 9-5) that was collected at 1 to 1.5 foot bgs (Table 9-2). The concentration of arsenic in this sample slightly exceeded the background level for arsenic of 15.4 mg/kg; however, the source of arsenic at this location is unknown. All other arsenic detections were below background. One sample out of 60 samples exceeded the residential screening criterion for lead of 80 mg/kg and background. This sample (043UXO6SB048) was collected in a location containing wood debris from 1 to 1.5 foot bgs and also contained the maximum detected concentration for lead of 197 mg/kg and exceeded the background level for lead of 35.7 mg/kg. The source of lead at this location could possibly be the wood debris or MC.

As discussed in Section 6.0, mercury was screened against both inorganic and organic mercury criteria since uncertainty is associated with the presence of mercury fulminate. Mercury was detected in four of 60 samples collected. The detected concentration for mercury was less than the residential and industrial screening criteria for both inorganic and organic mercury (Table 9-1) and was below the background level.

None of the perchlorate concentrations detected in soil at MRP Site UXO6 exceeded the human health screening criteria (Table 9-1).

The human health screening criteria used to compare the analytical results in soil at MRP Site UXO6 are based solely on general residential and industrial use scenarios. Therefore, the screening results presented in this report are applicable only under the assumptions inherent in the residential and industrial criteria used and the data available at the time of the evaluation.

9.5.3 Ecological Screening Results

Detected concentrations of three metals in soil at UXO6 (arsenic, lead, and selenium) exceeded their corresponding ecological benchmarks and background screening criteria (Table 9-1). The source of arsenic and lead may be MC, MC from MPPEH, or non-munitions related debris in the fill material. The remaining chemicals either did not exceed the ecological benchmarks and background screening criteria or were reported as being present at a concentration below the laboratory reporting limit. The results of the comparison are as follows:

Chemical	Detection Frequency	Maximum Concentration in Soil (mg/kg)	Background Screening Criteria (mg/kg)	Ecological Screening Benchmark (mg/kg)	Number of Detections Greater than Background and Ecological Screening Criteria
Arsenic	60/60	16.2	15.4	10	1
Cobalt	60/60	16.0	NA	13	9
Lead	60/60	197	35.7	11	3
Selenium	41/60	1.2	0.44	0.52	41

Notes:
mg/kg Milligram per kilogram
NA No background concentration available

9.5.4 Data Quality Review

A final review of the data set against the EPA data quality parameters indicated the soil analytical data are of high overall quality. The data quality review found that QA/QC objectives for bias and precision were met for most analytical results with the following exceptions:

- MS/MSD recoveries resulted in qualification of results as estimated (J) for antimony, barium, and thallium in multiple samples. Approximately 2.1 percent of the soil sample data were affected.
- ICS values resulted in qualification of results as estimated (J) for cadmium and thallium in a few samples. High concentrations of calcium and iron resulted in qualification of 0.2 percent of the data for soil.
- Several sample results were estimated because they were reported at concentrations between the MDL and the QL. The analytical instrument can make reliable qualitative identification of analytes MDL but below the QL; however, detected results below the QL are considered quantitatively uncertain.

A complete summary the data quality review is included in Appendix F. The supporting data validation reports are included in Appendix E-5. Chain-of-custody forms were used to trace possession of the samples from field collection to the analytical laboratory. The completed chain-of-custody forms are in Appendix E-4.

9.6 MRP SITE UXO6 UPDATED CONCEPTUAL SITE MODEL

The CSM for MRP Site UXO6 was updated based on the results of the 2009 SI field activities that include the types of MPPEH observed, the anticipated MEC density based on detector-aided visual survey results, observed site structures, MC sampling results, and information gathered from an interview with the agricultural lease owner of the property (ChaduxTt personnel communication with Mr. Roy Pursche in December 2009) that confirmed that fill was taken from the POLB Mitigation Pond and placed at UXO6. In addition, farmers and landscapers were added as potential receptors in the CSM since the eastern portion of the site was observed to be tilled for agriculture, and landscapers were observed mowing the low-lying seasonal vegetation that covers the majority of the site.

The updated CSM profile for UXO6 is provided as Table 9-3. Figures 9-7 and 9-8 provide a graphical representation of the current understanding of the exposure pathways through which site receptors could come in contact with, or be affected by, MEC and MC at MRP Site UXO6. Potentially complete exposure pathways for human or ecological receptors exist for MEC in the subsurface (Figure 9-7).

The graphical CSM for MEC from the PSI (Malcolm Pirnie 2008) shows complete MEC exposure pathways for Navy personnel, contractor/visitors, and biota for treading the site. The CSM from the PSI also shows potentially complete MEC exposure pathways for these receptors for intrusive activities (for example, digging, drilling, or construction) and incomplete MEC exposure pathways for the farmers for both treading and intrusive activities. However, based on the locations and density of suspect MEC and MPPEH observed during the 2009 SI field activities, the updated graphical CSM (Figure 9-7) has been revised to include potentially complete MEC exposure pathways for all receptors and activities since any of the receptors could potentially come in contact with MEC.

The updated graphical CSM for MC (Figures 9-8) shows has different exposure pathways than the PSI (Malcolm Pirnie 2008) based on the 2009 SI MC soil sampling results. The updated CSM shows complete MC exposure pathways for biota where the CSM from the PSI does not.

9.7 MRP SITE UXO6 CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations for MRP Site UXO6.

9.7.1 Potential or Existing MEC Hazards

MRP Site UXO6 (Westminster POLB Fill Area) was visually inspected during the PSI (Malcolm Pirnie 2008), during the site walk for the MRP SI project kickoff meeting (July 25, 2008), and most recently during the 2009 SI field activities. In 1989 and 1990, the site was used to place approximately 3 to 5 feet of fill that had been excavated from the POLB Mitigation Pond (the southern portion of MRP Site UXO1), a known MEC area.

Evidence of MPPEH (an artillery cartridge casing and a CAD) was observed by UXO technicians during the visual inspection conducted during the 2009 SI field effort. Numerous subsurface anomalies UXO technicians identified throughout the site indicate that munitions may be in the fill material. Based on visual evidence and past practices as well as the nature, extent, and distribution of subsurface anomalies mapped at the site, the MEC risk and hazard at MRP Site UXO6 are anticipated to range from low to high since some items had been reportedly removed during placement of the fill.

Because of the MPPEH items found at MRP Site UXO6 that were also found at MRP Site UXO1 and the distribution of subsurface anomalies throughout the site, and given fill material from MRP Site UXO1 was likely placed at the site according to interviews (ChaduxTt 2009e), an RI/FS for MEC is recommended for UXO6.

9.7.2 Potential or Existing MC Hazards

Concentrations of explosives, propellants, or picrate were not detected in soils at MRP Site UXO6. Perchlorate was detected in soil below the human health screening criteria. Arsenic and lead were detected in soil at concentrations greater than the human health and background screening criteria. Detected concentrations of three metals in soil (arsenic, lead, and selenium) exceeded the corresponding ecological benchmarks and background levels. Arsenic exceeded ecological benchmark screening criteria and background in one soil sample (043UXO6SB060). Because metals in some of the soil samples exceed human health, ecological, and background screening criteria and fill material from MRP Site UXO1 was likely placed at the site according to interviews (ChaduxTt 2009e), and given MPPEH (potential sources of MC) was found at the site, an RI/FS for MC is recommended for UXO6.

SECTION 9.0 PHOTOS – MRP SITE UXO6

Photo 1: View looking west from the central portion of MRP Site UXO6.

Photo 2: View looking north from the central portion of MRP Site UXO6.

Photo 3: View looking east from the central portion of MRP Site UXO6.

Photo 4: Cartridge activated device (MPPEH) located in the western portion of MRP Site UXO6.

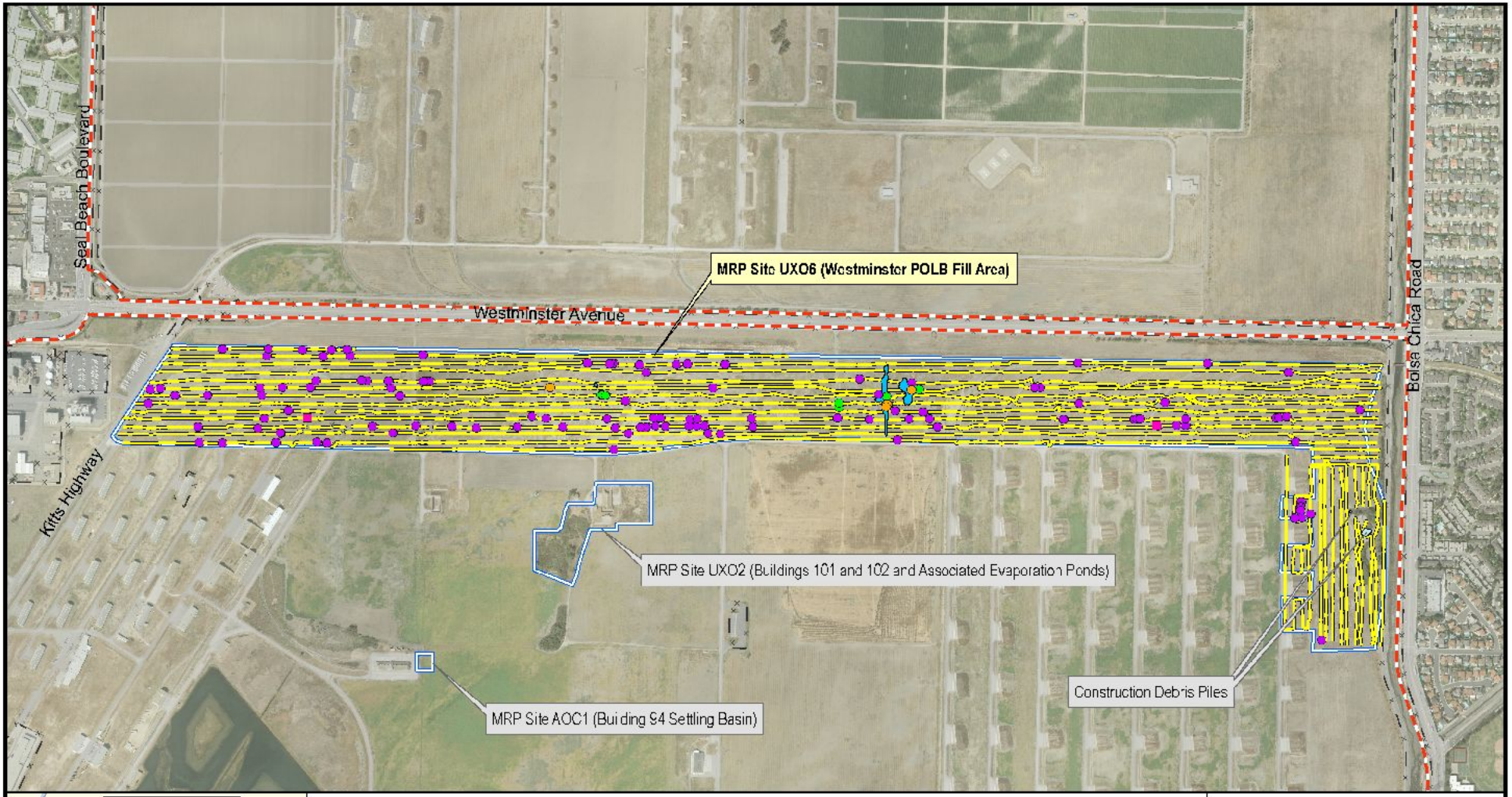
Photo 5: Partially buried artillery cartridge casing (MPPEH) located in the eastern portion of MRP Site UXO6.

Photo 6: View of wood debris, metal debris, and rubber debris possibly associated with munitions shipping containers observed on the ground surface at MRP Site UXO6.

Photo 7: Rubber debris possibly associated with munitions shipping containers and wood debris within the central portion of MRP Site UXO6.

Photo 8: View of construction debris piles on the eastern portion of MRP Site UXO6.

SECTION 9.0 FIGURES – MRP SITE UXO6



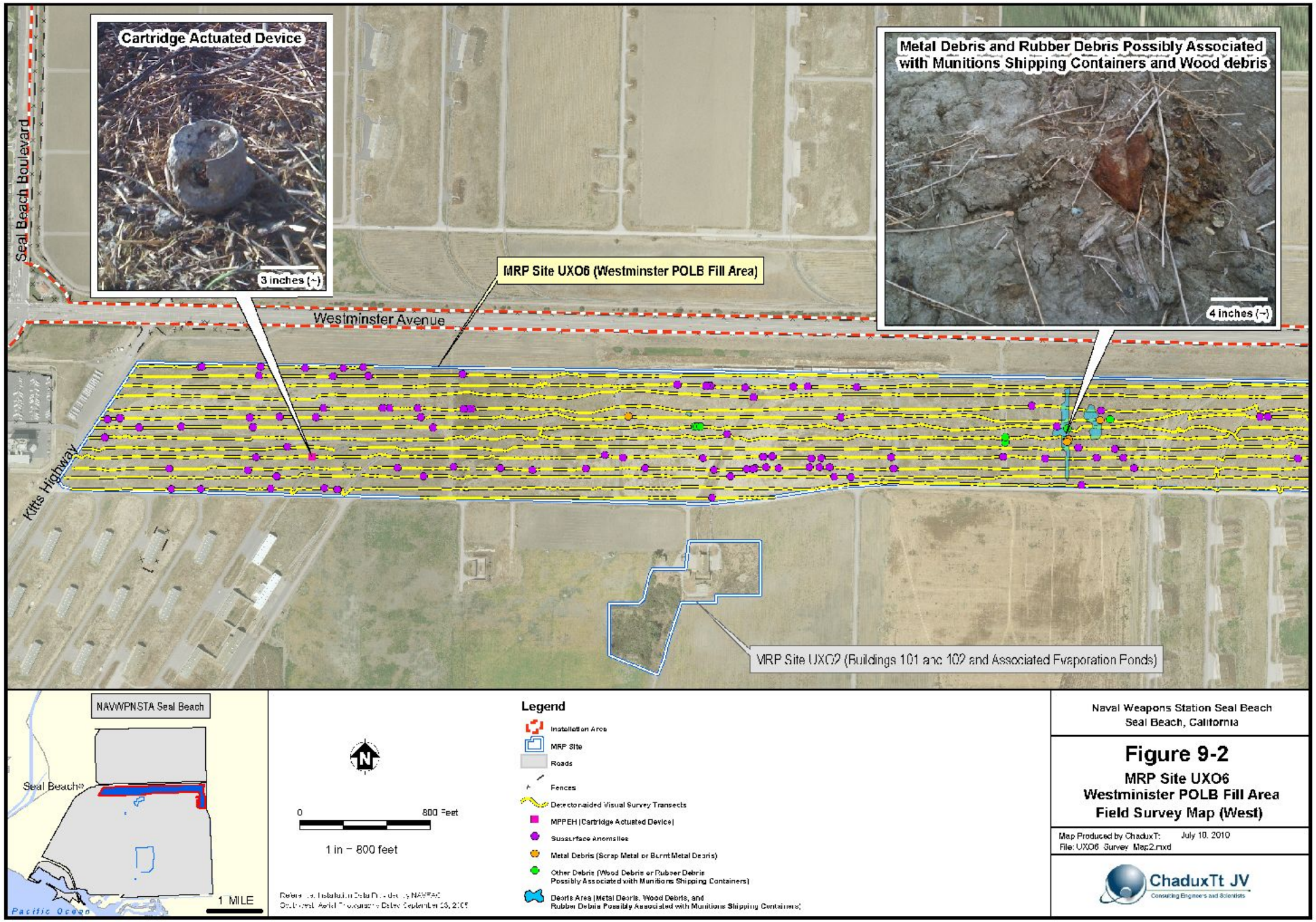
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-1

MRP Site UXO6
Westminster POLB Fill Area
Field Survey Map

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Survey Map.mxd

ChaduxTt JV
Consulting Engineers and Scientists



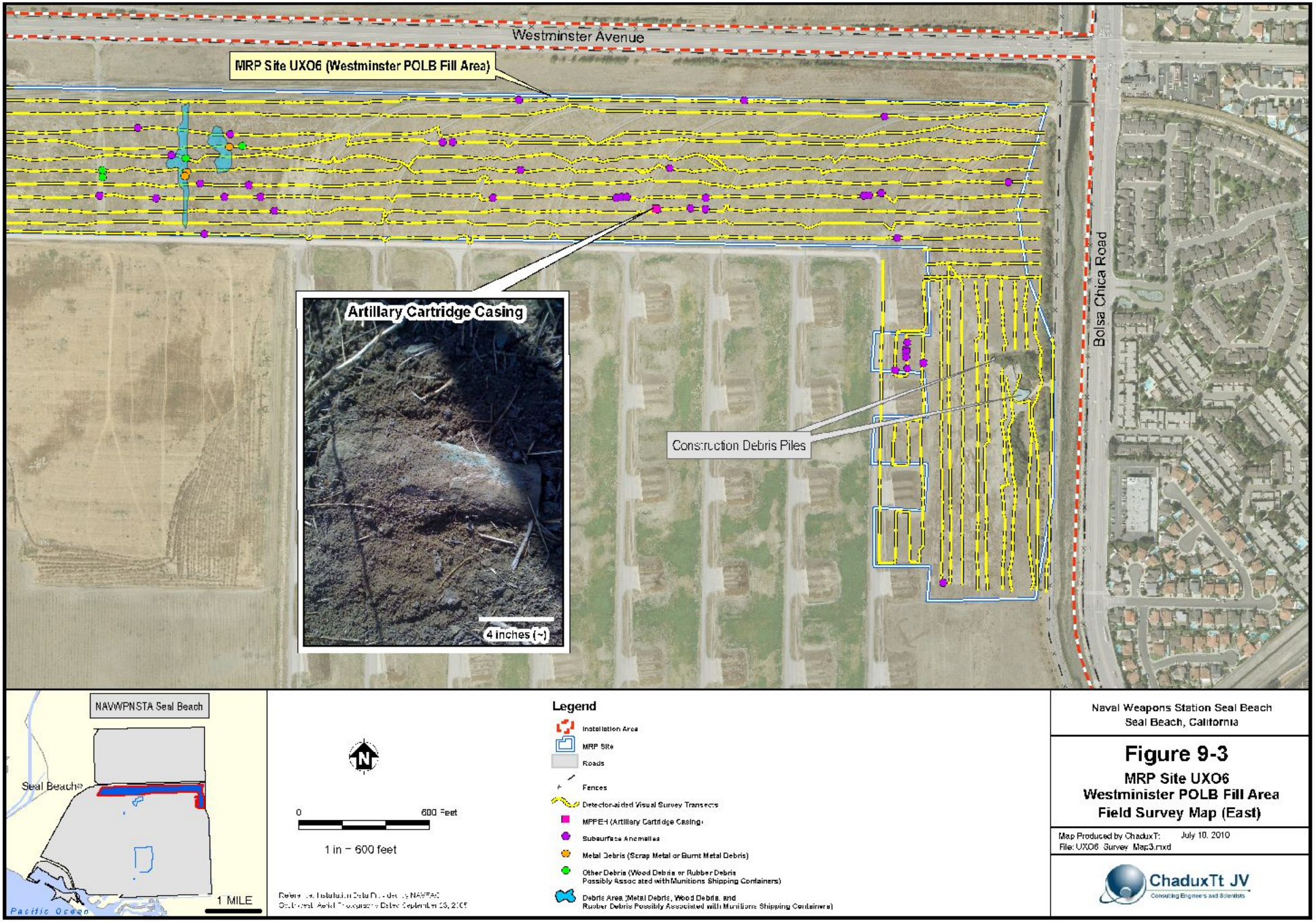
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-2

MRP Site UXO6
Westminster POLB Fill Area
Field Survey Map (West)

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Survey Map2.mxd

ChaduxTt JV
Consulting Engineers and Scientists



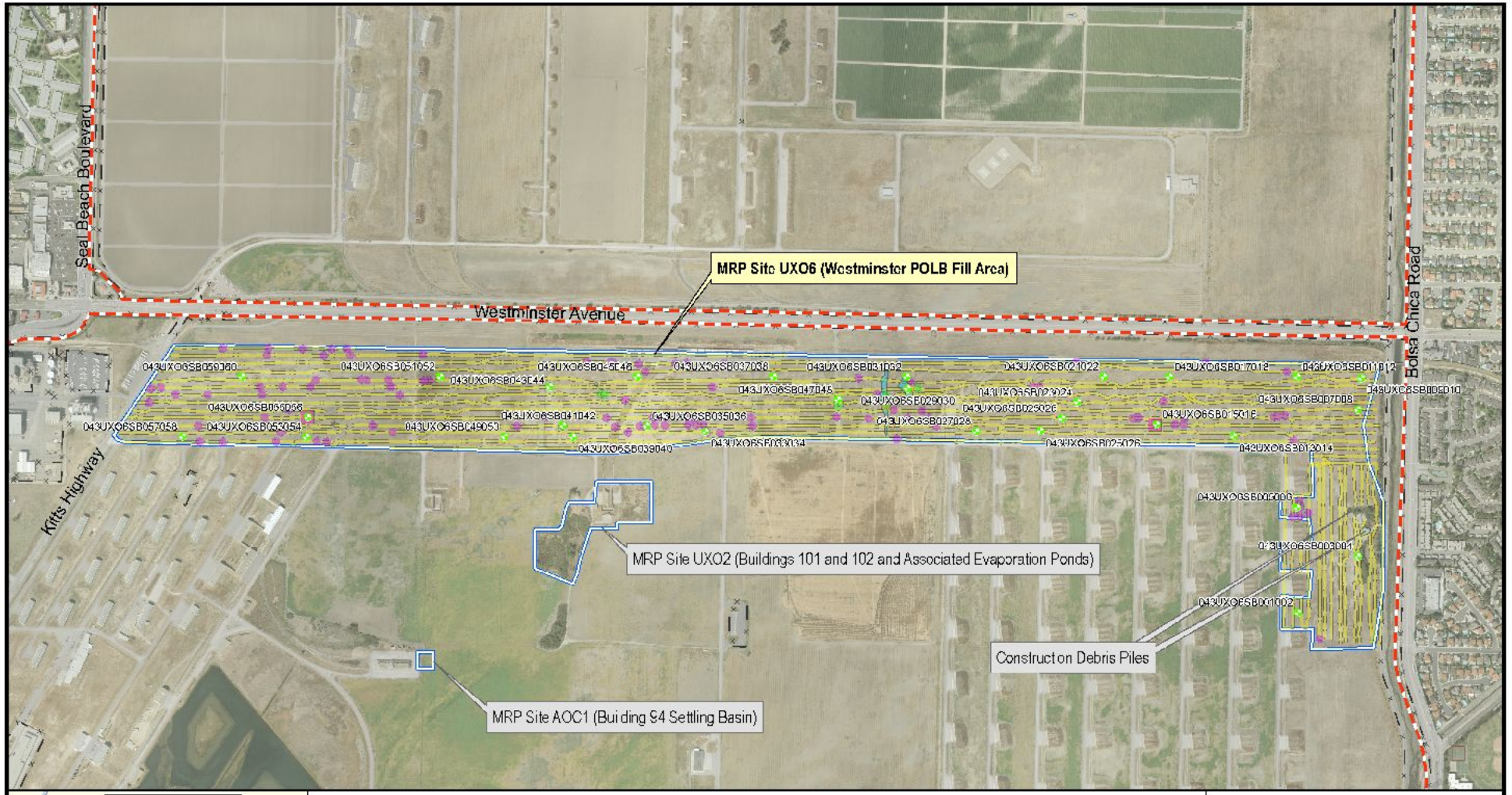
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-3

MRP Site UXO6
Westminister POLB Fill Area
Field Survey Map (East)

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Survey Map3.mxd

ChaduxTt JV
Consulting Engineers and Scientists



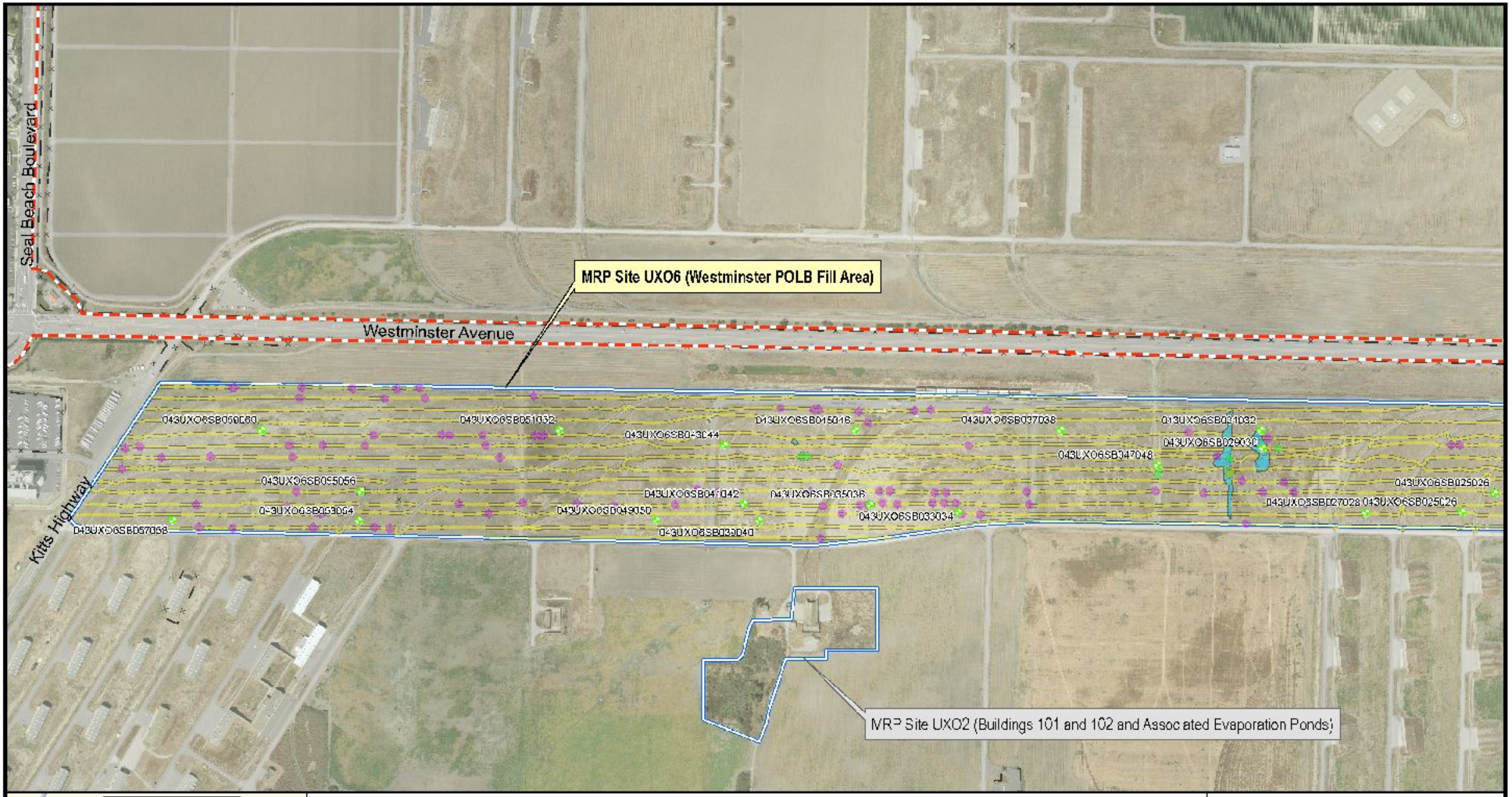
Naval Weapons Station Seal Beach
Seal Beach, California

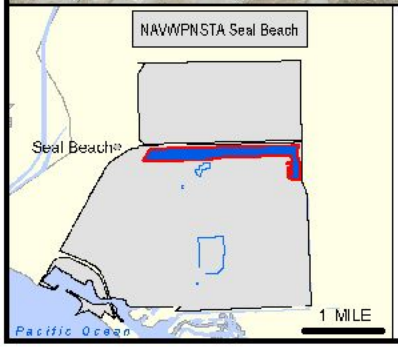
Figure 9-4

MRP Site UXO6
Westminster POLB Fill Area
Sample Location Map

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Sample Loc Map.mxd

ChaduxTt JV
Consulting Engineers and Scientists





0 800 Feet

1 in = 800 feet

Reference Installation Data Provided by NAVFAC
Background Aerial Photography Dated September 26, 2005

Legend

- Installation Area
- MRP Site
- Roads
- Fences
- Detector-aided Visual Survey Transects
- MPPEH (Cartridge Actuated Device)
- Subsurface Anomalies
- Metal Debris (Scrap Metal or Burnt Metal Debris)
- Other Debris (Wood Debris or Rubber Debris Possibly Associated with Munitions Shipping Containers)
- Debris Area (Metal Debris, Wood Debris, and Rubber Debris Possibly Associated with Munitions Shipping Containers)
- Soil Sample Location

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-5

MRP Site UXO6
Westminster POLB Fill Area
Sample Location Map (West)

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Sample Loc Map2.mxd

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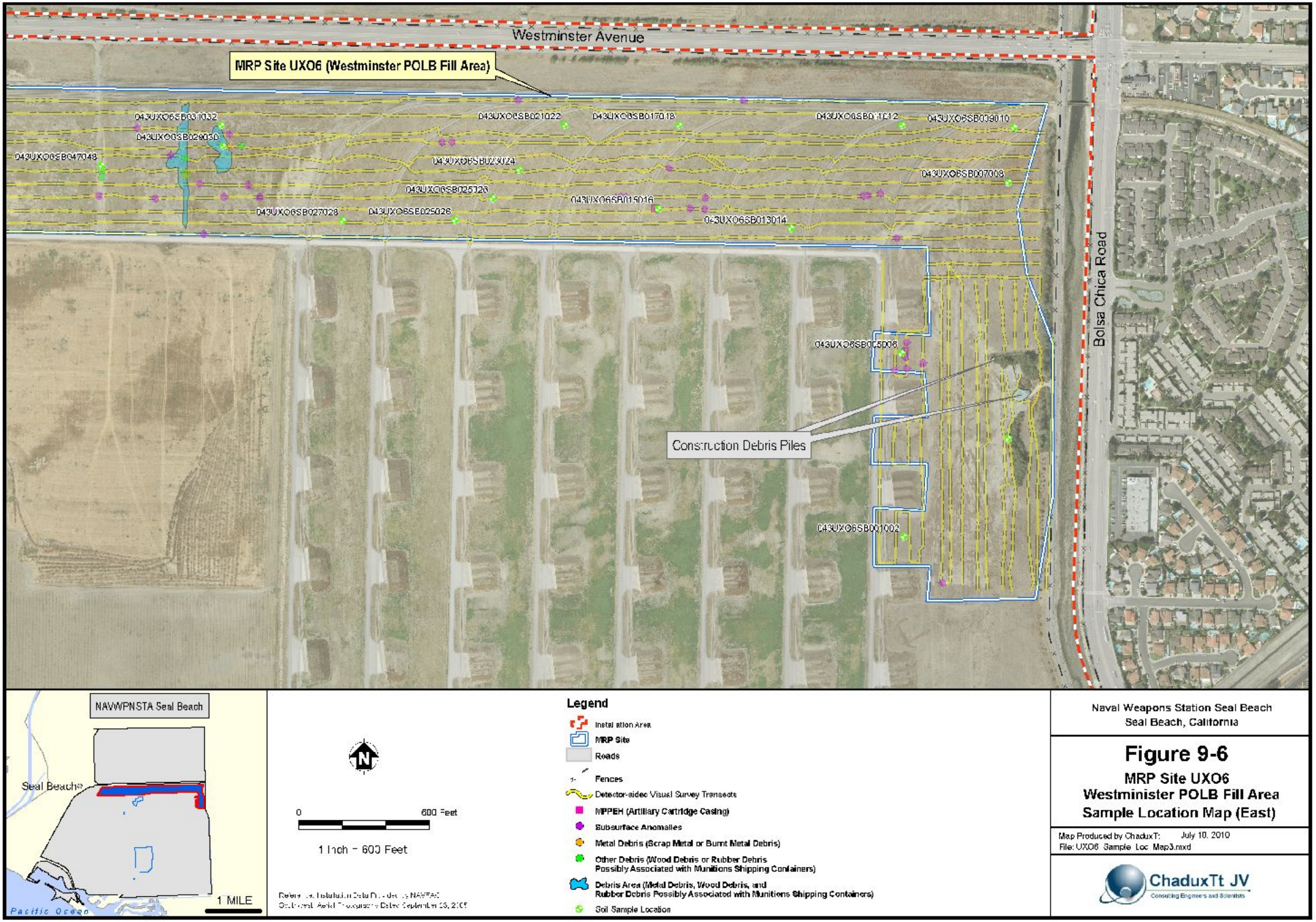

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-6

MRP Site UXO6
Westminster POLB Fill Area
Sample Location Map (East)

Map Produced by ChaduxTt: July 10, 2010
File: UXO6 Sample Loc Map3.mxd

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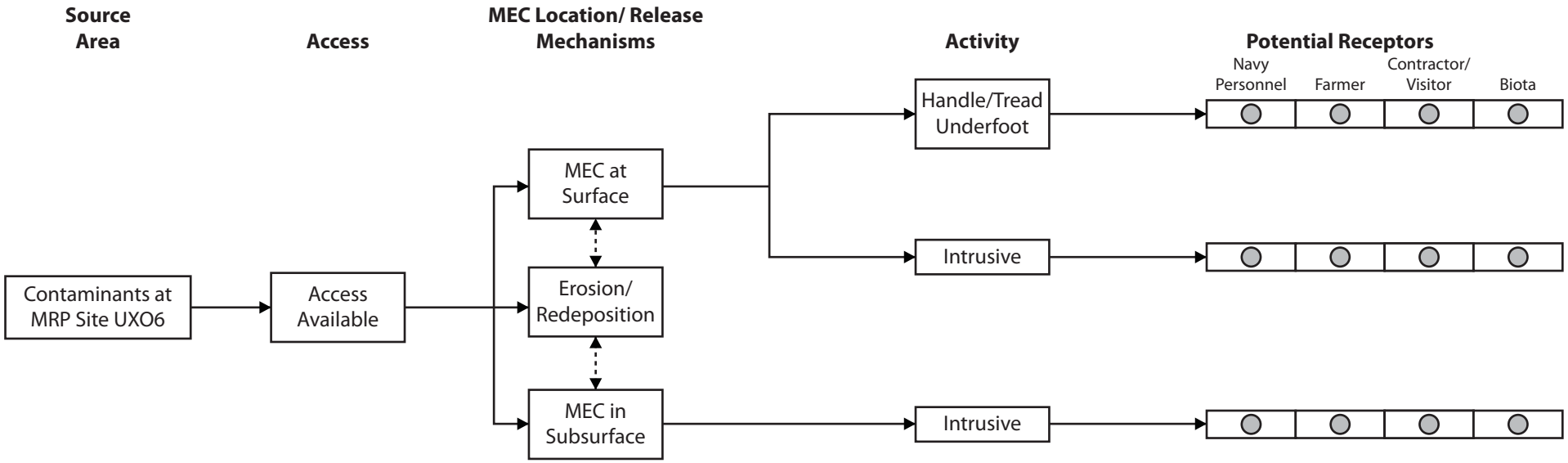

Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MEC - Munitions and Explosives of Concern

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

○ Incomplete Pathway

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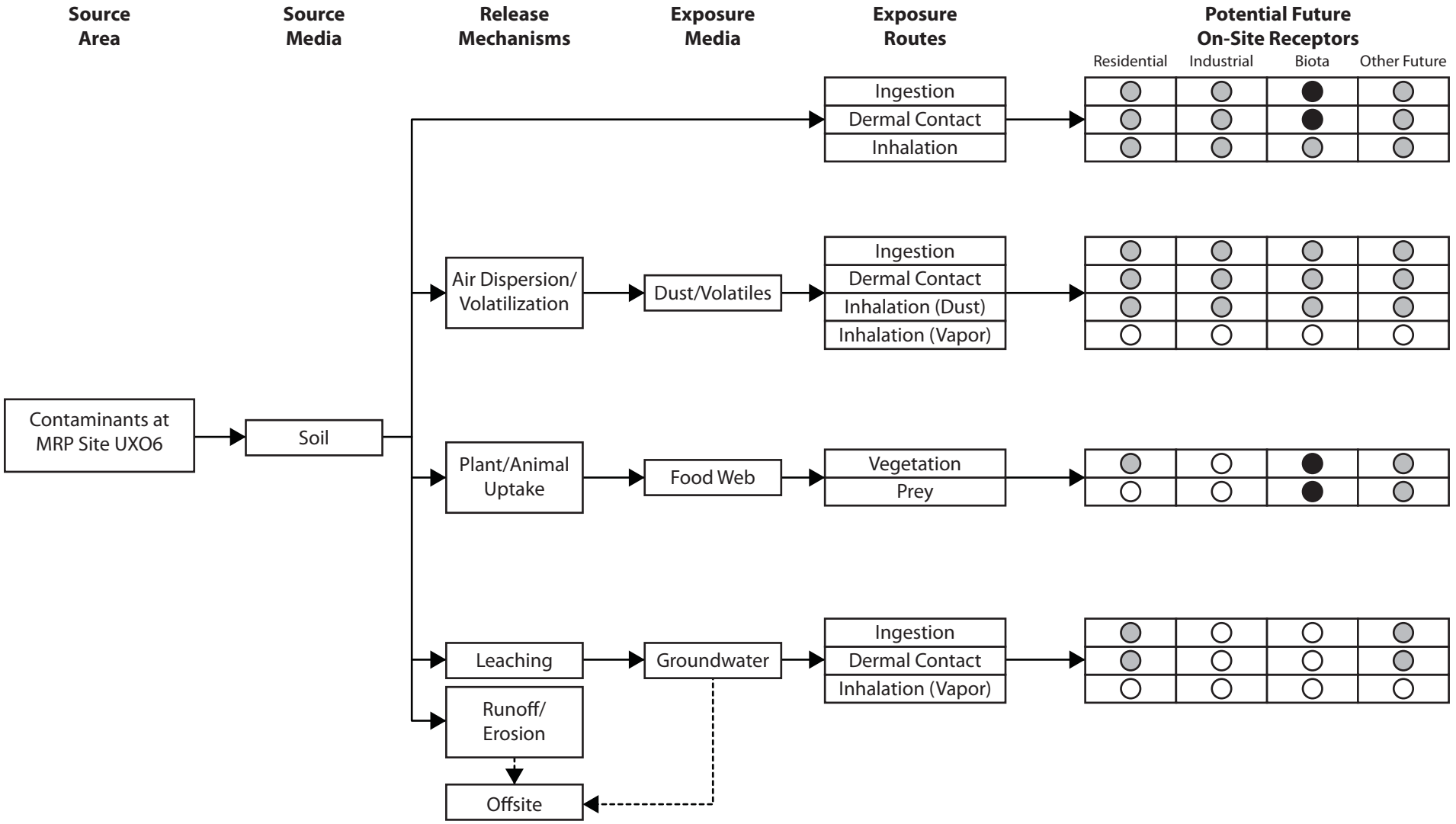
Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-7

MRP Site UXO6
Graphical Updated Conceptual Site Model for MEC
Site Inspection Report



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

○ Incomplete Pathway

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Naval Weapons Station Seal Beach
Seal Beach, California

Figure 9-8

MRP Site UXO6
Graphical Updated Conceptual Site Model
for MC
Site Inspection Report

SECTION 9.0 TABLES – MRP SITE UXO6

TABLE 9-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO6

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Screening Criteria	Number of Detections Above Residential Screening Criteria	Industrial Screening Criteria	Number of Detections Above Industrial Screening Criteria	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria	Back-ground Screening Level	Number of Detections Above Background Screening Level
Metals (mg/kg)													
ALUMINUM	60/60	10,800	25,300	043UXO6SB027028	20.7 - 26.4	77,000	0	990,000	0	50.0	**60**	36,300	0
ARSENIC	60/60	2.7	16.2	043UXO6SB059060	1.0 - 1.3	0.062	**60**	0.25	**60**	10.0	**1**	15.4	**1**
BARIUM	60/60	57.0 J	160	043UXO6SB027028	1.0 - 1.3	15,000	0	190,000	0	330	0	NC	-
BERYLLIUM	60/60	0.42 J	0.98 J	043UXO6SB059060	1.0 - 1.3	160	0	2,000	0	10.0	0	2.1	0
CADMIUM	4/60	0.14 J	0.43 J	043UXO6SB041042	1.1 - 1.2	1.7	0	7.5	0	0.36	**2**	2.2	0
CHROMIUM	60/60	14.0	32.9	043UXO6SB059060	1.0 - 1.3	120,000	0	1,500,000	0	0.40	**60**	46.2	0
COBALT	60/60	6.7	16.0	043UXO6SB047048	1.0 - 1.3	23.0	0	300	0	13.0	**9**	NC	-
COPPER	60/60	10.5	38.3	043UXO6SB059060	1.0 - 1.3	3,100	0	41,000	0	28.0	**8**	39.0	0
IRON	60/60	13,900	34,300	043UXO6SB047048	20.7 - 26.4	55,000	0	720,000	0	NC	-	NC	-
LEAD	60/60	5.0	197	043UXO6SB047048	1.0 - 1.3	80.0	**1**	320	0	11.0	**40**	35.7	**3**
MANGANESE	60/60	282	825	043UXO6SB053054	1.0 - 1.3	1,800	0	23,000	0	220	**60**	1,100	0
MERCURY-INORGANIC	4/60	0.049 J	0.23	043UXO6SB047048	0.11 - 0.12	23.0	0	310	0	0.10	**1**	NC	-
MERCURY-ORGANIC	4/60	0.049 J	0.23	043UXO6SB047048	0.11 - 0.12	7.8	0	100	0	0.10	**1**	NC	-
NICKEL	60/60	10.0	24.8	043UXO6SB059060	1.0 - 1.3	1,500	0	20,000	0	38.0	0	32.5	0
SELENIUM	41/60	0.55 J	1.2	043UXO6SB027028	1.0 - 1.3	390	0	5,100	0	0.52	**41**	0.44	**41**
VANADIUM	60/60	27.6	71.4	043UXO6SB047048	1.0 - 1.3	78.0	0	1,000	0	2.0	**60**	86.0	0
ZINC	60/60	39.1	176	043UXO6SB055056	1.0 - 1.3	23,000	0	310,000	0	46.0	**59**	177	0
Explosives (mg/kg)													
PERCHLORATE	53/60	0.00029 J	0.083	043UXO6SB005006	0.0051 - 0.026	29.0	0	380	0	NC	-	NC	-

TABLE 9-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE UXO6

Naval Weapons Station Seal Beach, California

Notes:

1. Data shown includes detected analytes in all soil samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).
4. "Total" metals were measured at the Site. Given the uncertainties, total mercury was screened by use of inorganic and organic mercury human health screening criteria.

-	Not applicable
J	Estimated value
mg/kg	Milligrams per kilogram
MRP	Munitions response program
NC	No criteria
QC	Quality control
UXO	Unexploded ordinance

TABLE 9-2: METALS RESULTS FOR SOIL SAMPLES EXCEEDING BACKGROUND CONCENTRATIONS FOR MRP SITE UXO6

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	Background Screening Level
Metals (mg/kg)										
ARSENIC	043UXO6SB059060	043UXO6SB060	1.00 - 1.50	12/07/09	16.2	1.2	**0.062**	**0.25**	**10.0**	**15.4**
LEAD	043UXO6SB005006	043UXO6SB005	0.00 - 0.50	12/06/09	36.5	1.1	80.0	320	**11.0**	**35.7**
LEAD	043UXO6SB005006	043UXO6SB006	1.00 - 1.50	12/06/09	62.4	1.2	80.0	320	**11.0**	**35.7**
LEAD	043UXO6SB047048	043UXO6SB048	1.00 - 1.50	12/07/09	197	1.2	**80.0**	320	**11.0**	**35.7**
SELENIUM	043UXO6SB001002	043UXO6SB001	0.00 - 0.50	12/06/09	0.72 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB003004	043UXO6SB003	0.00 - 0.50	12/06/09	0.66 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB003004	043UXO6SB004	1.00 - 1.50	12/06/09	0.70 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB005006	043UXO6SB005	0.00 - 0.50	12/06/09	0.81 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB005006	043UXO6SB006	1.00 - 1.50	12/06/09	0.69 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB007008	043UXO6SB007	0.00 - 0.50	12/06/09	0.72 J	1.3	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB009010	043UXO6SB009	0.00 - 0.50	12/06/09	0.67 J	1.0	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB011012	043UXO6SB011	0.00 - 0.50	12/06/09	0.55 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB011012	043UXO6SB012	1.00 - 1.50	12/06/09	0.87 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB013014	043UXO6SB013	0.00 - 0.50	12/06/09	0.66 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB013014	043UXO6SB014	1.00 - 1.50	12/06/09	0.97 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB015016	043UXO6SB015	0.00 - 0.50	12/06/09	0.78 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB015016	043UXO6SB016	1.00 - 1.50	12/06/09	0.72 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB017018	043UXO6SB017	0.00 - 0.50	12/06/09	0.68 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB019020	043UXO6SB019	0.00 - 0.50	12/06/09	0.64 J	1.0	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB019020	043UXO6SB020	1.00 - 1.50	12/06/09	0.67 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB021022	043UXO6SB021	0.00 - 0.50	12/06/09	0.74 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB021022	043UXO6SB022	1.00 - 1.50	12/06/09	0.97 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB023024	043UXO6SB023	0.00 - 0.50	12/06/09	0.64 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB027028	043UXO6SB028	1.00 - 1.50	12/06/09	1.2	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB029030	043UXO6SB029	0.00 - 0.50	12/06/09	0.67 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB031032	043UXO6SB031	0.00 - 0.50	12/06/09	0.59 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB031032	043UXO6SB032	1.00 - 1.50	12/06/09	0.69 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB033034	043UXO6SB033	0.00 - 0.50	12/06/09	0.74 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB035036	043UXO6SB035	0.00 - 0.50	12/06/09	0.76 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB035036	043UXO6SB036	1.00 - 1.50	12/06/09	0.75 J	1.2	390	5,100	**0.52**	**0.44**

TABLE 9-2: METALS RESULTS FOR SOIL SAMPLES EXCEEDING BACKGROUND CONCENTRATIONS FOR MRP SITE UXO6

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	Background Screening Level
Metals (mg/kg)										
SELENIUM	043UXO6SB037038	043UXO6SB037	0.00 - 0.50	12/06/09	0.91 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB037038	043UXO6SB038	1.00 - 1.50	12/06/09	0.79 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB039040	043UXO6SB040	1.00 - 1.50	12/07/09	0.87 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB043044	043UXO6SB043	0.00 - 0.50	12/07/09	0.81 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB043044	043UXO6SB044	1.00 - 1.50	12/07/09	0.78 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB045046	043UXO6SB045	0.00 - 0.50	12/07/09	0.89 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB045046	043UXO6SB046	1.00 - 1.50	12/07/09	0.63 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB047048	043UXO6SB047	0.00 - 0.50	12/07/09	1.0 J	1.3	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB047048	043UXO6SB048	1.00 - 1.50	12/07/09	0.67 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB049050	043UXO6SB049	0.00 - 0.50	12/07/09	0.78 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB051052	043UXO6SB051	0.00 - 0.50	12/07/09	0.84 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB051052	043UXO6SB052	1.00 - 1.50	12/07/09	0.69 J	1.1	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB055056	043UXO6SB055	0.00 - 0.50	12/07/09	0.69 J	1.2	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB057058	043UXO6SB057	0.00 - 0.50	12/07/09	0.84 J	1.3	390	5,100	**0.52**	**0.44**
SELENIUM	043UXO6SB059060	043UXO6SB060	1.00 - 1.50	12/07/09	0.67 J	1.2	390	5,100	**0.52**	**0.44**

Notes:
1. Exceeded screening criterion is shown in bold.
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
MRP Munitions response program
UXO Unexploded ordinance

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information	Installation Name	NAVWPNSTA Seal Beach
	Site Name	MRP Site UXO6 (Westminster POLB Fill Area)
	Site Area and Layout	MRP Site UXO6 occupies approximately 180 acres.
	Site Structures	A railroad spur runs along the length of MRP Site UXO6. In addition, an administrative building and vehicle and railroad scales are located at central portion of the site.
	Site Boundaries	Westminster Avenue is located 75 to 250 feet north of MRP Site UXO6 and bisects the northern and southern areas of NAVWPNSTA Seal Beach. The installation boundary is roughly 1 mile north of the site, where the installation is bordered by the City of Seal Beach. Westminster Street and agricultural fields are located just south of UXO6. In addition, the installation boundary is 1.75 miles south of the site. Beyond the installation boundary is the Orange County Flood Control Channel, which flows into Anaheim Bay and then the Pacific Ocean, as is the City of Huntington Beach. West of UXO6 is active installation offices and production buildings. The installation boundary is approximately 0.25 mile to the west, where the installation is bordered by the City of Seal Beach. The installation's fenced boundary is adjacent to the east of UXO6, where the installation is bordered by the City of Westminster.
	Site Security	MRP Site UXO6 is located on NAVWPNSTA Seal Beach, which is a fenced and guarded installation. Security personnel are responsible for maintaining law and order and for implementing access control policies and procedures. Access to UXO6 from within the station is controlled by vehicular security patrol.

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile	Munitions Types	The various types of munitions reported for the Primer/Salvage Yard and the POLB Mitigation Pond could be present at MRP Site UXO6 if fill material from the pond is also present. The types of munitions that may have been in fill placed at UXO6 include, but are not limited to, live, inert, or damaged submunitions (such as BLU-36 and M-40 bomblets), projectiles and cartridge casings (for example, 105-mm, 81-mm, 75-mm, 40-mm, and 20-mm), fuzes, CADs, PADs, primers, flash tubes, rockets (2.75- and 7.2-inch), grenades, obscurants (fog oil), black and smokeless powders, and small arms ammunition. According to site interviews (Malcolm Pirnie 2008), 3-inch rounds were reported falling off trucks during excavation of soil from the POLB Mitigation Pond (Malcolm Pirnie 2008). Munitions debris, including an artillery cartridge casing and a CAD, was observed during the 2009 SI field investigation.
	Maximum Probability Penetration Depth	If present, the depth would be equal to the fill placed at the site, which is approximately 3 to 5 feet deep.
	MEC Density	MEC density is suspected to be low.
	MEC Field Observations	MPPEH, including a CAD and an artillery cartridge casing, was observed during the detector-aided visual survey conducted at MRP Site UXO6. These MPPEH items were also found at MRP Site UXO1. Metal and rubber debris possibly associated with munitions shipping containers that were observed at MRP Site UXO1 were also observed at MRP Site UXO6.

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)	Munitions Constituents	MC associated with MRP Site UXO6 that may have been transported to the site include nickel, zinc, ammonia, and TKN. Black powder (potassium nitrate) and C4 explosives (RDX) reportedly were also used during EOD and safety demonstrations, which was the area excavated to create the POLB Mitigation Pond. Explosive MC related to cartridges likely include double base powders (nitrocellulose and nitroglycerin). MC related to removal of primers from projectiles also include black powder and smokeless powder, such as nitrocellulose, nitroglycerin, and nitroguanidine. Metals MC related to black and smokeless powder include antimony, arsenic, copper, nickel, and zinc. In addition, the obscurant fog oil (kerosene/mineral oil) reportedly was spilled in the vicinity of the Primer/Salvage Yard area of UXO1 that was partly excavated to create the POLB Mitigation Pond. Sixty soil samples were collected at MRP Site UXO6 and analyzed for metals, picrate, perchlorate, and explosives. Sixteen metals were detected at the site, but not in every sample. Three out of the 16 metals detected exceeded background concentrations including arsenic, lead, and selenium. Explosives were not detected in any of the samples. Perchlorate was detected in 53 of the 60 samples but was at concentrations below human health screening criteria.
	Migration Routes/Release Mechanisms	The natural migration of MEC is not suspected given the low erosion capability of soils at MRP Site UXO6. However, mowing the site for weed control and tilling the eastern portion of the site may result in migration of MEC. Earthmoving associated with future construction, excavation, and maintenance at the site is also a mechanism that could redistribute MEC and MC in soil. MC present in soil can leach through soil to groundwater and be bioaccumulated by biota or agricultural crops.

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile	Climate	The climate at NAVWPNSTA Seal Beach is typical of the maritime subclimate within the California Mediterranean climate, which includes mild winters, cool summers, high relative humidity, and frequent early morning clouds that lead to afternoon sunshine. The annual average temperature is 74°F. Summer average high temperatures range from 77 °F to 84 °F, and average lows range from 60 °F to 65 °F. Winter temperatures tend to be moderate, with highs typically 67 °F and average lows ranging from 45 °F to 47 °F. Yearly precipitation averages 13 inches; February, the wettest month, averages 3 inches, and July, the driest, averages 0.02 inch (WRCC undated). Periodically, the region experiences El Niño conditions, which tend to bring wetter winters to the area through heavy storms. The prevailing winds are westerly with an average velocity of 10 knots. Strong, dry northeasterly winds occasionally descend the mountain slopes in the fall, winter, and early spring months. The strongest winds that occur within the region are associated with the winter and spring storms off the Pacific Ocean (NAVFAC SW 2005).
	Topography	MRP Site UXO6 has relatively flat terrain and was filled to an elevation of 8.5 feet asl at the western edge of the site to 16.5 feet asl at its eastern edge (Malcolm Pirnie 2008; Appendix A).
	Geology	MRP Site UXO6 is underlain by undocumented or debris fill in the fill areas between the roads and railroad spurs. Beneath the debris fill layer is native material of young alluvial fan and valley deposits (Qyf), which are Holocene and late Pleistocene in age and consist of gently sloping, slightly dissected alluvial fan deposits.

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Soil	MRP Site UXO6 soil fill was excavated from the creation of the POLB Mitigation Ponds between the railroad spur and roads crossing the site. The fill consisted of a grayish brown or brownish gray very fine to fine-grained well sorted silty sand. The administrative building and vehicle and railroad scales areas within the site are underlain by artificial fill material. Native soils underlying fill materials at the site consist of moderately consolidated and poorly sorted silty sand and clay.
	Hydrogeology	Groundwater was not encountered in the borings completed to a maximum depth of 1.5 feet bgs within the site during the 2009 SI field activities. Groundwater in the vicinity of MRP Site UXO6 is approximately 20 feet bgs and reportedly flows to the northeast (NAVFAC SW 1999). Shallow groundwater is not used for drinking water or agricultural irrigation in the vicinity of the site; however, production wells on the installation extend to depths greater than 600 feet bgs. The closest reported well to UXO6 is located near the Contractors Gate and is screened at a depth of roughly 670 feet bgs (NAVFAC SW 1998a). Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985).
	Hydrology	Surface water generally flows southwest, following the topography of the installation (NAVFAC SW 2002). Runoff is expected to be slow over bare level soil, and surface water is expected only intermittently to pond and to infiltrate to groundwater. No permanent surface water bodies exist within MRP Site UXO6.
	Vegetation	The dominant vegetation at MRP Site UXO6 is sparse coverage of low grasses and pickleweed (*Salicornia* spp.).

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile	Current Land Use	MRP Site UXO6 is primarily unused, other than for limited railcar movement through the site and a small portion in the center of the site that is used for railroad transfer operations.
	Current Human Receptors	Current human receptors include Navy personnel, contractors (including maintenance personnel and landscapers that mow site vegetation), and Navy-escorted visitors. In addition, leaseholder farmers and farm workers are receptors sine the eastern portion of the site is tilled and used for agriculture.
	Current Activities (Frequency, Nature of Activity)	MRP Site UXO6 is currently unused other than for railcar transport through the site, maintenance of the rail spurs, and mowing to keep grasses low.
	Potential Future Land Use	Future land uses are expected to be the same as current uses.
	Potential Future Human Receptors	Future human receptors are expected to be the same as current receptors.
	Potential Future Land Use-Related Activities	Future land uses are anticipated to be the same as current uses.
	Zoning/Land Use Restrictions	The unfenced site is part of a secure and active Navy base. There are no other known land use restrictions.
	Demographics/Zoning	NAVWPNSTA Seal Beach has a combined workforce of 150 military personnel and 600 civilian personnel. Population data include the following (U.S. Census 2000): • City of Seal Beach: 24,154 • City of Westminster: 88,207 • City of Huntington Beach: 189,594 • Orange County: 2,846,289
	Beneficial Resources	Besides railway operations, MRP Site UXO6 is open, unused land. In addition, UXO6 is noted in the INRMP as a goose foraging area that can be used by wildlife (NAVWPNSTA Seal Beach 2007).

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Ecological Profile	Habitat Type	MRP Site UXO6 habitat is open land and is classified as dredge spoil pickleweed (*Salicornia* spp.) (NAVWPNSTA Seal Beach 2007).
	Degree of Disturbance	MRP Site UXO6 is composed of fill material. No activities associated with the site would create disturbance other than tilling for agriculture on the eastern portion of the site, occasional mowing to keep the grasses low, and railcars passing through the site.
	Ecological Receptors	
	General	Mammals reported at the installation include various species of pocket gophers, voles, shrews, and ground squirrels, Audubon's cottontail rabbit *(Sylvilagus audubonii)*, and brush rabbit *(Sylvilagus bachmani)*. Nineteen species of raptors are known to occur within NAVWPNSTA Seal Beach, nine of which nest on the station. These species include red-tailed hawk *(Buteo jamaicensis)*, Swainson's hawk *(Buteo swainsoni)*, great-horned owl *(Bubo virginianus)*, burrowing owl *(Athene cunicularia)*, loggerhead shrike *(Lanius ludovicianus)*, American kestrel *(Falco sparverius)*, great blue heron *(Ardea herodias)*, common raven *(Corvus corax)*, and American crow *(Corvus brachyrhynchos)*. The avian wildlife forages over a large area and would spend relatively little time on site. Aquatic ecological receptors within the POLB Mitigation Pond area include marine invertebrates and fish, such as the tidewater goby *(Eucyclogobius newberryi)*, which also inhabit the Anaheim Bay (NAVFAC SW 2005; NAVWPNSTA Seal Beach 2007). Migrant or resident bird species listed as threatened or endangered by federal or state agencies (or both) include the following: • Belding's savannah sparrow *(Passerculus sandwichensis beldingi)* • California least tern *(Sterna antillarum browni)* • Light-footed clapper rail *(Rallus longirostris levipes)* • Western snowy plover *(Charadrius alexandrinus nivosus)*

Table 9-3: MRP Site UXO6 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Ecological Profile (continued)	General (continued)	The breeding season for these salt marsh and shorebird species extends from approximately late January to mid-September. The California least tern occupies the Seal Beach NWR only during the breeding season, with most of its food supply coming from the Seal Beach NWR during that period (NAVFAC SW 2005).
	Relationship of Contaminant Sources to Habitat and Potential Receptors	Ecological receptors may come into direct contact with MEC or MC in soil. It is unlikely that ecological receptors would come into contact with MEC and create an explosive hazard, but the possibility should be considered where threatened or endangered species may be present. Receptors may be exposed to MC that could have been incorporated into the food chain (for example, bioaccumulated in plants and animals). Various mammals and other animals that inhabit the site may come into contact with MC while burrowing, foraging, or nesting. In addition, they may also consume plants and prey in which MC has bioaccumulated.

10.0 MRP SITE AOC1 (BUILDING 94 SETTLING BASIN)

10.1 SITE DESCRIPTION AND HISTORY

MRP Site AOC1, Building 94 Settling Basin, is located east of Case Road in the central portion of the installation (Figure 10-1). Building 94 (a gun propellant charge loading and breakdown facility) was commissioned in 1945 and operated until at least 1981 for the loading and breaking down 20-mm, 40-mm, 3-inch, and 5-inch projectiles (NEESA 1985). The cartridge case loading function consisted of filling both 3-inch and 5-inch casings with smokeless powder (NEESA 1985). Reportedly, approximately 1.5 tons of waste smokeless powder were generated per week between 1945 and 1970. To prevent accumulation of dust from smokeless powder, the interior of Building 94 was occasionally washed down with water, and the wash water was drained through floor drains. According to engineering diagrams (Appendix A), the floor drains led to a 50-foot by 50-foot settling basin east of Building 94. The frequency, period of use, and amount of MC drained to the basin area unknown. The settling basin is no longer visible, and its previous location has been graded and used for agriculture. In January 2010, Building 94 and associated drain lines were demolished and removed.

Reportedly, small spills of smokeless powder occurred during operations at Building 94. They which were swept up, placed in powder cans, and taken to a magazine for storage (Malcolm Pirnie 2008). In 2003, analytical results for samples from inside Building 94 reported below-hazard-threshold concentrations of RDX, HMX, and picrate in floor drains (NAVFAC SW 2005). However, the existence of the wash-down and draining system implies that release of MC is possible. This hypothesis is supported by an NSWC explosive hazard characterization evaluation for Building 94 that noted that a conveyor shaft and four floor drains in the east side of the building contain below-hazard-threshold concentrations of explosives including RDX, HMX, and picrate. The primary concern noted during the investigation was that Building 94 has the potential for to accumulate gun propellant in drains that were inaccessible (NSWC Indian Head 2003).

Based on a 1944 engineering diagram, a drain line which was likely associated with the Building 94 floor drains originated from the east side of Building 94 and led to a about 50-foot by 50-foot settling basin (Appendix A). The settling basin at Building 94 is visible in a 1947 aerial photograph (Appendix A) and also appears in aerial photographs through 1968. However, all post-1968 aerial photos reviewed show the settling basin has been graded over. Reportedly, Building 94 was redesigned to drain to the sanitary sewer system at an unknown date (NEESA 1985). It is possible that this change occurred in 1973, when the station's sewer system was connected to the Orange County municipal wastewater collection system (NEESA 1985).

10.2 SITE AOC1 GEOLOGY AND HYDROGEOLOGY

MRP Site AOC1 is underlain by native material of young alluvial deposits (Qyf) that are Holocene and late Pleistocene in age and consist mostly of poorly to moderately consolidated and poorly sorted silty sand and clay. The native material encountered at AOC1 has been tilled to approximately 2 feet bgs and is very dark grayish brown silty sand with gravel. Underlying

the tilled soil horizon in the former evaporation ponds is grayish brown silty sand (sometimes containing hard white particulates) from approximately 2 to 3 feet bgs that is underlain by light yellowish brown fine grained sand.

Groundwater was not encountered in the borings completed to a maximum 1.5 feet bgs within the site. Groundwater in the vicinity of AOC1 is approximately 10 to 20 feet bgs (NEESA 1985) and reportedly flows generally to the northeast (NAVFAC SW 1999). Shallow groundwater is not used for drinking water or agricultural irrigation at NAVWPNSTA Seal Beach, although parts of the station use groundwater for agriculture. Navy Well 2 was reported to be located adjacent to AOC1 and is about 800 feet deep. This well was properly demolished in 2000. Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985).

10.3 MEC Field Investigation Results

This section provides the results of the MEC investigation for MRP Site AOC1.

10.3.1 Detector-Aided Visual Survey Results

ChaduxTt UXO technicians completed detector-aided visual surveys over accessible portions of MRP Site AOC1 along north-south transects nominally spaced 5 feet apart (100 percent coverage). UXO technicians did detector-aided visual surveys over the site footprint of MRP Site AOC1 (Figure 10-1) before soil sampling began; however, 100 percent survey coverage could not be achieved over the western portion of the site because of physical obstructions from dense brush cover. Suspect MEC or MPPEH items identified by the UXO technicians were marked with plastic pin flags, photographed, and mapped with the DGPS. Magnetic anomalies were also mapped during the detector-aided visual surveys. Fourteen subsurface anomalies were identified throughout the site with the hand-held magnetic gradiometer along transects and were mapped with the DGPS. Detailed results of the detector-aided visual survey are shown on Figures 10-1 and 10-2, in the photographs in the back of this section, and the table in Appendix D-4.

UXO technicians did not observe any physical evidence of the former settling basin or any explosive residue in soil. One MPPEH item, a single suspect 20-mm cartridge casing, was identified at AOC1 on the southern portion of the site (Figure 10-2).

10.3.2 MEC Findings

UXO technicians did not observe any explosive residue in soil. One MPPEH item, a single suspect 20-mm cartridge casing, was identified at AOC1. The MPPEH did not appear to be associated with use of the former settling basin, but instead was likely a result of haphazard disposal since Building 94 was used for breaking down and loading 20-mm projectiles. Only one-half of the cartridge casing was left, and the casing appeared to have been expended, which may indicate that the item could have been transported to its current location from farmers tilling the area. ChaduxTt also observed that the immediate area surrounding MRP Site AOC1 was tilled for agriculture.

10.3.3 Deviations from the Work Plan

There were no deviations from the work plan during the MEC investigation at MRP Site AOC1.

10.4 MC Sampling Locations and Depths

Before soil samples were collected at MRP Site AOC1, an exploratory soil boring was advanced with a hand auger to 5 feet bgs at the site of the former settling basin. The soil cuttings from the test boring were logged for lithology in accordance with the Unified Soil Classification System. Based on the soil lithology, disturbed or tilled soils were observed to be present from the surface to approximately 2 feet bgs. The boring log for the exploratory soil boring is in Appendix C-4.

Ten soil borings were advanced at biased locations throughout AOC1. Two soil samples were collected from each soil boring. Surface soil samples were collected from the first encountered soil horizons that were observed to be undisturbed. The sample depth for the first surface soil sample collected from each boring ranged between 2.3 feet bgs and 3 feet bgs. Subsequent deeper surface soil samples were collected from depths ranging between 3.25 feet bgs and 4 feet bgs. Soil sample locations are shown on Figure 10-3.

Ten discrete surface soil samples (043AOC1SB001, 043AOC1SB002, 043AOC1SB007 though 043AOC1SB010, and 043AOC1SB017 through 043AOC1SB020) were collected from five soil borings advanced in the former settling basin (Figure 10-3). Two discrete surface soil samples (043AOC1SB013 and SB14) were collected adjacent to the discharge location of the former drain line on the slope leading to the settling basin. Two discrete surface soil samples (043AOC1SBSB005 and 043AOC1SBSBSB006) were collected adjacent to MPPEH (a suspect 20-mm cartridge casing). The remaining six surface soil samples (043AOC1SB003 through 043AOC1SBSB006, 043AOC1SBSB011, and 043AOC1SBSB012) were collected from three borings advanced in biased locations where magnetic anomalies were detected.

All soil samples collected from AOC1 were analyzed for explosives, picrate, and metals.

10.4.1 Deviations from the Work Plan

Samples were collected from MRP Site AOC1 area according to the work plan SAP (ChaduxTt 2009b), and there were no deviations from the work plan during the MC soil investigation.

10.5 MC Soil Investigation Results

This section provides a summary of the site inspection sampling results and analytical data quality review for MRP Site AOC1.

10.5.1 Soil Sampling Results

The soil sampling results for MRP Site AOC1 are provided in Tables 10-1 and 10-2, and Appendix E-1. Fifteen metals were detected at the site, but not in every sample. One of the 16 metals detected exceeded background – selenium exceeded background (0.44 mg/kg) in one

sample with an estimated concentration 0.62 mg/kg. Explosives and picrate were not detected in any of the samples.

10.5.2 Human Health Screening Results

Analytical results for soil were compared with risk-based screening criteria to assess potential impacts on human health from exposure to chemicals in soils at MRP Site AOC1 under a residential and an industrial land use scenario. All chemicals detected in at least one sample from the depth intervals of 2.25 to 3 feet bgs and 3.25 to 4 feet bgs were included in the screening except for calcium, magnesium, potassium, and sodium that are known to be required human trace nutrients. Section 6.1 describes the selection procedure used to identify the residential and industrial soil screening criteria for the chemicals in soils.

The screening results including detected chemicals in soil, detection frequency, minimum and maximum detected concentrations, range of reporting limits; residential, industrial, and background screening criteria used; and number of samples with concentrations that exceeded each criteria, are in Table 10-1. The list of chemicals that exceeded the screening criteria is in Table 10-2. Table 10-2 also has information on location (point) and sample ID for the analyte that exceeded criteria, sample depth, sample collection date, detected concentration, laboratory reporting limit, residential and industrial screening criteria, and background screening level for each analyte. The analytical results for soil are in Appendix E-1.

All of the metals analyzed, except for mercury, were detected at least once in site soil at MRP Site AOC1, with the majority of the metals being detected in all of the samples collected at the site (Table 10-1). Metals detected in soil were less than background screening criteria except for selenium in soil sample 043AOC1SB019 which was below human health screening criteria. All detected metals were below human health screening criteria, except for arsenic – none of the arsenic concentrations exceeded the background level for arsenic of 15.4 mg/kg. All analytical results for arsenic exceeded both its residential (0.062 mg/kg) and industrial (0.25 mg/kg) screening criteria (Table 10-1). The maximum detected concentration for arsenic was 13.3 mg/kg at 043AOC1SB013 (Figure 10-2), collected at 2.70 to 3.20 feet bgs (Table 10-2) and was below the background concentration of 15.4 mg/kg for arsenic.

As discussed in Section 6.0, mercury was screened against both inorganic and organic mercury criteria since uncertainty is associated with the presence of mercury fulminate. Mercury was not detected in any of the 20 samples collected at MRP Site AOC1 (Appendix E-1).

No explosives were detected in soil at MRP Site AOC1 (Table 10-1).

The human health screening criteria used to compare the analytical results in soil at MRP Site AOC1 are based solely on general residential and industrial use scenarios. Therefore, the screening results presented in this report are applicable only under the assumptions inherent in the residential and industrial criteria used and the data available at the time of the evaluation.

10.5.3 Ecological Screening Results

Except for selenium and cobalt, concentrations of all metals detected in the soil at AOC1 during the SI were below the background concentrations. A background concentration was not established for cobalt. Selenium was detected in only one of the 20 soil samples collected at AOC1 at 0.62 mg/kg, which also slightly exceeded the ecological screening bench mark of 0.52 mg/kg (Table 10-1). Selenium is not an MC associated with past site practices. The source of selenium at this location may be background or agricultural runoff. The maximum cobalt result (13.4 mg/kg) only slightly exceeded the ecological screening criteria (13 mg/kg). This sample (043AOC1SB0016) was collected adjacent to a subsurface anomaly just east of former Building 94 (outside of the former settling basin). The results of the comparisons for cobalt and selenium are as follows:

Chemical	Detection Frequency	Maximum Concentration in Soil (mg/kg)	Background Screening Criteria (mg/kg)	Ecological Screening Benchmark (mg/kg)	Number of Detections Greater than Background and Ecological Screening Criteria
Cobalt	20/20	13.4	NA	13	3
Selenium	1/20	0.62	0.44	0.52	1

Notes:
mg/kg Milligram per kilogram
NA No background concentration available

10.5.4 Data Quality Review

The data quality review found that QA/QC objectives for bias and precision were met for most analytical results, with the following exceptions:

- MS/ MSD recoveries resulted in qualification of results as estimated (J) for antimony and thallium in multiple samples. Approximately 0.8 percent of the soil sample data were affected.
- ICS values resulted in qualification of results as estimated (J) for cadmium and thallium in a few samples. High concentrations of calcium and iron resulted in qualification of 0.07 percent of the soil data.
- Several sample results were estimated because they were reported at concentrations between the MDL and the QL. The analytical instrument can make reliable qualitative identification of analytes greater than the MDL but below the QL; detected results below the QL are considered quantitatively uncertain.

A complete summary the data quality review is in Appendix F. The supporting data validation reports are in Appendix E-5. Chain-of-custody forms were used to trace possession of the samples from field collection to the analytical laboratory. The completed chain-of-custody forms are in Appendix E-4.

10.6 MRP Site AOC1 Updated Conceptual Site Model

The CSM for MRP Site AOC1 was updated based on the results of the 2009 SI field activities that include detector-aided visual survey results, a summary of MC sampling results, and observed site structures, such as the former drain line leading from Building 94. The CSM was also updated to reflect current changes in the site conditions caused by demolition and removal of Building 94 and the associated drain lines.

The updated CSM profile for AOC1 is provided as Table 10-3. Figures 10-4 and 10-5 provide a graphical representation of the current understanding of the exposure pathways through which site receptors could come in contact with, or be affected by, MEC and MC at MRP Site AOC1. The updated graphical CSM shows there are incomplete exposure pathways for both MEC and MC at MRP Site AOC1; the graphical CSM from the PSI (Malcolm Pirnie 2008) shows potentially complete MC exposure pathways for some receptors.

10.7 MRP Site AOC1 Conclusions and Recommendations

This section provides conclusions and recommendations for MRP Site AOC1.

10.7.1 Potential or Existing MEC Hazards

Building 94 was commissioned in 1945 and operated until at least 1981 for loading and breaking down 20-mm, 40-mm, 3-inch, and 5-inch projectiles (NEESA 1985). The cartridge case loading consisted of filling 3-inch and 5-inch casings with smokeless powder (NEESA 1985). To prevent accumulation of dust from smokeless powder, the interior of Building 94 was occasionally washed down with water, and the wash water drained through floor drains that led to a 50-foot by 50-foot settling basin to the east of Building 94. One MPPEH item (half of a suspect 20-mm cartridge casing) was observed outside of the former settling basin location and approximately 10 feet north of the southern site boundary.

Because no explosives residue in soil, MEC, or MPPEH was observed in the former settling basin and the one MPPEH item observed outside the former settling basin could likely be attributed to haphazard disposal, and because explosives or picrate were not detected in soil, NFA for MEC for MRP Site AOC1 is recommended.

10.7.2 Potential or Existing MC Hazards

Explosives or picrate were not detected. Selenium slightly exceeded the ecological benchmark screening criterion (0.52 mg/kg) and background (0.44 mg/kg) in one sample with an estimated concentration 0.62 mg/kg. Selenium is not an MC associated with former use of the settling basin and may be attributed to background or agricultural runoff. Cobalt has no available background screening criteria. The maximum cobalt result (13.4 mg/kg) only slightly exceeded the ecological screening criteria (13 mg/kg) for a sample (043AOC1SB016) collected outside the former settling basin.

Because soil samples were collected from the potential source areas (at the end of the former drain line discharge area in the settling basin), and because explosives or picrate were not detected in soil, and other site-related MC (metals) in soil were less than screening criteria (with the exception of cobalt), NFA for MC is recommended for MRP Site AOC1.

SECTION 10.0 PHOTOS – MRP SITE AOC1

Photo 1: View looking northeast at MRP Site AOC1.

Photo 2: View looking north at the former settling basin area at MRP Site AOC1.

Photo 3: View looking east at the northern portion of MRP Site AOC1 with staked soil sampling locations and flagged subsurface anomalies.

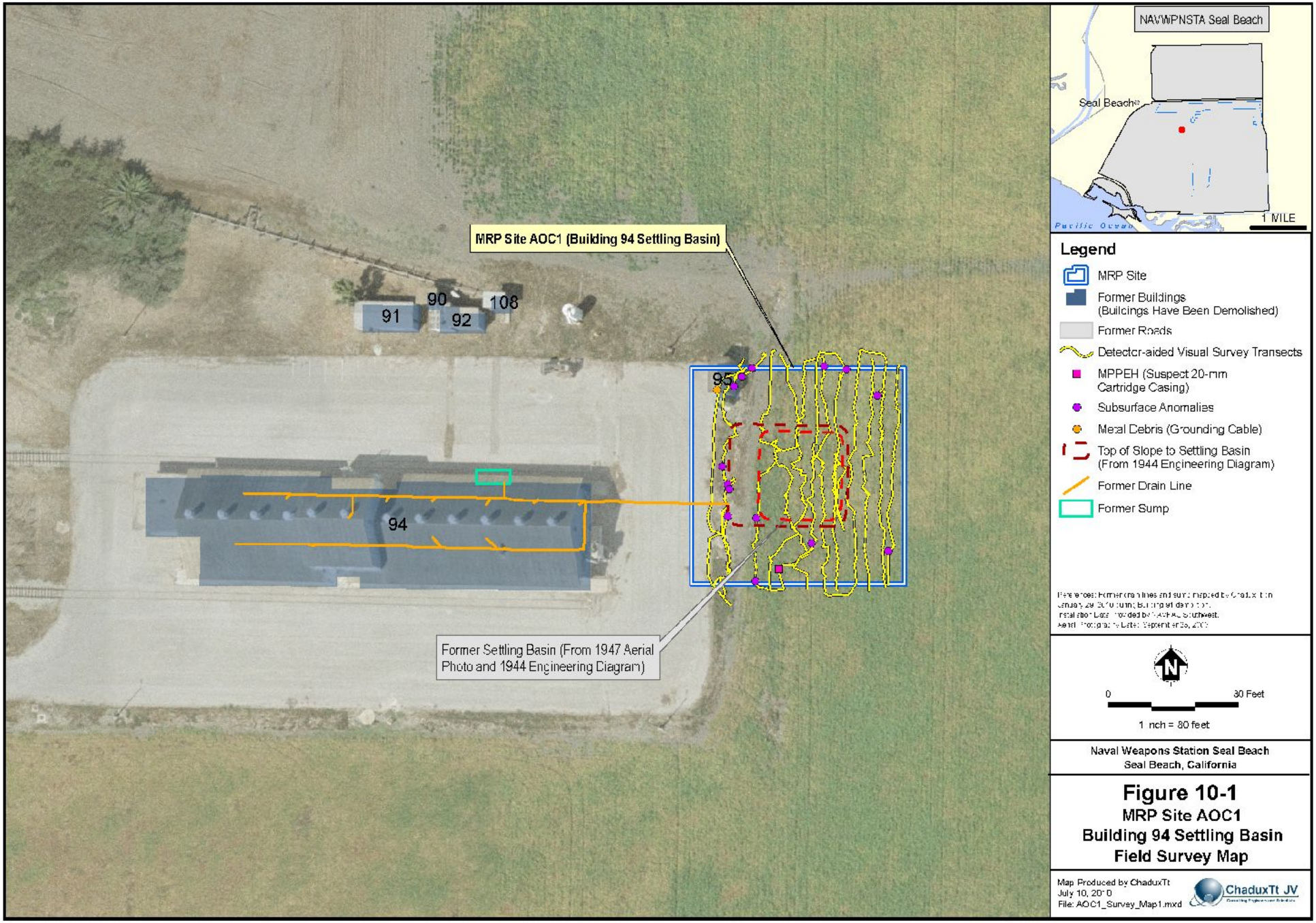
Photo 4: View looking north at biased sampling location 043AOC1SB005006 adjacent to a suspect 20-mm cartridge casing (MPPEH) observed on the southern portion of MRP Site AOC1.

Photo 5: View of the suspect 20-mm cartridge casing (MPPEH) located at MRP Site AOC1.

Photo 6: View looking east at the exposed drain line from former Building 94 that discharged to the settling basin at MRP Site AOC1.

Photo 7: View of the soil sampling location (043AOC1SB013014) adjacent to the drain line discharge area on the western edge of MRP Site AOC1.

SECTION 10.0 FIGURES – MRP SITE AOC1

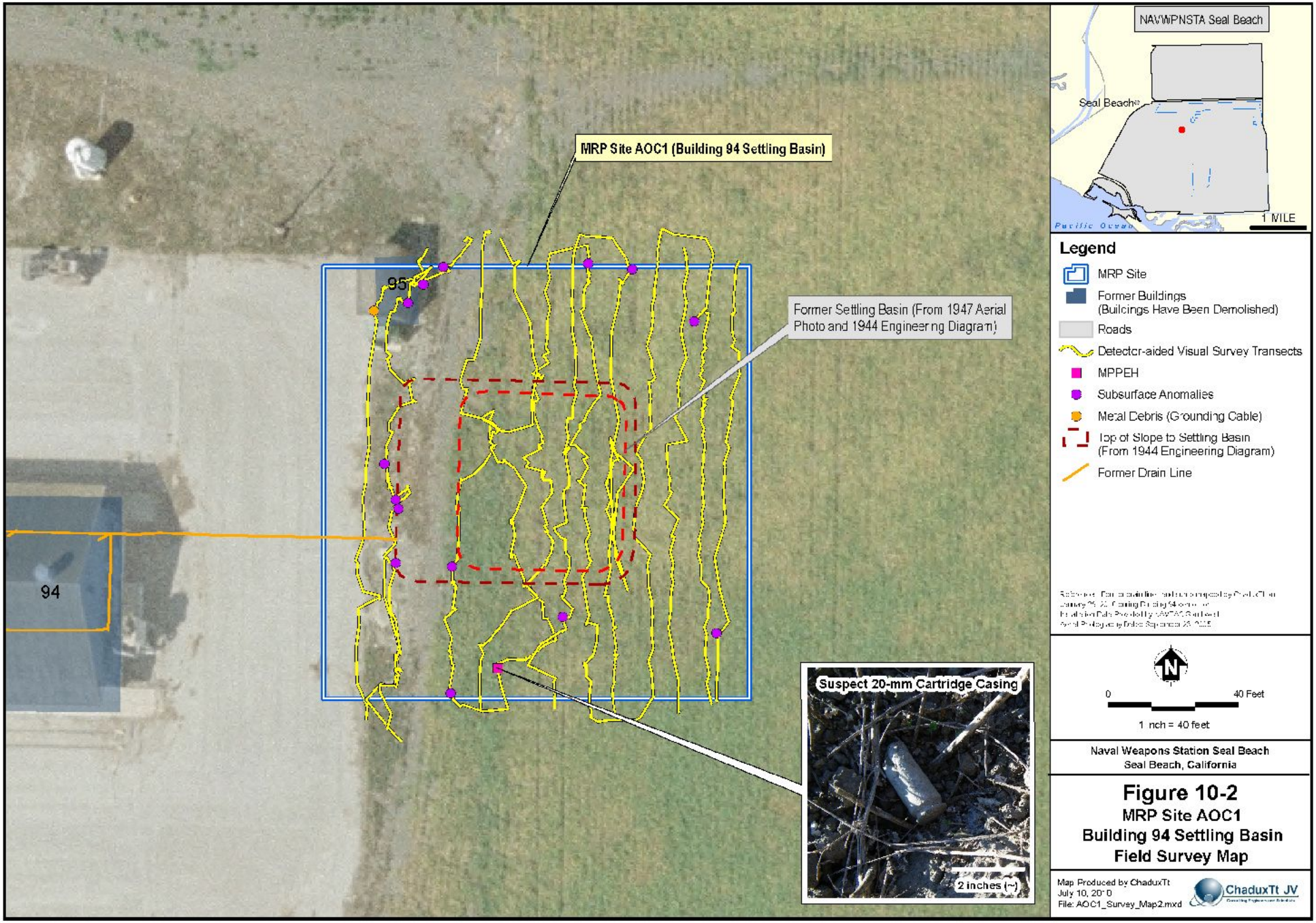


Naval Weapons Station Seal Beach
Seal Beach, California

Figure 10-1
MRP Site AOC1
Building 94 Settling Basin
Field Survey Map

Map Produced by ChaduxTt
July 10, 2010
File: AOC1_Survey_Map1.mxd

ChaduxTt JV

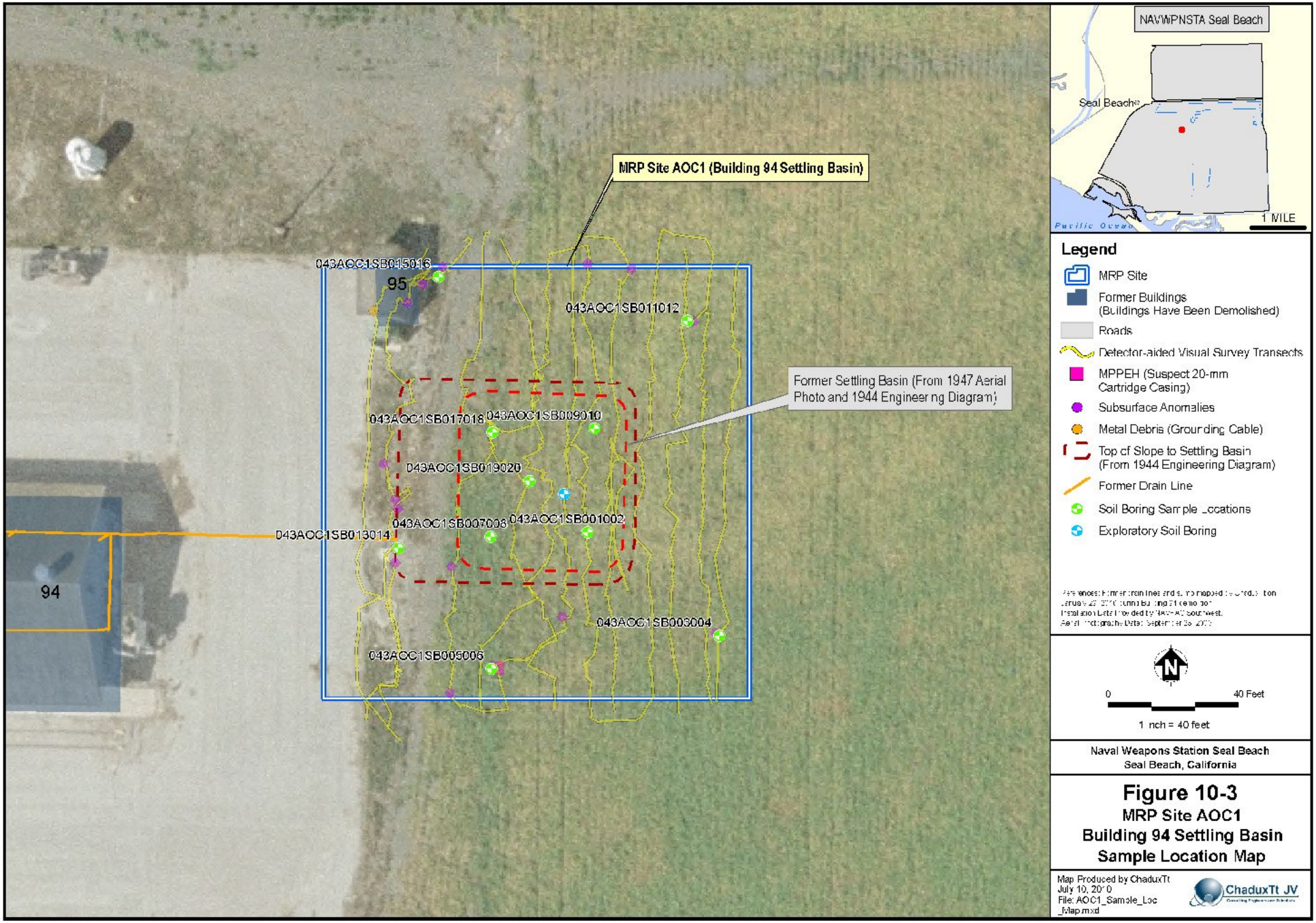


Naval Weapons Station Seal Beach
Seal Beach, California

Figure 10-2
MRP Site AOC1
Building 94 Settling Basin
Field Survey Map

Map Produced by ChaduxTt
July 10, 2010
File: AOC1_Survey_Map2.mxd

ChaduxTt JV

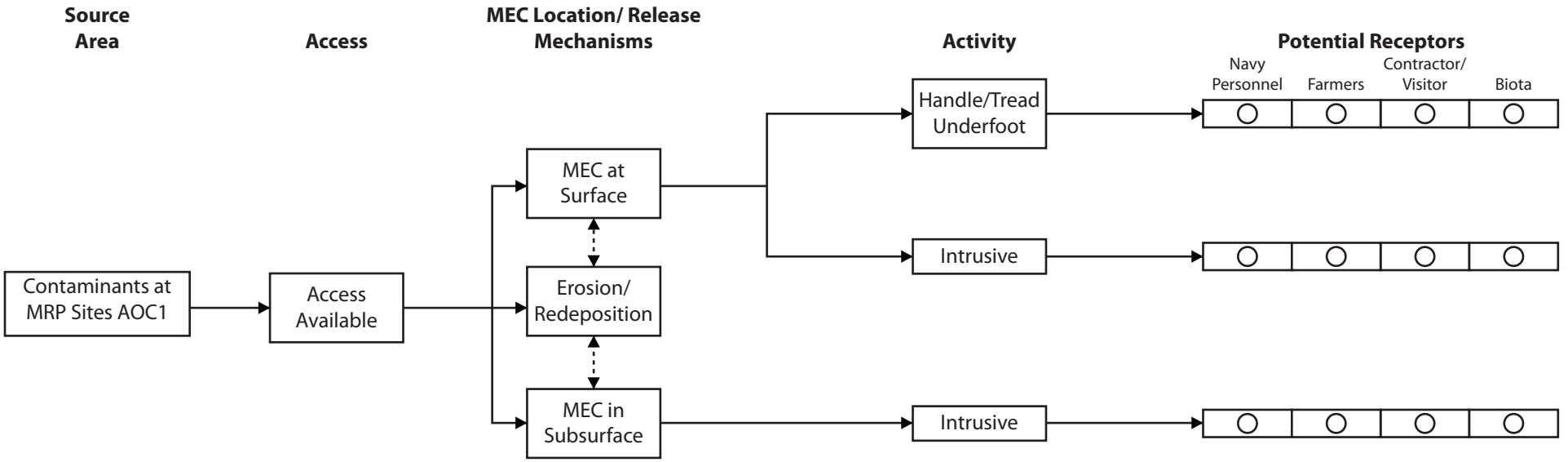


Naval Weapons Station Seal Beach
Seal Beach, California

Figure 10-3
MRP Site AOC1
Building 94 Settling Basin
Sample Location Map

Map Produced by ChaduxTt
July 10, 2010
File: AOC1_Sample_Loc_Map.mxd

ChaduxTt JV



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MEC - Munitions and Explosives of Concern

MRP - Munitions Response Program

● Complete Pathway

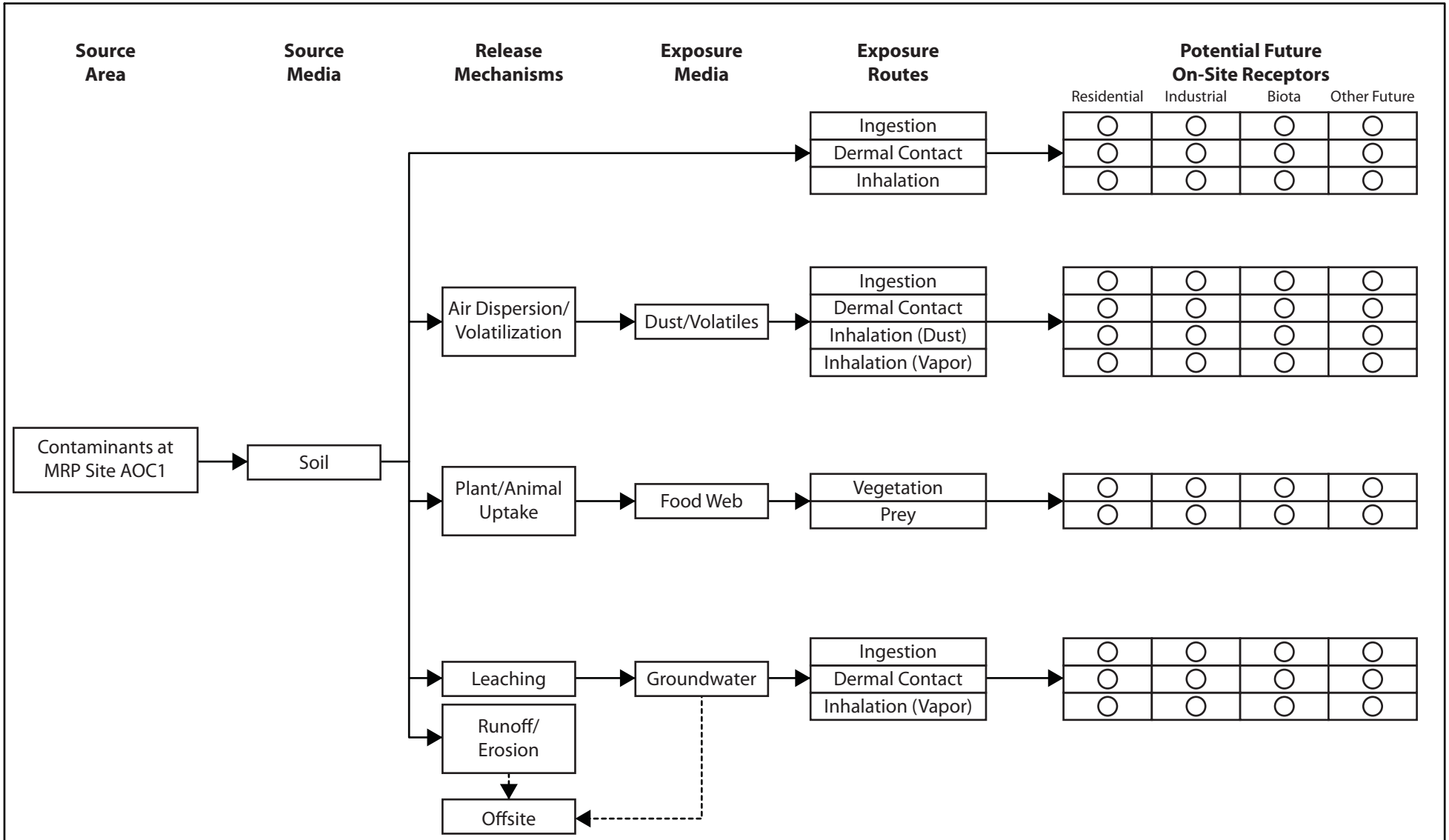
◉ Potentially Complete Pathway

○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 10-4
MRP Site AOC1
Graphical Updated Conceptual Site Model for MEC
Site Inspection Report



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MRP - Munitions Response Program

- ● Complete Pathway
- ◉ Potentially Complete Pathway
- ○ Incomplete Pathway

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Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 10-5
MRP Site AOC1
Graphical Updated Conceptual Site Model
for MC
Site Inspection Report

SECTION 10.0 TABLES – MRP SITE AOC1

TABLE 10-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE AOC1

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 4.75 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Screening Criteria	Number of Detections Above Residential Screening Criteria	Industrial Screening Criteria	Number of Detections Above Industrial Screening Criteria	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria	Back-ground Screening Level	Number of Detections Above Background Screening Level
Metals (mg/kg)													
ALUMINUM	20/20	8,520	29,900	043AOC1SB015016	20.9 - 25.6	77,000	0	990,000	0	50.0	**20**	36,300	0
ARSENIC	20/20	2.9	13.3	043AOC1SB013014	1.0 - 1.3	0.062	**20**	0.25	**20**	10.0	**3**	15.4	0
BARIUM	20/20	29.6	151	043AOC1SB017018	1.0 - 1.3	15,000	0	190,000	0	330	0	NC	-
BERYLLIUM	20/20	0.27 J	1.0 J	043AOC1SB015016	1.0 - 1.3	160	0	2,000	0	10.0	0	2.1	0
CADMIUM	14/20	0.13 J	0.92 J	043AOC1SB017018	1.1 - 1.3	1.7	0	7.5	0	0.36	**6**	2.2	0
CHROMIUM	20/20	12.4	31.8	043AOC1SB015016	1.0 - 1.3	120,000	0	1,500,000	0	0.40	**20**	46.2	0
COBALT	20/20	4.9	13.4	043AOC1SB015016	1.0 - 1.3	23.0	0	300	0	13.0	**3**	NC	-
COPPER	20/20	6.5	37.9	043AOC1SB013014, 043AOC1SB015016	1.0 - 1.3	3,100	0	41,000	0	28.0	**7**	39.0	0
IRON	20/20	14,500	32,700	043AOC1SB011012	20.9 - 25.6	55,000	0	720,000	0	NC	-	NC	-
LEAD	20/20	3.2	25.6	043AOC1SB017018	1.0 - 1.3	80.0	0	320	0	11.0	**7**	35.7	0
MANGANESE	20/20	200	723	043AOC1SB013014	1.0 - 1.3	1,800	0	23,000	0	220	**19**	1,100	0
NICKEL	20/20	7.9	22.0	043AOC1SB013014	1.0 - 1.3	1,500	0	20,000	0	38.0	0	32.5	0
SELENIUM	1/20	0.62 J	0.62 J	043AOC1SB019020	1.2 - 1.2	390	0	5,100	0	0.52	**1**	0.44	**1**
VANADIUM	20/20	29.9	70.0	043AOC1SB011012	1.0 - 1.3	78.0	0	1,000	0	2.0	**20**	86.0	0
ZINC	20/20	34.5	111	043AOC1SB017018	1.0 - 1.3	23,000	0	310,000	0	46.0	**17**	177	0
Explosives (mg/kg)													
None Detected	0/ 20	ND	ND	-	-	-	-	-	-	-	-	-	-

Notes:
1. Data shown includes detected analytes in all soil samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

- Not applicable
AOC Area of concern
J Estimated value
mg/kg Milligrams per kilogram
MRP Munitions response program
NC No criteria
ND None detected
QC Quality control

TABLE 10-2: METALS RESULTS FOR SOIL SAMPLES EXCEEDING BACKGROUND CONCENTRATIONS FOR MRP SITE AOC1

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 4.75 feet below ground surface

Analyte	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	Background Screening Level
Metals (mg/kg)										
SELENIUM	043AOC1SB019020	043AOC1SB019	3.25 - 3.75	11/30/09	0.62 J	1.2	390	5,100	**0.52**	**0.44**

Notes:
1. Exceeded screening criterion is shown in bold.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

AOC Area of concern
ID Identification
J Estimated value
mg/kg Milligrams per kilogram
MRP Munitions response program

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
General Information	Installation Name	NAVWPNSTA Seal Beach
	Site Name	MRP Site AOC1 (Former Building 94 Settling Basin)
	Site Area and Layout	The MRP Site AOC1 site footprint occupies an area of approximately 0.4 acre. Within the site footprint was the former 50-foot-square settling basin.
	Site Structures	There are no structures on site. Former Building 94 and its associated paint locker, smoke stack, and equipment storage buildings were the only structures adjacent to the site but are not included within the site footprint. In January 2010, Building 94 and associated drain lines were demolished and removed from MRP Site AOC1.
	Site Boundaries	Agricultural fields exist north of MRP Site AOC1. The installation boundary is roughly 1.5 miles north of the site, where the installation is bordered by the City of Seal Beach. Agricultural fields lie south of the AOC1, and the Seal Beach NWR lies about 400 yards south. The installation boundary is located roughly 1.5 miles to the south. Beyond the installation boundary is an Orange County flood control channel, which flows into Anaheim Bay and then the Pacific Ocean, as well as the City of Huntington Beach. Former Building 94 is located adjacent to and west of the site. The northern tip of the Seal Beach NWR is located nearby AOC1 to the west. In addition, the installation boundary is roughly 1 mile west, where the installation is bordered by the City of Seal Beach. East of the AOC1 are more agricultural fields. The installation boundary is located approximately 1.5 miles to the east, where the installation is bordered by the Cities of Westminster and Huntington Beach.
	Site Security	MRP Site AOC1 is located on NAVWPNSTA Seal Beach, which is a fenced and guarded installation. Security personnel are responsible for maintaining law and order and for implementing access control policies and procedures. Access to AOC1 from within NAVWPNSTA Seal Beach is enforced by vehicular security patrol.

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Munitions/ Release Profile	Munitions Types	Building 94 was a processing facility for 20-mm, 40-mm, 3- inch, and 5-inch projectiles. Reportedly, no munitions were processed in the settling basin. However, wash water with MC, which was disposed of in the settling basin, could create explosive soil conditions (explosive MC concentrations greater than 10 percent) in the subsurface.
	Maximum Probability Penetration Depth	No munitions were processed in MRP Site AOC1, but possible explosive MC concentrations exist in soil from the former settling basin, which was approximately 2 to 3 feet deep.
	MEC Density	UXO and discarded military munitions (DMM) are not suspected or known to be present within the former settling basin. Because explosives were not detected in soil samples collected for the 2009 SI field investigation, explosive soils (MC concentrations in soil greater than 10 percent) are unlikely below grade in the former settling basin.
	MEC Field Observations	No MEC items were observed at the site during the SI field investigation conducted at MRP Site AOC1. Only one MPPEH item (half of a suspect 20-mm cartridge casing) was observed, which was not related to former use of the basin and could have been transported to the southern boundary of the site from tilling. The MPPEH item was likely attributed to haphazard disposal outside of the former settling basin.
	Munitions Constituents	Small amounts of spillage were reported for smokeless powder inside Building 94, which drained to the settling basin (Malcolm Pirnie 2008). Analytical sampling of floor drains inside Building 94 reported below-hazard-threshold concentrations of RDX, HMX, and picrate (NAVFAC SW 2005). A total of 20 soil samples were collected at MRP Site AOC1 during the 2009 SI field investigation. The samples were analyzed for metals, picrate, and explosives. Explosives and picrate were not detected in any of the samples. Fifteen metals were detected at the site, but not in every sample. One out of the 16 metals detected exceeded background screening criteria. Selenium slightly exceeded

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Munitions/ Release Profile (continued)	Munitions Constituents (continued)	both ecological benchmark screening criteria and background in one sample collected at the site. However, selenium is not a MC associated with past practices at the site. Cobalt exceeded ecological screening criteria but has no available background screening criteria. However, the maximum cobalt result (13.4 mg/kg) only slightly exceeded the ecological screening criteria (13 mg/kg) for a sample (043AOC1SB0016) collected just east of former Building 95 (outside of the former settling basin).
	Migration Routes/Release Mechanisms	UXO and DMM are not known or suspected to be present within the former settling basin based on visual observations. There are incomplete exposure pathways for MEC and MC at MRP site AOC1.
Physical Profile	Climate	The climate at NAVWPNSTA Seal Beach is typical of the maritime subclimate within the California Mediterranean climate, which includes mild winters, cool summers, high relative humidity, and frequent early morning clouds that lead to afternoon sunshine. The annual average temperature is 74°F. Summer average high temperatures range from 77 °F to 84 °F, and average lows range from 60 °F to 65 °F. Winter temperatures tend to be moderate, with highs typically 67 °F and average lows ranging from 45 °F to 47 °F. Yearly precipitation averages 13 inches; February, the wettest month, averages 3 inches, and July, the driest, averages 0.02 inch (WRCC undated). Periodically, the region experiences El Niño conditions, which tend to bring wetter winters to the area through heavy storms. The prevailing winds are westerly with an average velocity of 10 knots. Strong, dry northeasterly winds occasionally descend the mountain slopes in the fall, winter, and early spring (NAVFAC SW 1979). The strongest winds that occur within the region are associated with the winter and spring storms off the Pacific Ocean (NAVFAC SW 2005).
	Topography	MRP Site AOC1 consists of relatively flat terrain and lies at an elevation of approximately 7 feet asl.

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Physical Profile (continued)	Geology	MRP Site AOC1 is underlain by native material of young alluvial fan and valley deposits (Qyf), which are Holocene and late Pleistocene in age and consist of gently sloping, slightly dissected alluvial fan deposits
	Soil	The native soil at MRP Site AOC1 has been tilled to an approximate depth of 2 feet bgs and is very dark grayish brown silty sand with gravel. Underlying the tilled soil horizon within the former evaporation ponds is grayish brown silty sand (sometimes containing hard white particulates) from approximately 2 to 3 feet bgs, which is underlain by light yellowish brown fine-grained sand. The IAS and INRMP note the site is characterized by drained Bolsa silty clay loam, which occurs on large alluvial fans and is moderately to slowly permeable (NEESA 1985; NAVWPNSTA Seal Beach 2007). In general, runoff is slow over bare level soil, and the erosion hazard is slight. The soil within AOC1 is moderately alkaline and calcareous to a depth of approximately 49 inches (NEESA 1985).
	Hydrogeology	Groundwater was not encountered in the borings completed to a maximum depth of 1.5 feet bgs within the site during the SI field investigation. Groundwater in the vicinity of MRP Site AOC1 is approximately 10 to 20 feet bgs (NEESA 1985) and reportedly flows generally to the northeast (NAVFAC SW 1999). Shallow groundwater is not used for drinking water or agricultural irrigation at NAVWPNSTA Seal Beach, although parts of the station use groundwater for agriculture. Navy Well 2 was reported to be located adjacent to AOC1 and is roughly 800 feet deep. This well was properly demolished in 2000. Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985).
	Hydrology	There are no permanent surface water bodies within MRP Site AOC1. Runoff is expected to be slow over level terrain, and surface water is expected to only intermittently pond and to infiltrate to groundwater. Surface water generally flows southwest, following the topography of the installation.

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Physical Profile (continued)	Vegetation	MRP Site AOC1 is located in a cultivated field. Nearby, west of the site, are 4 acres of southern willow scrub and 4 acres of non-native annual grasses. Southwest of AOC1 across from Case Road is wheatgrass grassland that grades into the coastal salt marsh of the Case Road POLB Mitigation Pond (NAVWPNSTA Seal Beach 2007).
Land Use and Exposure Profile	Current Land Use	MRP Site AOC1 is no longer in use. The former settling basin has been graded over and is now used for agriculture.
	Current Human Receptors	Current human receptors include Navy personnel and contractors (including maintenance personnel) and Navy-escorted visitors. In addition, leaseholder farmers and farm workers are receptors.
	Current Activities (Frequency, Nature of Activity)	MRP Site AOC1 is currently used for farming and crop cultivation.
	Potential Future Land Use	Future land uses at the site are expected to be the same as current land uses.
	Potential Future Human Receptors	Future receptors are expected to be the same as current receptors.
	Potential Future Land Use-Related Activities	Future land uses are expected to be the same as current uses. Agricultural use in the vicinity of the site is likely to continue.
	Zoning/Land Use Restrictions	MRP Site AOC1 is part of a secure and active Navy base. There are no other known land use restrictions.
	Demographics/Zoning	NAVWPNSTA Seal Beach has a combined workforce of 150 military personnel and 600 civilian personnel. Population data include the following (U.S. Census 2000): • City of Seal Beach: 24,154 • City of Westminster: 88,207 • City of Huntington Beach: 189,594 • Orange County: 2,846,289

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Land Use and Exposure Profile (continued)	Beneficial Resources	The 50-acre Case Road POLB Mitigation Pond, part of the Seal Beach NWR, lies approximately 400 yards southwest of MRP Site AOC1 and provides habitat for migratory birds and for other endangered, threatened, and sensitive species (NAVWPNSTA Seal Beach 2007).
Ecological Profile	Habitat Type	MRP Site AOC1 lies on graded cultivated land. West of the site is 4 acres of southern willow scrub. The 50-acre Case Road POLB Mitigation Pond is located 400 yards southwest and is part of the Seal Beach NWR.
	Degree of Disturbance	MRP Site AOC1 has been filled in and graded over and is used for agriculture.
	Ecological Receptors	
	General	Mammals reported at the installation include various species of pocket gophers, voles, shrews, and ground squirrels, Audubon's cottontail rabbit (*Sylvilagus audubonii*), and brush rabbit (*Sylvilagus bachmani*). Nineteen species of raptors are known to occur within NAVWPNSTA Seal Beach, nine of which nest on the station. These species include red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), great-horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), common raven (*Corvus corax*), and American crow (*Corvus brachyrhynchos*). The avian wildlife forages over a large area and would spend relatively little time on site. Aquatic ecological receptors within the POLB Mitigation Pond area include marine invertebrates and fish, including the tidewater goby (*Eucyclogobius newberryi*), which also inhabit the Anaheim Bay (NAVFAC SW 2005; NAVWPNSTA Seal Beach 2007). Migrant or resident bird species listed as threatened or endangered by federal or state agencies (or both) include the following:

Table 10-3: MRP Site AOC1 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Preliminary Assessment Findings**
Ecological Profile (continued)	General (continued)	• Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) • California least tern (*Sterna antillarum browni*) • Light-footed clapper rail (*Rallus longirostris levipes*) • Western snowy plover (*Charadrius alexandrinus nivosus*) The breeding season for these salt marsh and shorebird species extends from approximately late January to mid-September. The California least tern occupies the Seal Beach NWR only during the breeding season, with most of its food supply coming from the Seal Beach NWR during that period (NAVFAC SW 2005).
	Relationship of Contaminant Sources to Habitat and Potential Receptors	Based on visual site observations and the MC sampling results for the 2009 SI field investigation, there are likely incomplete exposure pathways for MEC and MC at MRP site AOC1.

11.0 MRP SITE AOC2 (EXPLOSIVES DROP TEST TOWER)

11.1 SITE DESCRIPTION AND HISTORY

MRP Site AOC2, Explosives Drop Test Tower, is located at the southern terminus of 7th Street in the Seal Beach NWR (Figure 11-1). The Explosives Drop Test Tower was used from 1955 to 1977, in conjunction with former Buildings 435 and 437, to perform both free fall and guided safety drop testing on fuzes, cartridges, experimental propellants, and other low-level explosive items. Reportedly, the tower was used for safety testing of 1.4-cartridges that pose a minor explosion hazard (Malcolm Pirnie 2008).

Engineering diagrams (Appendix A) show that ordnance was dropped through the center of the 50-foot tall tower into a 2.5-foot-square, 6-foot-high, thick steel box for guided drop testing. The bottom of the box is reinforced with a below-ground 4-inch-thick armor plate block on top of a 3-foot-thick concrete block. Based on the engineering diagram, a small ball-type object the size of a large grenade was dropped into the steel box during guided drop testing (Appendix A).

The low-lying salt marsh area north of and adjacent to the tower was used for disposal of waste quenching water that contained RDX (NEESA 1985). The marsh was investigated as IRP Site 24 in 1990 and sampled for explosives, including HMX and RDX (Appendix A). IRP Site 24 was recommended for NFA because no explosives were detected. However, the area beneath the tower was not evaluated. A detonator cap was observed about 70 feet east of the drop test tower during the 1990 SI (NAVFAC SW 1990).

11.2 SITE AOC2 GEOLOGY AND HYDROGEOLOGY

MRP Site AOC2 is underlain by artificial fill (Figure 2-1). The artificial fill appeared to have been in place during the period of use for the drop test tower based on surface observations of kickout debris and detonated MPPEH. The fill material consists of dry to saturated olive brown sandy silt with some clay and sub-angular gravels. The fill material was logged to approximately 1 foot bgs. Observed beneath the fill layer is native material consisting of paralic estuarine deposits (Qpe) of dark reddish brown clayey silt that are late Holocene in age.

Groundwater within the upper unconfined aquifer is tidally influenced and is present at near-surface depths (less than 5 feet bgs). During high tide, groundwater seepage was observed at the surface approximately 30 feet north of the tower (Figure 11-1). Groundwater is reported to flow to the northeast, toward the 7th Street POLB Mitigation Pond (NAVFAC SW 1999). As a result of saltwater intrusion, groundwater at the site is saline to brackish and is not used for drinking water (NAVFAC SW 2002). Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985). Two monitoring wells are located north of Slough Road. Navy Well 3, located about 0.75 mile north of AOC2, is 616 feet deep (screened at two different intervals starting at 548 ft bgs) and currently is used for agricultural irrigation (Malcolm Pirnie 2008).

11.3 MEC Field Investigation Results

This section provides the results of the MEC investigation for MRP Site AOC2.

11.3.1 Detector-Aided Visual Survey Results

ChaduxTt UXO technicians completed detector-aided visual surveys over accessible portions of MRP Site AOC2 along north-south transects nominally spaced 5 feet apart (100 percent coverage). UXO technicians conducted the detector-aided visual surveys over the entire site footprint of MRP Site AOC1 (Figure 11-1) before soil sampling began; however, 100 percent survey coverage could not be achieved over the northern portion of the site where surface water seepage was present. Suspect MEC or MPPEH items identified by the UXO team were marked with plastic pin flags, photographed, and mapped with the DGPS. Subsurface anomalies were also mapped during the detector-aided visual surveys. Twelve subsurface anomalies were identified throughout the site with the hand-held magnetic gradiometer along transects and were mapped with the DGPS. Detailed results of the detector-aided visual survey are shown on Figure 11-1, in the photographs in the back of this section, and the table in Appendix D-5.

Two munitions related items were identified by UXO technicians at MRP Site AOC2 – a single blasting cap (MPPEH) and a 2.75-inch rocket motor end cap (an inert item) on the southern portion of the site (Figure 11-1). Kickout debris observed just east, west, and south of the tower and signs posted on the tower (Appendix D-5) provide supporting evidence that the tower was also used for free fall or unguided drop testing. Non-munitions related materials observed at the site consisted of metal debris (scrap metal, metal banding, Marshall matting, copper rod, pipe, and rebar), construction debris (asphalt), and other debris (wood).

11.3.2 MEC Findings

One MPPEH, a single blasting cap just southeast of the tower, and one inert munitions item, a 2.75-inch rocket motor end cap on the southern portion of the concrete pad, were identified by UXO technicians at AOC2. The blasting cap appeared to be kickout debris associated with free fall or unguided drop testing since other detonated debris was found just south of the item. The 2.75-inch rocket motor end cap could be associated with the former static rocket test firing facility (former Buildings 435 and 437).

11.3.3 Deviations from the Work Plan

There were no deviations from the work plan during the MEC investigation at MRP Site AOC2.

11.4 MC Sampling Locations and Depths

A combination of biased and grid soil sampling was used to investigate MRP Site AOC2. Soil samples collected from AOC2 were analyzed for metals, perchlorate, and explosive compounds.

Soil sample locations are shown on Figure 11-2.

Six soil borings were advanced at biased locations throughout AOC2 in the vicinity of the drop test tower. Two discrete surface soil samples (043AOC2SB003 and 043AOC2SB004) were collected from one soil boring advanced adjacent to a blasting cap (MPPEH). Eight discrete surface soil samples (043AOC2SB009 to 043AOC2SB012 and 043AOC2SB015 to 043AOC2SB018) were collected from four soil borings advanced adjacent to anomalies and kickout debris areas. One additional soil boring was advanced in a biased location just south of the AOC2 site boundary in a kickout debris area. Soil samples 043AOC2SB001 and 043AOC2SB002 were collected from the kickout debris area.

A sampling grid was established over the entire site, and four soil boring locations were selected from the grid cells as non-biased locations to provide adequate horizontal coverage. Eight discrete random surface soil samples (043AOC2SB005 through 043AOC2SB008, 043AOC2SB013, 043AOC2SB014, 043AOC2SB019, and 043AOC2SB020) were collected from the grid locations (Figure 11-2).

11.4.1 Deviations from the Work Plan

Samples were collected from MRP Site AOC2 according to the work plan SAP (ChaduxTt 2009b), and there were no deviations from the work plan during the MC soil investigation.

11.5 MC Soil Investigation Results

This section provides a summary of the site inspection sampling results and analytical data quality review for MRP Site AOC2.

11.5.1 Soil Sampling Results

The soil sampling results for MRP Site AOC2 is in Tables 11-1 and 11-2, and Appendix E-1. Sixteen metals were detected at the site, but not in every sample. Five of the 16 metals detected exceeded background concentrations, including cadmium, copper, lead, selenium, and zinc. Explosives were not detected in any of the samples. Perchlorate was detected in 11 of the 20 samples.

11.5.2 Human Health Screening Results

Analytical results for soil were compared with risk-based screening criteria to assess potential impacts on human health from exposure to chemicals in soils at MRP Site AOC2 under a residential and an industrial land use scenario. All chemicals detected in at least one sample from the sampled soil depth intervals of 0 to 0.5 feet bgs and 1 to 1.5 feet bgs were included in the screening, except for calcium, magnesium, potassium, and sodium that are known to be required human trace nutrients. Section 6.1 describes the selection procedure used to identify the residential and industrial soil screening criteria for the chemicals in soils.

The screening results including detected chemicals in soil, detection frequency, minimum and maximum detected concentrations, range of reporting limits; residential, industrial, and background screening criteria used; and number of samples with concentrations exceeding

each criteria, are presented in Table 11-1. The list of chemicals that exceeded the screening criteria is shown in Table 11-2. Table 11-2 also has information on location (point) and sample ID for the analyte that exceeded the criteria, sample depth, sample collection date, detected concentration, laboratory reporting limit, residential and industrial screening criteria, and background screening level for each analyte. The analytical results for soil are in Appendix E-1.

All of the metals analyzed were detected at least once in site soil at MRP Site AOC2, with the majority of the metals being detected in all of the samples collected at the site (Table 11-1). Detected metals were less than human health and background screening criteria except for cadmium and lead. None of the arsenic concentrations exceeded the background level for arsenic of 15.4 mg/kg. For cadmium, four of the 20 samples exceeded the residential screening criteria of 1.7 mg/kg and background screening criteria (2.2 mg/kg). Three of the 20 samples exceeded the industrial screening criterion for cadmium of 7.5 mg/kg and the background level. The three samples that exceeded both the industrial human health criteria and the background level for cadmium were 043AOC2SB011, 043AOC2SB017, and 043AOC2SB019 (Figure 11-2). The sample that exceeded the industrial screening criterion and background level for cadmium was l 043AOC2SB015. The maximum detected concentration for cadmium was 10.1 mg/kg. One of 20 samples exceeded the residential criterion for lead of 80 mg/kg. This sample (043AOC2SB017), collected from 0 to 0.5 foot bgs adjacent to a subsurface anomaly at the base of the tower, also contained the maximum detected concentration for lead of 81.1 mg/kg and exceeded the background level for lead of 35.7 mg/kg. The source of elevated cadmium and lead in soil may be MC associated with kickout debris or MPPEH resulting former free fall or unguided drop testing of munitions.

As discussed in Section 6.0, mercury was screened against both inorganic and organic mercury criteria since uncertainty is associated with the presence of mercury fulminate. Mercury was detected in two of 20 samples collected. The detected concentration for mercury was less than the residential and industrial screening criteria for both inorganic and organic mercury (Table 11-1).

Perchlorate was detected in 11 of the 20 samples; however, none of the perchlorate concentrations detected in soil at MRP Site AOC2 exceeded the screening criteria (Table 11-1).

The human health screening criteria used to compare the analytical results in soil at MRP Site AOC2 are based solely on general residential and industrial use scenarios. Therefore, the screening results presented in this report are applicable only under the assumptions inherent in the residential and industrial criteria used and the data available at the time of the evaluation.

11.5.3 Ecological Screening Results

Detected concentrations of five metals (cadmium, copper, lead, selenium, and zinc) in soil at MRP Site AOC2 exceeded ecological benchmarks and background screening criteria (Table 11-1). The source of elevated metals in soil may be MC associated with kickout debris or MPPEH resulting former unguided drop testing practices. The remaining chemicals did not exceed the ecological benchmarks, did not have a benchmark, or were reported as being present at a concentration below the laboratory reporting limit. The results of the comparisons are as follows:

Chemical	Detection Frequency	Maximum Concentration in Soil (mg/kg)	Background screening Criteria (mg/kg)	Ecological Screening Benchmark (mg/kg)	Number of Detections Greater than Background and Ecological Screening Criteria
Cadmium	12/20	10.1	2.2	0.36	4
Copper	20/20	173	39	28	3
Lead	20/20	81.1	35.7	11	4
Selenium	1/20	0.58	0.44	0.52	1
Zinc	20/20	750	177	46	4

Note:
mg/kg Milligram per kilogram

11.5.4 Data Quality Review

A final review of the analytical data set against EPA data quality parameters indicated that the data are of high overall quality. The data quality review found that QA/QC objectives for bias and precision were met for most analytical results with the following exceptions:

- MS/ MSD recoveries resulted in qualification of results as estimated (J) for antimony, barium, and zinc in multiple samples. Approximately 1.1 percent of the soil sample data were affected.
- ICS values resulted in qualification of results as estimated (J) for cadmium and thallium in a few samples. High concentrations of calcium and iron resulted in qualification of 0.02 percent of the soil data.
- Several sample results were estimated because they were reported at concentrations between the MDL and the QL. The analytical instrument can make reliable qualitative identification of analytes greater than the MDL but below the QL; detected results below the QL are considered quantitatively uncertain.

A complete summary the data quality review is in Appendix F. The supporting data validation reports are in Appendix E-5. Chain-of-custody forms were used to trace possession of the samples from field collection to the analytical laboratory. The completed chain-of-custody forms are in Appendix E-4.

11.6 MRP Site AOC2 Updated Conceptual Site Model

The CSM for MRP Site AOC2 was updated, based on the results of the 2009 SI field activities, to include the types of munitions debris observed, anticipated MEC density based on detector-aided visual survey results, MC sampling results, observed site structures, observed groundwater seepage, and signs observed on the tower indicating the site was used for both free fall (unguided) and guided drop testing. The original CSM indicated that AOC2 was not a suspect MEC site and that the site was used for only guided drop testing. However, based on signs posted on the tower

indicating “free fall or guided”, MPPEH observations, and observations of detonated kickout debris around the tower, AOC2 is acknowledged as a suspect MEC site in the updated CSM.

The updated CSM profile for AOC2 is provided as Table 11-3. Figures 11-3 and 11-4 provide a graphical representation of the current understanding of the exposure pathways through which site receptors could come in contact with, or be affected by, MEC and MC at MRP Site AOC2. Based on observations of MPPEH, kickout debris, and signs on the drop test tower, potentially complete MEC exposure pathways for human or ecological receptors exist in the subsurface at AOC2 (Figure 11-3). Potentially complete MC exposure pathways for human receptors, and complete and potentially complete MC exposure pathways exist for ecological receptors (Figure 11-3).

11.7 MRP SITE AOC2 CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations for MRP Site AOC2.

11.7.1 Potential or Existing MEC Hazards

MRP Site AOC2 (Explosives Drop Test Tower) was used from 1955 to 1977, in conjunction with former Buildings 435 and 437, to perform both free fall (unguided) and guided safety drop testing on fuzes, cartridges, experimental propellants, and other low-level explosive items.

Based on evidence of MPPEH (a blasting cap) and MDAS (a 2.75-inch rocket motor end cap) and past practices, as well as the nature and extent of magnetic anomalies detected by the hand-held magnetometer, the MEC risk and hazard at MRP Site AOC2 are anticipated to be low.

Because of the MPPEH item, evidence of free fall (unguided) drop testing (signs on the tower and metal kickout debris around the tower), and the distribution of subsurface anomalies, a RI/FS for MEC is recommended for MRP Site AOC2.

11.7.2 Potential or Existing MC Hazards

No concentrations of explosives were detected in soils at MRP Site AOC2. Perchlorate was detected in soil below the human health screening criteria. Cadmium and lead were detected at concentrations greater than the corresponding residential and background screening criteria. Detected concentrations of five metals in soil (cadmium, copper, lead, selenium, and zinc) exceeded the corresponding ecological benchmarks and background levels.

Because of the human health, ecological, and background screening criteria exceedances for metals in soil around the tower, evidence of free fall drop testing (signs on the tower, metal kickout debris around the tower, and the distribution of subsurface anomalies), a RI/FS for MC is recommended for MRP Site AOC2.

SECTION 11.0 PHOTOS – MRP SITE AOC2

Photo 1: View looking northwest at the drop test tower at MRP Site AOC2. Subsurface anomalies are marked with yellow flagging.

Photo 2: View looking northwest at the drop test tower at MRP Site AOC2.

Photo 3: View looking east at the drop test tower signage at MRP Site AOC2.

Photo 4: View of the 2.75-inch rocket motor end cap (MDAS) located on the concrete pad at MRP Site AOC2.

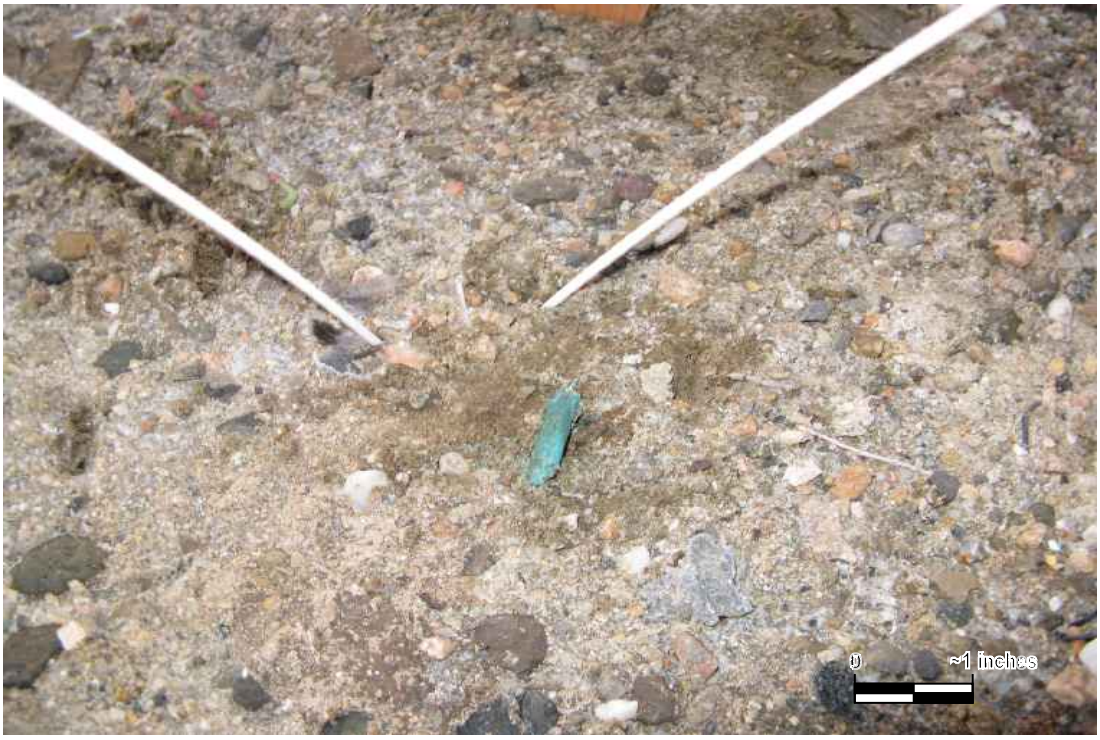
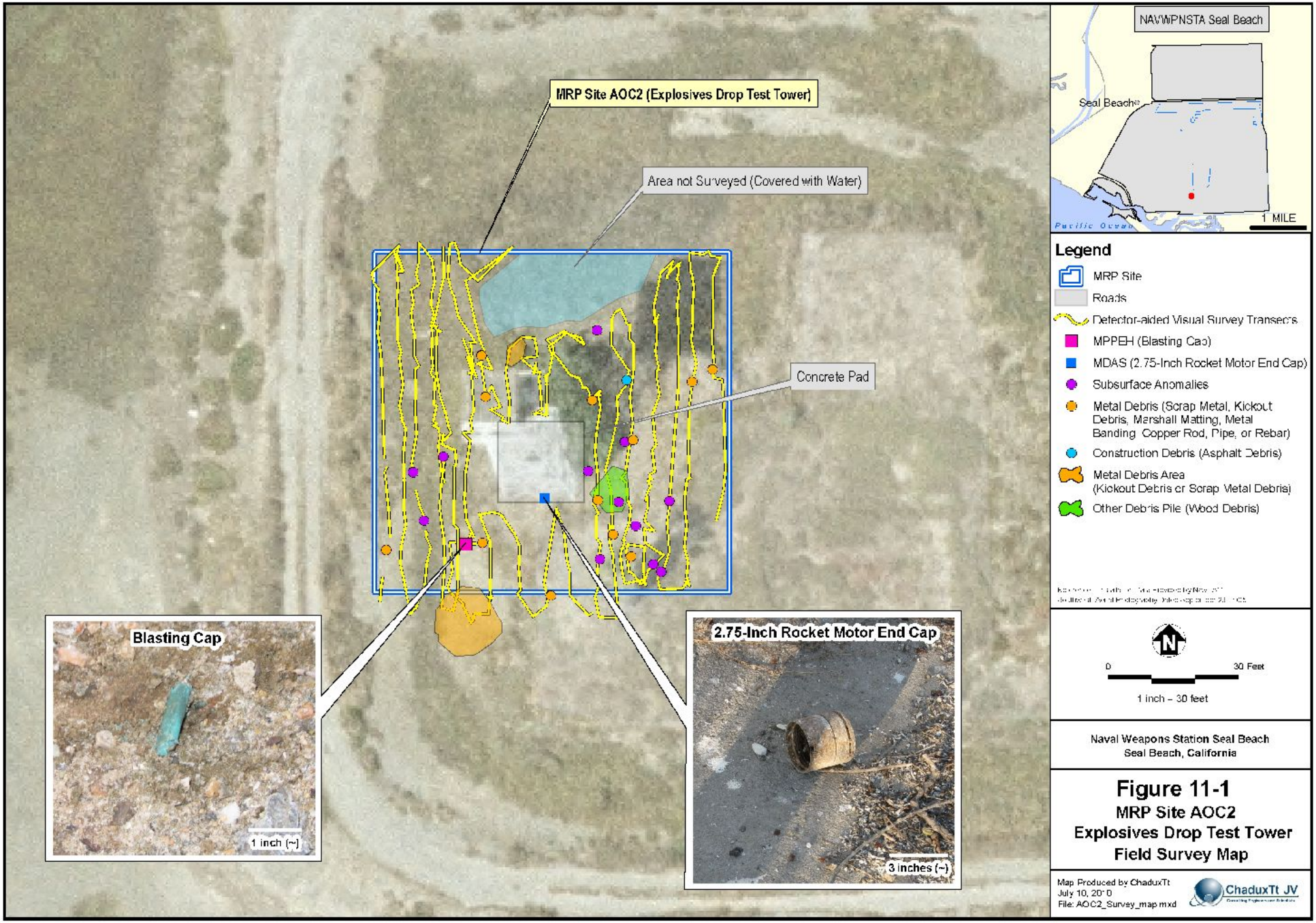


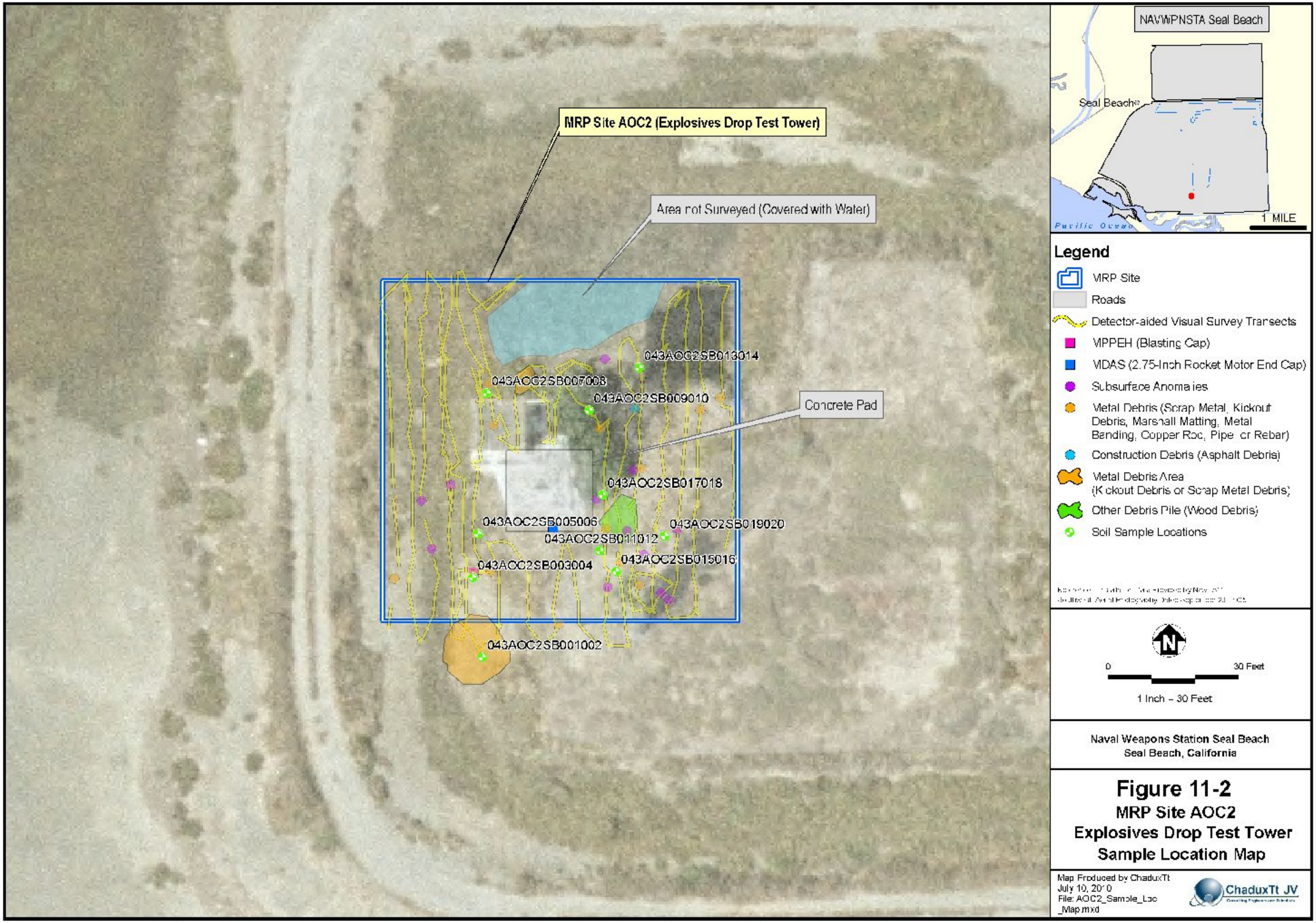
Photo 5: View of the blasting cap (MPPEH) located at MRP Site AOC2.

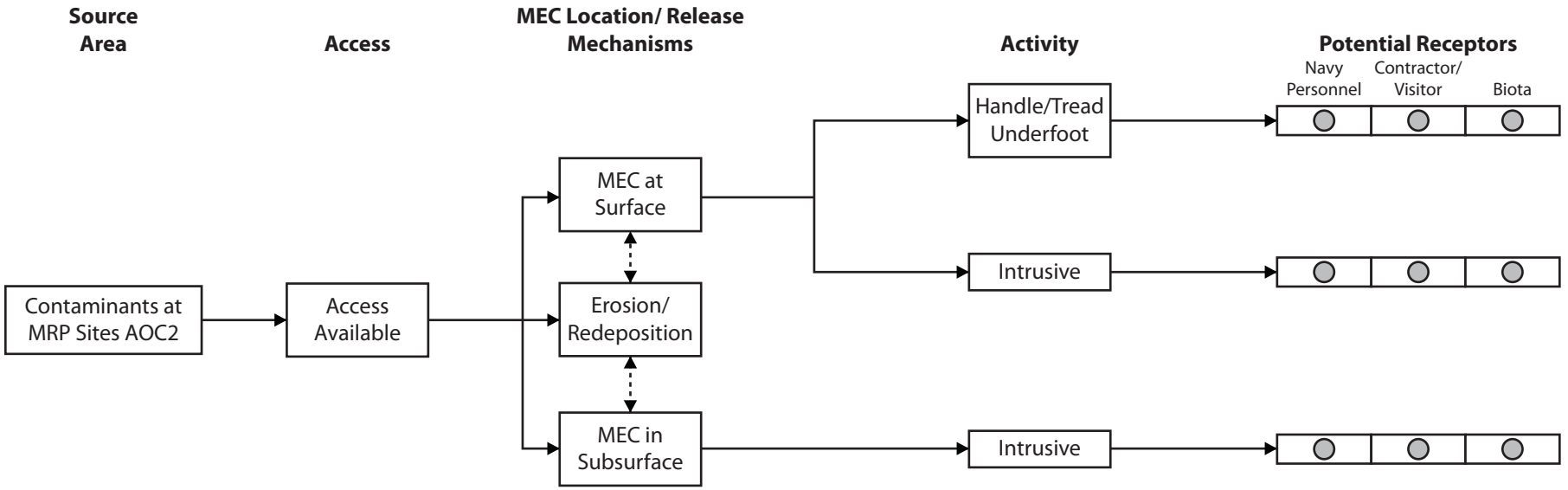
Photo 6: View looking southeast at a metal debris area containing kickout debris on the ground surface and biased soil sampling location 043AOC2SB001002 at MRP Site AOC2.

Photo 7: View of kickout debris and soil discoloration observed on the ground surface at MRP Site AOC2.

SECTION 11.0 FIGURES – MRP SITE AOC2


MRP Site AOC2 (Explosives Drop Test Tower)
Area not Surveyed (Covered with Water)
Concrete Pad
Blasting Cap
1 inch (~)
2.75-Inch Rocket Motor End Cap
3 inches (~)
NAVWPNSTA Seal Beach
Seal Beach
Pacific Ocean
1 MILE
Legend
MRP Site
Roads
Detector-aided Visual Survey Transects
MPPEH (Blasting Cap)
MDAS (2.75-Inch Rocket Motor End Cap)
Subsurface Anomalies
Metal Debris (Scrap Metal, Kickout Debris, Marshall Matting, Metal Banding, Copper Rod, Pipe, or Rebar)
Construction Debris (Asphalt Debris)
Metal Debris Area (Kickout Debris or Scrap Metal Debris)
Other Debris Pile (Wood Debris)
N
0
30 Feet
1 inch = 30 feet
Naval Weapons Station Seal Beach
Seal Beach, California
Figure 11-1
MRP Site AOC2
Explosives Drop Test Tower
Field Survey Map
Map Produced by ChaduxTt
July 10, 2010
File: AOC2_Survey_map.mxd
ChaduxTt JV


MRP Site AOC2 (Explosives Drop Test Tower)
Area not Surveyed (Covered with Water)
Concrete Pad
043AOC2SB013014
043AOC2SB007008
043AOC2SB009010
043AOC2SB017018
043AOC2SB005006
043AOC2SB019020
043AOC2SB011012
043AOC2SB003004
043AOC2SB015016
043AOC2SB001002
NAVWPNSTA Seal Beach
Seal Beach
Pacific Ocean
1 MILE
Legend
MRP Site
Roads
Detector-aided Visual Survey Transects
MPPEH (Blasting Cap)
MDAS (2.75-Inch Rocket Motor End Cap)
Subsurface Anomalies
Metal Debris (Scrap Metal, Kickout Debris, Marshall Matting, Metal Banding, Copper Roc, Pipe or Rebar)
Construction Debris (Asphalt Debris)
Metal Debris Area (Kickout Debris or Scrap Metal Debris)
Other Debris Pile (Wood Debris)
Soil Sample Locations
N
0
30 Feet
1 Inch = 30 Feet
Naval Weapons Station Seal Beach
Seal Beach, California
Figure 11-2
MRP Site AOC2
Explosives Drop Test Tower
Sample Location Map
Map Produced by ChaduxTt
July 10, 2010
File: AOC2_Sample_Loc_Map.mxd
ChaduxTt JV



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MEC - Munitions and Explosives of Concern

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

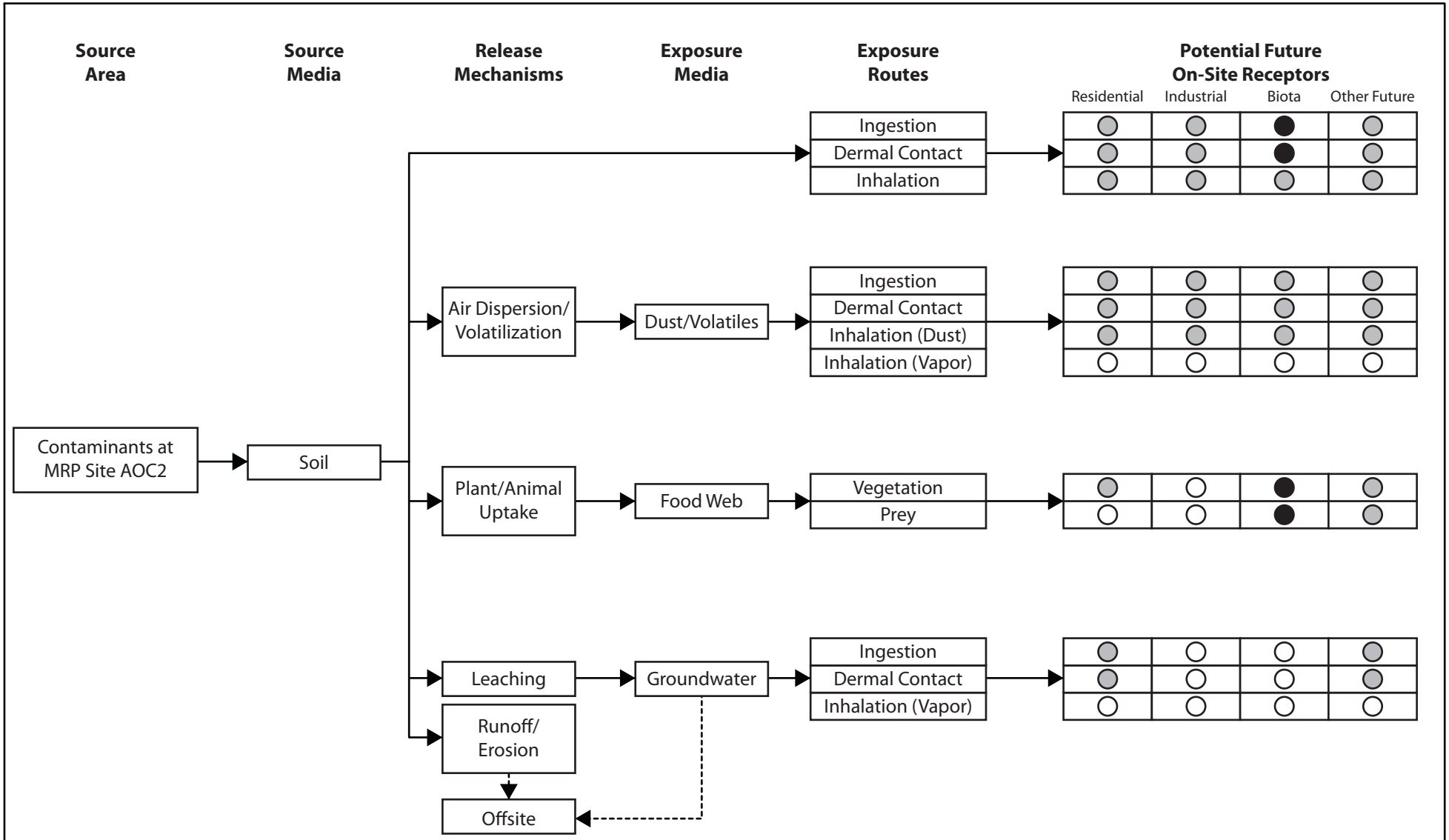
○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 11-3

MRP Site AOC2
Graphical Updated Conceptual Site Model for MEC
Site Inspection Report



Notes:

This is an updated conceptual site model. Exposure pathways and receptors may change when additional information becomes available.

MRP - Munitions Response Program

● Complete Pathway

◉ Potentially Complete Pathway

○ Incomplete Pathway

ChaduxTt JV
Consulting Engineers and Scientists

Naval Weapons Station Seal Beach
Seal Beach, California

Figure 11-4

MRP Site AOC2
Graphical Updated Conceptual Site Model
for MC
Site Inspection Report

SECTION 11.0 TABLES – MRP SITE AOC2

TABLE 11-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE AOC2

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Detection Frequency	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Range of Reporting Limits	Residential Screening Criteria	Number of Detections Above Residential Screening Criteria	Industrial Screening Criteria	Number of Detections Above Industrial Screening Criteria	Ecological Screening Criteria	Number of Detections Above Ecological Screening Criteria	Back-ground Screening Level	Number of Detections Above Background Screening Level
Metals (mg/kg)													
ALUMINUM	20/20	5,470	18,800	043AOC2SB007008	21.1 - 26.9	77,000	0	990,000	0	50.0	**20**	36,300	0
ARSENIC	20/20	2.3	14.0	043AOC2SB013014	1.1 - 1.3	0.062	**20**	0.25	**20**	10.0	**2**	15.4	0
BARIUM	20/20	34.4 J	155 J	043AOC2SB005006	1.1 - 1.3	15,000	0	190,000	0	330	0	NC	-
BERYLLIUM	19/20	0.23 J	0.80 J	043AOC2SB007008	1.1 - 1.3	160	0	2,000	0	10.0	0	2.1	0
CADMIUM	12/20	0.16 J	10.1	043AOC2SB011012, 043AOC2SB019020	1.1 - 1.3	1.7	**4**	7.5	**3**	0.36	**7**	2.2	**4**
CHROMIUM	20/20	9.3	28.5	043AOC2SB013014	1.1 - 1.3	120,000	0	1,500,000	0	0.40	**20**	46.2	0
COBALT	20/20	3.2	11.9	043AOC2SB007008	1.1 - 1.3	23.0	0	300	0	13.0	0	NC	-
COPPER	20/20	7.2	173	043AOC2SB011012	1.1 - 1.3	3,100	0	41,000	0	28.0	**4**	39.0	**3**
IRON	20/20	8,560	25,000	043AOC2SB019020	21.1 - 26.9	55,000	0	720,000	0	NC	-	NC	-
LEAD	20/20	5.3	81.1	043AOC2SB017018	1.1 - 1.3	80.0	**1**	320	0	11.0	**14**	35.7	**4**
MANGANESE	20/20	123	566	043AOC2SB005006	1.1 - 1.3	1,800	0	23,000	0	220	**14**	1,100	0
MERCURY-INORGANIC	2/20	0.066 J	0.076 J	043AOC2SB013014	0.12 - 0.13	23.0	0	310	0	0.10	0	NC	-
MERCURY-ORGANIC	2/20	0.066 J	0.076 J	043AOC2SB013014	0.12 - 0.13	7.8	0	100	0	0.10	0	NC	-
NICKEL	20/20	6.9	20.5	043AOC2SB005006	1.1 - 1.3	1,500	0	20,000	0	38.0	0	32.5	0
SELENIUM	1/20	0.58 J	0.58 J	043AOC2SB017018	1.1 - 1.1	390	0	5,100	0	0.52	**1**	0.44	**1**
VANADIUM	20/20	19.4	50.9	043AOC2SB019020	1.1 - 1.3	78.0	0	1,000	0	2.0	**20**	86.0	0
ZINC	20/20	32.6 J	750 J	043AOC2SB017018	1.1 - 1.3	23,000	0	310,000	0	46.0	**18**	177	**4**
Explosives (mg/kg)													
PERCHLORATE	11/20	0.00041 J	0.023	043AOC2SB015016	0.0053 - 0.0062	29.0	0	380	0	NC	-	NC	-

TABLE 11-1: SUMMARY OF SOIL ANALYTICAL RESULTS COMPARED WITH SCREENING CRITERIA FOR MRP SITE AOC2

Naval Weapons Station Seal Beach, California

Notes:

1. Data shown includes detected analytes in all soil samples. No QC or duplicate samples were identified.
2. Number of detections exceeding screening criteria is shown in bold.
3. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).
4. "Total" metals were measured at the Site. Given the uncertainties, total mercury was screened by use of inorganic and organic mercury human health screening criteria.

-	Not applicable
AOC	Area of concern
J	Estimated value
mg/kg	Milligrams per kilogram
MRP	Munitions response program
NC	No criteria
QC	Quality control

TABLE 11-2: METALS RESULTS FOR SOIL SAMPLES EXCEEDING BACKGROUND CONCENTRATIONS FOR MRP SITE AOC2

Naval Weapons Station Seal Beach, California

Sample depth from 0 to 1.5 feet below ground surface

Analyte	Point ID	Sample ID	Sample Depth (feet)	Sample Collection Date	Detected Concentration	Laboratory Reporting Limit	Residential Screening Criteria	Industrial Screening Criteria	Ecological Screening Criteria	Background Screening Level
Metals (mg/kg)										
CADMIUM	043AOC2SB011012	043AOC2SB011	0.00 - 0.50	12/05/09	10.1	1.1	**1.7**	**7.5**	**0.36**	**2.2**
CADMIUM	043AOC2SB015016	043AOC2SB015	0.00 - 0.50	12/05/09	7.1	1.1	**1.7**	7.5	**0.36**	**2.2**
CADMIUM	043AOC2SB017018	043AOC2SB017	0.00 - 0.50	12/05/09	7.9	1.1	**1.7**	**7.5**	**0.36**	**2.2**
CADMIUM	043AOC2SB019020	043AOC2SB019	0.00 - 0.50	12/05/09	10.1	1.1	**1.7**	**7.5**	**0.36**	**2.2**
COPPER	043AOC2SB011012	043AOC2SB011	0.00 - 0.50	12/05/09	173	1.1	3,100	41,000	**28.0**	**39.0**
COPPER	043AOC2SB015016	043AOC2SB015	0.00 - 0.50	12/05/09	114	1.1	3,100	41,000	**28.0**	**39.0**
COPPER	043AOC2SB017018	043AOC2SB017	0.00 - 0.50	12/05/09	42.4	1.1	3,100	41,000	**28.0**	**39.0**
LEAD	043AOC2SB013014	043AOC2SB013	0.00 - 0.50	12/05/09	38.9	1.3	80.0	320	**11.0**	**35.7**
LEAD	043AOC2SB013014	043AOC2SB014	1.00 - 1.50	12/05/09	49.2	1.3	80.0	320	**11.0**	**35.7**
LEAD	043AOC2SB015016	043AOC2SB015	0.00 - 0.50	12/05/09	57.2	1.1	80.0	320	**11.0**	**35.7**
LEAD	043AOC2SB017018	043AOC2SB017	0.00 - 0.50	12/05/09	81.1	1.1	**80.0**	320	**11.0**	**35.7**
SELENIUM	043AOC2SB017018	043AOC2SB017	0.00 - 0.50	12/05/09	0.58 J	1.1	390	5,100	**0.52**	**0.44**
ZINC	043AOC2SB001002	043AOC2SB001	0.00 - 0.50	12/05/09	217 J	1.2	23,000	310,000	**46.0**	**177**
ZINC	043AOC2SB011012	043AOC2SB011	0.00 - 0.50	12/05/09	185 J	1.1	23,000	310,000	**46.0**	**177**
ZINC	043AOC2SB013014	043AOC2SB013	0.00 - 0.50	12/05/09	231 J	1.3	23,000	310,000	**46.0**	**177**
ZINC	043AOC2SB017018	043AOC2SB017	0.00 - 0.50	12/05/09	750 J	1.1	23,000	310,000	**46.0**	**177**

Notes:
1. Exceeded screening criterion is shown in bold.
2. Screening criteria sources are presented in Sections 6.1 (human-health) and 6.2 (ecological).

AOC Area of concern
ID Identification
J Estimated value
mg/kg Milligrams per kilogram
MRP Munitions response program

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information	Installation Name	NAVWPNSTA Seal Beach
	Site Name	MRP Site AOC2 (Explosives Drop Test Tower)
	Site Area and Layout	The site footprint for MRP Site AOC2 is an area of approximately 0.15 acre. The tower occupies an 11-foot-square footprint within an approximate 1/4-acre flat area surrounded by a 4-foot-high berm. A low-lying area (IRP Site 24) is located immediately northeast of AOC2.
	Site Structures	The only structure that remains within MRP Site AOC2 is the tower itself, including the associated concrete pad that supports the tower.
	Site Boundaries	MRP Site AOC2 is bounded by a 4-foot-high berm located approximately 100 feet north. The berm acts as a boundary for the Seal Beach NWR wetland area. The installation boundary is located roughly 2.75 miles north of AOC2, where the installation is bordered by the City of Seal Beach. The installation boundary is located 0.25 mile south of AOC2. Beyond the installation boundary is the City of Huntington Beach and an Orange County flood control channel, which flows into Anaheim Bay and the Pacific Ocean. The installation boundary lies approximately 1 mile west of AOC2, where the installation is bordered by the City of Seal Beach. The former Buildings 432-437 complex was located 80 feet east of AOC2. Primarily bare earth extends 400 to 500 feet from the former complex to a 4-foot-high soil berm that separates the area from IRP Site 6 and the Seal Beach NWR. The installation boundary with the City of Huntington Beach is located roughly 1.5 miles from the site.

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
General Information (continued)	Site Security	MRP Site AOC2 is located on NAVWPNSTA Seal Beach, which is a fenced and guarded installation. Security personnel are responsible for maintaining law and order and for implementing access control policies and procedures. Access to AOC2 from within NAVWPNSTA Seal Beach is controlled by vehicular security patrol. In addition, the site is bordered on three sides by Seal Beach NWR.
Munitions/ Release Profile	Munitions Types	The tower was used to perform both free fall and guided safety drop testing on fuzes, cartridges, experimental propellants, and other low-level explosive items.
	Maximum Probability Penetration Depth	Subsurface MEC are not suspected directly beneath the tower, as the bottom of the tower at MRP Site AOC2 was reinforced with a below-ground, 4-inch-thick armor plate block that rested on top of a 3-foot-thick concrete block. MEC penetration depths resulting from free fall or unguided drop testing would be 0 to 1.5 feet bgs based on the past site practices, detected subsurface anomalies, as well as observations of metal kickout debris and MPPEH .
	MEC Density	Based on the distribution of subsurface anomalies mapped during the 2009 SI field investigation, MEC density (if MEC is present) surrounding the tower could range from low to high.
	MEC Field Observations	MEC items were not observed at MRP Site AOC2 during the 2009 SI field investigation. However, one MPPEH item and one MDAS item was identified at the site and consisted of a blasting cap (MPPEH) located approximately 10 feet southwest of the tower and a 2.75-inch rocket motor end cap (MDAS) on the southern portion of the concrete pad.

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Munitions/ Release Profile (continued)	Munitions Constituents	Twenty soil samples were collected at MRP Site AOC2 and analyzed for metals, perchlorate, and explosives. Explosives were not detected in soils at MRP Site AOC2. Perchlorate was detected in soil at concentrations below the human health screening criteria. Cadmium and lead were detected at concentrations above the corresponding residential and background screening criteria. Detected concentrations of five metals in soil (cadmium, copper, lead, selenium, and zinc) exceeded the corresponding ecological benchmarks and background screening criteria. The source of elevated cadmium, copper, lead, selenium, and zinc in soil may be MC associated with kickout debris or MPPEH resulting former free fall (unguided) drop testing of munitions.
	Migration Routes/Release Mechanisms	Earthmoving associated with future construction, excavation, and maintenance at the site is a mechanism that can physically redistribute both MEC and MC in soil at the surface and to the subsurface. Surface migration of MC may occur naturally through surface soil erosion and by wind or mechanically driven dust generation. MC that may be present in surface soil can also be bioaccumulated by biota. MC can leach through soil to groundwater in the shallow alluvial aquifer.
Physical Profile	Climate	The climate at NAVWPNSTA Seal Beach is typical of the maritime subclimate within the California Mediterranean climate, which includes mild winters, cool summers, high relative humidity, and frequent early morning clouds that lead to afternoon sunshine. The annual average temperature is 74°F. Summer average high temperatures range from 77 °F to 84 °F, and average lows range from 60 °F to 65 °F. Winters temperatures tend to be moderate, with highs typically 67 °F and average lows ranging from 45 °F to 47 °F. Yearly precipitation averages 13 inches; February, the wettest

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Climate (continued)	month, averages 3 inches, and July, the driest, averages 0.02 inch (WRCC undated). Periodically, the region experiences El Niño conditions, which tend to bring wetter winters to the area through heavy storms. The prevailing winds are westerly with an average velocity of 10 knots. Strong, dry northeasterly winds occasionally descend the mountain slopes in the fall, winter, and early spring (NAVFAC SW 1979). The strongest winds that occur within the region are associated with the winter and spring storms off the Pacific Ocean (NAVFAC SW 2005).
	Topography	The terrain at MRP Site AOC2 is flat and lies at an elevation of 5 feet asl (Malcolm Pirnie 2008).
	Geology	MRP Site AOC2 is underlain by artificial fill (Figure 2-1). The fill material consists of dry to saturated olive brown sandy silt with some clay and sub-angular gravels. The fill material was logged to a depth of approximately 1 foot bgs. Beneath the fill layer is native material consisting paralic estuarine deposits (Qpe) of dark reddish brown clayey silt that are late Holocene in age.
	Soil	MRP Site AOC2 surface soil appears to be composed primarily of soil with gravel fill. The artificial fill appeared to have been in place during the period of use for the drop test tower, based on surface observations of kickout debris and detonated MPPEH. Runoff is slow over bare level soil, and the erosion hazard is slight. The soil at the site is also moderately alkaline and calcareous to a depth of about 49 inches (NEESA 1985).
	Hydrogeology	Groundwater within the upper unconfined aquifer is tidally influenced and is present at near-surface depths (less than 5 feet bgs). During high tide, groundwater seepage was observed at the surface approximately 30 feet north of the tower (Figure 11-1). Groundwater is reported to flow to the northeast, toward the 7th Street POLB Mitigation Pond (NAVFAC SW 1999). Groundwater at the site is saline to brackish and is not

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Physical Profile (continued)	Hydrogeology (continued)	used for drinking water because of saltwater intrusion (NAVFAC SW 2002). Lateral groundwater movement in the moderately permeable shallow aquifer at NAVWPNSTA Seal Beach is estimated to be on the order of several hundred feet per year (NEESA 1985). Two monitoring wells are located north of Slough Road. Navy Well 3, located roughly 0.75 mile north of AOC2, is 616 feet deep (screened at two different intervals starting at 548 feet bgs) and currently is used for agricultural irrigation (Malcolm Pirnie 2008).
	Hydrology	Surface water from MRP Site AOC2 would be contained within the roughly 3-acre bermed area surrounding the site.
	Vegetation	Low grasses, pickleweed (*Salicornia* spp.), and a few large bushes are present at AOC2.
Land Use and Exposure Profile	Current Land Use	The tower within MRP Site AOC2 is no longer in use, other than as a nesting platform for herons (NAVWPNSTA Seal Beach 2007).
	Current Human Receptors	Navy personnel and contractors (including maintenance personnel), Navy-escorted visitors, and environmental and ecological researchers are current human receptors. Only limited public access is granted to the NWR.
	Current Activities (Frequency, Nature of Activity)	MRP Site AOC2 is no longer in use. The only activities within the site are infrequent visits to conduct environmental and ecological surveys.
	Potential Future Land Use	Future land uses for are expected to be the same as current uses.
	Potential Future Human Receptors	Future receptors are expected to be the same as current receptors.
	Potential Future Land Use-Related Activities	The tower will remain in place to accommodate heron nesting. NAVWPNSTA Seal Beach Environmental Division has plans to restore tidal flow by removing the road extending east from MRP Site AOC2 and excavating tidal channels into the area (NAVWPNSTA Seal Beach 2007).
	Zoning/Land Use Restrictions	MRP Site AOC2 is part of a secure and active Navy base and is located within the Seal Beach NWR.

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Land Use and Exposure Profile (continued)	Demographics/Zoning	NAVWPNSTA Seal Beach has a combined workforce of 150 military personnel and 600 civilian personnel. Population data include the following (U.S. Census, 2000): • City of Seal Beach: 24,154 • City of Westminster: 88,207 • City of Huntington Beach: 189,594 • Orange County: 2,846,289
	Beneficial Resources	As MRP Site AOC2 remains unused and part of the Seal Beach NWR, the area provides habitat to potentially sensitive resources. Additionally, herons, which are protected by the U.S. Migratory Bird Treaty Act, use the tower for nesting (NAVWPNSTA Seal Beach 2007).
Ecological Profile	Habitat Type	MRP Site AOC2 is characterized by low grasses to barren land with isolated shrubs. The site is located within the Seal Beach NWR.
	Degree of Disturbance	The site is unused, although the soil is largely composed of what appears to be soil with gravel fill. The western portion of the site may have been disturbed during creation of the berm that bounds the site to the west based on observations of kickout debris along the face of the berm.
	Ecological Receptors	
	General	Mammals reported at the installation include various species of pocket gophers, voles, shrews, and ground squirrels, Audubon's cottontail rabbit *(Sylvilagus audubonii)*, and brush rabbit *(Sylvilagus bachmani)*. Nineteen species of raptors are known to occur within NAVWPNSTA Seal Beach, nine of which nest on the station. These species include red-tailed hawk *(Buteo jamaicensis)*, Swainson's hawk *(Buteo swainsoni)*, great-horned owl *(Bubo virginianus)*, burrowing owl

Table 11-3: MRP Site AOC2 Updated Conceptual Site Model Profile		
Information Category	**Information Descriptor**	**Site Inspection Findings**
Ecological Profile (continued)	General (continued)	*(Athene cunicularia)*, loggerhead shrike *(Lanius ludovicianus)*, American kestrel *(Falco sparverius)*, great blue heron *(Ardea herodias)*, common raven *(Corvus corax)*, and American crow *(Corvus brachyrhynchos)*. The avian wildlife forages over a large area and would spend relatively little time on site. Aquatic ecological receptors within the POLB Mitigation Pond area include marine invertebrates and fish, such as the tidewater goby *(Eucyclogobius newberryi)*, which also inhabit the Anaheim Bay (NAVFAC SW 2005; NAVWPNSTA Seal Beach 2007). Migrant or resident bird species listed as threatened or endangered by federal or state agencies (or both) include the following: • Belding's savannah sparrow *(Passerculus sandwichensis beldingi)* • California least tern *(Sterna antillarum browni)* • Light-footed clapper rail *(Rallus longirostris levipes)* • Western snowy plover *(Charadrius alexandrinus nivosus)* The breeding season for these salt marsh and shorebird species extends from approximately late January to mid-September. The California least tern occupies the Seal Beach NWR only during the breeding season, with most of its food supply coming from the Seal Beach NWR during that period (NAVFAC SW 2005).
	Relationship of Contaminant Sources to Habitat and Potential Receptors	Ecological receptors may come into direct contact with MEC or MC in soil. Based on the 2009 SI site observations it is unlikely that ecological receptors would come into contact with MEC and creating an explosive hazard, but the possibility should be considered if threatened or endangered species are present. Receptors may be exposed to MC that could have been incorporated into the food chain (for example, bioaccumulated in plants and animals). Various mammals and other animals that inhabit the site may come into contact with MC while burrowing, foraging, or nesting. In addition, they may also consume plants and prey in which MC has bioaccumulated.

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