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Final

Phase II Remedial Investigation Report Installation Restoration Program Site 1 Explosive Ordnance Disposal Training Range

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

December 2006

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared under:
Naval Facilities Engineering Command
Contract Number N62742-94-D-0048
Contract Task Order 0072

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EXECUTIVE SUMMARY

This Report presents the results of the Phase II Remedial Investigation (RI) conducted at the Installation Restoration Program (IRP) Site 1 at Former Marine Corps Air Station (MCAS) El Toro, in Orange County, California. The investigation was performed by Earth Tech Inc., on behalf of the Base Realignment and Closure, Program Management Office West and Naval Facilities Engineering Command Southwest (abbreviated as NAVFAC SW; formerly abbreviated as SWDIV) as authorized by the United States (U.S.) Navy, Pacific Division, Naval Facilities Engineering Command (NAVFAC EFD Pacific) under contract task order (CTO) no. 0072 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048.

BACKGROUND

Former MCAS El Toro covers approximately 4,738 acres in a semi-urban area of southern California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach. The IRP Site 1 is located in the northeast portion of Former MCAS El Toro in the foothills of the Santa Ana Mountains. IRP Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above mean sea level (MSL). IRP Site 1 is about 73 acres in size, and includes the Northern Explosive Ordnance Disposal (EOD) Training Range (16.9 acres) and the Southern EOD Training Range (16.6 acres), and surrounding areas.

SITE HISTORY AND PREVIOUS INVESTIGATIONS

Training for EOD and detonation of munitions has been conducted at IRP Site 1 since 1952. Military ordnance used during these activities included hand grenades, land mines, cluster bombs, smoke bombs, and rocket warheads. Additionally, there have been reports of burning approximately 2,000 gallons of sulfur trioxide chlorosulfonic acid (FS smoke) in trenches in the northern portion of the site. During disposal from 1952 to 1993, it has been estimated that approximately 300,000 gallons of petroleum fuels were burned at IRP Site 1. Such activities have a potential to contaminate the soil with Munitions and Explosives of Concern (MEC), perchlorate, fuel hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and dioxins/furans. Potential contamination of groundwater may occur due to leaching of contaminants from the soil; therefore, numerous rounds of investigations were performed at IRP Site 1, with each investigation targeted toward specific environmental media or contaminants, and to adequately define the nature and extent of contamination at the site. Based on their scopes, previous studies at IRP Site 1, including the Phase I RI may be divided into the following categories:

1. Geophysical surveys
2. Ordnance and explosives range evaluation
3. Ecological evaluation
4. Soil investigations
5. Groundwater investigations

OBJECTIVES OF THE PHASE II RI

The Phase II RI was conducted at IRP Site 1 to further characterize the conditions at the site, determine the nature and extent of contaminants, and assess risks to human health and the environment. The results of the Phase II RI were combined with the previous field investigations at IRP Site 1 for a comprehensive delineation of the nature and extent of contamination at the site. The findings and conclusions of this Report will be used to support the decision-making process for further courses of action in conjunction with future land-use options.

PHASE II REMEIDAL INVESTIGATION APPROACH AND FIELD INVESTIGATIONS

The general approach of the Phase II RI was to conduct the field investigation in stages such that each successive data collection activity was planned and conducted based on the results of the preceding stage. In this way, the site characterization efforts were continually scoped to minimize the collection of unnecessary data and maximize data quality. The Phase II RI activities were also scoped to ensure that the concerns and the areas of potential contamination identified by the previous studies were adequately addressed. The Phase II RI addresses soil, sediment, surface water, and groundwater at IRP Site 1 using a three-tiered sampling approach.

Tier I

The Tier I investigation was conducted in January of 2002. The objective of the Tier I investigation was to collect sufficient soil and groundwater data to complete a screening-level human-health and ecological risk evaluation at IRP Site 1. The sampling design for the soil investigation was based on both probability and judgmental sampling to allow for uniform coverage of the Northern and Southern EOD Training Ranges. All soil samples collected during the Tier I investigation were analyzed for compounds characteristic of releases during the EOD operations, including VOCs, SVOCs, perchlorate, explosives residues, fuel hydrocarbons, dioxins/furans, and metals.

To establish the baseline conditions, one round of groundwater sampling was conducted during Tier I. The groundwater samples were analyzed for the same suite of compounds analyzed during the soil sampling, with the addition of N-nitrosodimethylamine (NDMA).

Tier II

The Tier II soil investigation was conducted from January to April 2002, and investigated the previously defined geophysical anomaly areas through trenching or potholing, and collection of soil samples from depths ranging from 0.5-foot to 10 feet below ground surface (bgs). During the investigation activities, all located MEC or Munitions Debris (MD) items were logged and categorized.

Tier III

Tier III was conducted from June 2002 to April 2005. The objectives of the Tier III investigation were to:

- Investigate the vertical extent of soil contamination at any Tier II locations that indicated potential for contamination greater than 10 feet bgs.
- Evaluate groundwater at locations where the Tier I and Tier II data indicated potential impact.
- Determine potential risk to Riverside fairy shrimp in the Ephemeral Pond in the northern portion of the Northern EOD Training Range.
- Delineate perchlorate contamination in groundwater within the central portion of IRP Site 1.
- Delineate perchlorate contamination in groundwater in the areas south of IRP Site 1

Tier III field activities were divided into several sub-investigations:

Tier III-A. As a part of Tier III-A activities, a borehole was advanced at the location of a Tier II pothole where elevated concentrations of petroleum hydrocarbons, VOCs, SVOCs, and metals were

detected at 6 and 10 feet bgs. Soil samples collected as a part of Tier III-A were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals. Additionally, three new groundwater monitoring wells (01-MW208, 01-MW209, and 01-MW210) were installed upgradient and downgradient from monitoring well 01-MW201, which had historically yielded elevated concentrations of perchlorate.

Tier III-B. Tier III-B sampling included installation of 16 piezometers (2-inch groundwater monitoring wells), 01-PZ01 through 01-PZ16, throughout IRP Site 1 and south of IRP Site 1 in order to delineate perchlorate concentrations in the groundwater at these locations. Five rounds of groundwater samples from these 16 piezometers and from selected existing wells were analyzed for perchlorate only.

Tier III-C. Tier III-C sampling involved the installation of 12 additional monitoring wells, for the purpose of further delineating perchlorate contamination in the central portion of IRP Site 1 and in areas near Piezometers 01-PZ15 and 01-PZ16, located south of IRP Site 1. Continuous lithologic cores were collected from all 12 monitoring wells in order to better characterize the subsurface geologic and hydrogeologic conditions. Groundwater samples were collected from all 12 newly installed wells, and from selected previously installed wells and piezometers.

The final portion of the Tier III-C investigation included sediment sampling within the Ephemeral Pond at IRP Site 1. A total of 21 sediment samples were collected from 19 locations. The sampling was conducted in response to a request from the United States Fish and Wildlife Service (USFWS), in order to evaluate risk to the Federally Endangered Riverside fairy shrimp (*Streptocephalus woottoni*).

Tier III-D. The Tier III-D investigation involved advancing 31 boreholes in the southern portion of IRP Site 1 and in the areas south of IRP Site 1 in areas between IRP Site 1 and IRP Site 2, to further characterize the geologic and hydrogeologic conditions. A total of 23 Hydropunch™ groundwater samples were collected from the alluvium, and 17 Hydropunch™ samples were collected from the weathered bedrock; groundwater samples were analyzed for perchlorate only.

SUMMARY OF RESULTS

Physical Characteristics of the Study Area

In order to define potential contaminant transport pathways and receptor populations, data were collected on the physical characteristics of IRP Site 1 and surrounding areas during previous investigations and the Phase II RI.

IRP Site 1 is located in the northeast portion of Former MCAS El Toro. The major portion of land adjacent to IRP Site 1 is used for nursery and agricultural activities. However, continued urbanization has brought housing developments within ½-mile to the northeast of the site.

Subsurface lithology of IRP Site 1 consists of poorly consolidated and weathered strata of the Capistrano Formation, which is overlain in the southern portion of the site by Holocene-aged alluvium. A fault is present in the southwestern portion of the site between the location of Monitoring Wells 01-DGMW57 and 01-DGMW58.

Although groundwater beneath IRP Site 1 is not currently used for beneficial uses, according to the Santa Ana Region Basin Plan, potential beneficial uses include municipal water supply, agricultural and industrial supplies, and industrial process supply according to the Santa Ana Region Basin Plan. Based on groundwater monitoring data collected as part of Phase II RI, the depth to groundwater at

IRP Site 1 ranges from 22 feet to 109 feet bgs. Historical groundwater monitoring data and groundwater monitoring data collected as a part of Phase II RI suggest that groundwater at IRP Site 1 generally flows toward the south-southwest at an average gradient of 0.05-foot-per-foot.

The habitat assessment conducted at IRP Site 1 in December 2000 suggested that the dominant vegetation types at the site consist of non-native grassland, coastal sage scrub (CSS), and toyon-sumac chaparral. The wildlife documented at IRP Site 1 includes: 1 reptile, 36 amphibians, and 6 mammalian species. Additionally, two special status species (those listed by the State and Federal agencies as endangered, threatened, rare, or of special concern) were documented at IRP Site 1, including the Riverside fairy shrimp and the California gnatcatcher.

Nature and Extent of Contamination

The nature and extent of contamination at IRP Site 1 was delineated for soil, groundwater, sediment, surface water, and MEC using the data from previous investigations as well as from the Phase II RI.

Nature and Extent of Munitions and Explosives of Concern. Four Safe-to-Move MEC items and approximately 5,000 pounds of MD were recovered during the MEC field investigations at IRP Site 1. While the MEC was recovered in the Northern EOD Training Range, ordnance and explosives (OE) scrap or munitions debris (MD) was recovered in all the remaining portions of the site investigated, including the Southern EOD Training Range, the area surrounding the Northern and Southern EOD Training Ranges, and the Range perimeter. The maximum depth of MEC/MD recovered was 8 feet bgs.

Nature and Extent of Soil Contamination. Soil investigations performed at IRP Site 1 may be divided into two parts – an investigation of a 3.3-acre area located in the southern part of the site (in support of a Site-Specific Environmental Baseline Survey [EBS]), and an investigation of the Northern and Southern EOD Training Ranges.

Environmental Baseline Survey Soil Investigation

Chemicals of potential concern (COPCs) were not detected above the U.S. Environmental Protection Agency (EPA) Region 9 residential and industrial preliminary remediation goals (PRGs) for soil during the investigation of the 3.3-acre area sampled in support of the EBS. Metals were detected at concentrations below residential and industrial PRGs with the exception of arsenic, for which 10 samples exceeded the residential and industrial PRGs, and 1 sample exceeded the Former MCAS El Toro background concentration. Among the detected explosives residues, only RDX exceeded its U.S. EPA Region 9 residential PRG in one soil sample.

Northern and Southern Explosive Ordnance Disposal Training Ranges

The following presents a summary of the nature and extent of contamination in the Northern and Southern EOD Training Ranges:

- Various COPCs were detected in soil at IRP Site 1 during previous investigations and the Phase II RI. These COPCs include: VOCs, SVOCs, hydrocarbons, explosives residues, perchlorate, metals, and dioxins/furans.
- VOCs detected in the soil at the Northern and Southern EOD Training Ranges include acetone, benzene, 2-butanone, chloroform, ethylbenzene, 2-hexanone, 4-methyl-2-pentanone, tetrachloroethene, toluene, and xylenes. Concentrations of all the detected VOCs were below the U.S. EPA Region 9 residential and industrial PRGs.

- SVOCs detected in soil at the Northern and Southern EOD Training Ranges include diethyl phthalate; di-n-butyl phthalate; hexachlorobenzene; phenol; 2,4-dinitrotoluene; 2-methylnaphthalene; bis(2-ethylhexyl) phthalate; naphthalene; and NDMA. Concentrations of all detected SVOCs were below U.S. EPA Region 9 residential and industrial PRGs with the exception of naphthalene. Concentrations of naphthalene exceeded the Cal-Modified EPA Region 9 residential and industrial PRGs of 1.7 and 4.2 milligrams per kilogram (mg/kg), respectively, at seven sampling locations.
- Hydrocarbons detected in soil at the Northern and Southern EOD Training Ranges include total petroleum hydrocarbons as motor oil (TPH-MO); TPH as diesel fuel (TPH-D); and TPH as gasoline (TPH-G) (PRGs are not available for TPH). Concentrations ranged from 1 to 37,000 mg/kg for TPH-D; 0.03 to 1,600 mg/kg for TPH-G; and 4 to 69 mg/kg for TPH-MO.
- Explosives residues detected in soil at the Northern and Southern EOD Training Ranges include 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; and cyclotrimethylenetrinitramine (RDX). All detected explosives residues were below U.S. EPA Region 9 industrial PRGs. Residential PRGs were also not exceeded except in the case of RDX, for which one sample collected at 5 feet bgs during the Tier III soil investigation exceeded the respective residential PRG of 4.42 mg/kg.
- Perchlorate was detected at low concentrations and at low frequencies in soil at the Northern and Southern EOD Training Ranges during all previous investigations and during the Phase II RI. All these detections were well below the U.S. EPA Region 9 residential and industrial PRGs of 7.82 mg/kg and 102.2 mg/kg, respectively. The maximum concentration of perchlorate detected at the Northern and Southern EOD Training Ranges was 1.6 mg/kg.
- Analysis of soil for metals during the *Verification of Perchlorate Study* and Phase II RI Tier I and Tier III soil investigations showed that very few metals exceeded respective background concentrations. Also during these investigations, none of the metals exceeded the U.S. EPA Region 9 residential or industrial PRGs, with the exception of arsenic. However, the results of metal analysis for the soil samples collected as part of the Tier II investigation show that a relatively large number of metals exceeded respective background concentrations. A comparison of reported metal concentrations with residential and industrial PRGs shows that few of these metals exceeded the residential and industrial PRGs. Metals that exceeded the residential and/or industrial PRGs in the soil samples collected from the Northern and Southern EOD Training Ranges include aluminum, antimony, arsenic, cadmium, copper, lead, thallium, and zinc.
- Toxicity equivalency quotients (TEQs) for dioxins/furans in soil samples collected during the *Verification of Perchlorate Study* and the Tier III soil investigation did not exceed U.S. EPA Region 9 residential PRGs; however, during the Tier II investigation, one soil sample exceeded the residential and industrial PRGs and one soil sample exceeded only the residential PRGs.
- Results of the Tier III soil investigation were combined with the results of the Tier I and Tier II investigations to estimate the depth of contamination at IRP Site 1. These results show that minimal VOC, SVOC, and hydrocarbon contamination exists at IRP Site 1 and is restricted to shallow depths (less than 5 feet bgs). The location of Borehole B-1 is likely to be the only location where this contamination extends up to the depth of 20 feet bgs.
- For explosives residues and perchlorate, it can be concluded that negligible concentrations of explosives residues and perchlorate exist in IRP Site 1 soil up to a

depth of 5 feet bgs. It is likely that Borehole B-1 is the only location where low concentrations of explosives residues and perchlorate exist up to a maximum depth of 35 feet bgs.

- The radiological scan surveys and soil sampling indicated that occurrence and distribution of Ra-226 at IRP Site 1 is consistent with the naturally occurring background. Therefore, a site evaluation accomplished (SEA) recommendation was made to remove the radionuclides from the list of COPCs at IRP Site 1.

Nature and Extent Groundwater Contamination. The following presents a summary of the nature and extent of groundwater contamination at IRP Site 1 and in areas south of IRP Site 1, based on the results from Stationwide groundwater monitoring, from the V*erification of Perchlorate* study, and from the Phase 1 and Phase II evaluation of radionuclides in groundwater:

- Very few VOCs were detected at IRP Site 1 during Stationwide groundwater monitoring and Tier I groundwater sampling events. The concentrations of detected VOCs were generally low and below maximum contaminant levels (MCLs). This suggests that no or negligible VOC contamination exists at IRP Site 1.
- SVOCs were detected in groundwater only sparingly and at very low concentrations during the Stationwide groundwater monitoring, and only one SVOC was detected during the Tier I groundwater sampling. This suggests that negligible concentrations of SVOC contamination exist at IRP Site 1.
- Low concentrations of TPH-MO, TPH-D, and TPH-G were detected in groundwater at some IRP Site 1 monitoring wells.
- Perchlorate concentrations in groundwater exceeding the EPA perchlorate drinking water equivalent level (DWEL) of 24.5 micrograms per liter (µg/L) (EPA 2006) by over one order of magnitude were observed in the central portion of IRP Site 1 in the Northern EOD Training Range. An evaluation of historical operations and soil sampling results indicates that this area is likely the source of perchlorate contamination for areas located south (downgradient) of IRP Site 1, including the alluvial aquifer between IRP Site 1 and IRP Site 2.
- Relatively high concentrations of perchlorate were reported in groundwater south of the central source area, particularly in the area between IRP Site 1 and IRP Site 2 along the western reach of Borrego Canyon Wash. Perchlorate is present predominantly in the weathered bedrock at IRP Site 1; however, downgradient of IRP Site 1 perchlorate is present both in the saturated alluvium and in the saturated weathered bedrock.
- The Phase I and Phase II radionuclide evaluations concluded that radionuclides in groundwater at IRP Site 1 are naturally occurring and are not related to site activities.

Nature and Extent of Sediment Contamination. The COPCs detected in sediment samples collected in the Ephemeral Pond in the northern portion of IRP Site 1 included toluene (a VOC) and petroleum hydrocarbons. No SVOCs, polynuclear aromatic hydrocarbons (PAHs), explosives residues, or perchlorate were detected in any sediment sample. Toluene was detected at low concentrations at two sampling locations. Petroleum hydrocarbons detected in sediment samples included low concentrations of TPH-MO, TPH-D, and TPH-G. None of the detected concentrations of metals exceeded their U.S. EPA Region 9 residential or industrial PRGs, except arsenic, which exceeded its residential PRG in all 19 sediment samples. However, none of the arsenic concentrations were greater than its established background concentration of 6.86 mg/kg.

Nature and Extent of Surface Water Contamination. The following summarizes the nature and extent of surface water contamination based on the surface water samples collected in the ephemeral pond and in the western reach of Borrego Canyon Wash south of IRP Site 1 in January and February 2005:

- Acetone was the only VOC detected in any of the surface water samples, at a concentration of 6 μg/L in both the Ephemeral Pond sample and in the stream sample.
- The only explosive residue detected in surface water samples was RDX. RDX was detected in only one sample collected from the western reach of Borrego Canyon Wash near Monitoring Well 01-MW207 at a concentration of 1 μg/L.
- Low concentrations of TPH-MO, TPH-D, and TPH-G were detected in three surface water samples collected near the pond and western reach of Borrego Canyon Wash. The maximum concentrations of TPH-MO, TPH-D, and TPH-G were 0.09 milligrams per liter (mg/L), 0.08 mg/L, and 0.05 mg/L, respectively.
- SVOCs, PAHs, and perchlorate were not detected in any surface water sample.
- Of the metals detected, aluminum, arsenic, barium, copper, iron, lead, and mercury exceeded their National Recommended Water Quality Criteria or risk-based screening values for aquatic life.

Human Health Risk Assessment (HHRA)

Surface and Subsurface Soil. The screening risk assessment (SRA) for surface and subsurface soil (i.e., comparison of data to U.S. EPA Region 9 residential and industrial PRGs) resulted in cumulative incremental cancer risks above the 10^{-6} point of departure. However, none of the cumulative incremental cancer risks exceeded 10^{-4}. Arsenic is the carcinogenic risk driver in soil; however, arsenic occurs naturally in soils at the site, and is present within background levels. Noncancer hazard indices (HIs) for direct exposure to surface and subsurface soil range between 5 and 10 for the residential scenario and are near 1 for the industrial scenario. Antimony, thallium, naphthalene, and 2-methylnaphthalene are the main contributors to the HI. However, the surface and subsurface HIs are based on chemicals that are reported at a low detection frequency of less than 5 percent of the samples. Maximum detections of these compounds were used to estimate the noncancer hazard. Indirect exposure to chemicals in soil that result from soil vapor migration into potential buildings may result in a slightly higher noncancer hazard.

The surface soil (0 to 2 feet bgs) and the subsurface soil (0 to 10 feet bgs) do not pose a significant risk for the construction worker, casual trespasser, or EOD Training Range supervisor exposure scenario as incremental cancer risks and HIs are near or below the acceptable target levels of $1x10^{-6}$ and 1, respectively.

Ephemeral Pond Sediment. The SRA for sediment in the Ephemeral Pond used U.S. EPA Region 9 residential soil PRGs for comparison. The assessment resulted in cumulative incremental cancer risks slightly above $1x10^{-6}$ for the residential scenario (but below the point of departure for the industrial scenario), which is primarily driven by the presence of arsenic. The concentrations of arsenic detected in sediment were less than those detected in surface and/or subsurface soil.

Groundwater. The SRA for exposure to groundwater resulted in cumulative incremental cancer risks of $1x10^{-3}$ under a high-end or reasonable maximum exposure (RME) assumption. Under an average exposure (or central tendency exposure [CTE]) assumption, cumulative incremental cancer risks are $9x10^{-5}$. Arsenic, benzene, trichloroethene (TCE), methylene chloride, and bis (2-ethylhexyl) phthalate (BEPH) were reported above their respective U.S. EPA Region 9 tap water PRGs. The

primary risk driver is TCE, which was only reported in the original groundwater sampling event in January 2002. TCE was not reported in subsequent groundwater monitoring events. Although the risk estimate for arsenic also exceeded $1x10^{-6}$, the maximum reported concentration (4.4 µg/L) is below the MCL of 5 µg/L. Estimated noncancer hazard indices from exposure to groundwater are approximately 10 for both RME and CTE scenarios. Perchlorate is a significant contributor to this hazard. TCE, thallium, chromium, and nickel slightly exceeded their tap water PRGs. Cumulative incremental cancer risks for future offsite residents potentially residing near IRP Site 1 are necessarily less due to groundwater mixing and potential biodegredation. The likelihood of groundwater in the vicinity to be used for residential drinking water is unknown but expectedly low. Groundwater was not evaluated in the site-specific risk-based evaluation since other site-specific receptors are not expected to become significantly exposed to groundwater.

The evaluation of potential vapor migration from groundwater through the soil column and into indoor air resulted in estimated ILCRs for the resident that were within the risk management range of 10^{-6} to 10^{-4}. Noncancer hazard estimates were below the target HI of 1. The cancer risk estimate was driven by TCE, for which the continued presence has not been confirmed.

Surface Water. The screening risk assessment for surface water used U.S. EPA Region 9 tap water PRGs for comparison. The assessment resulted in cumulative incremental cancer risks of $3x10^{-5}$, which is driven by arsenic. Only arsenic and RDX exceeded their respective tap water PRG. The concentration of arsenic detected in surface water was less than detected in groundwater. Noncancer HIs for surface water are less than 1.

Summary of Human Health Risks. In summary, the cancer risk estimates are below or within the EPA established risk management range of 10^{-4} to 10^{-6} for all media except groundwater. While the cancer risk estimate for groundwater exceeds $1x10^{-4}$, it is based on TCE, which has not been confirmed in groundwater by subsequent groundwater monitoring events. Noncancer hazards for groundwater exceed EPA's acceptable target hazard of 1. The majority of this risk is driven by the presence of perchlorate, TCE, nickel, and thallium. Based on the data collected and their evaluation in the risk assessment, further evaluation of groundwater may be necessary. Noncancer hazard estimates for other media are generally near or below one; however, indirect exposure to chemicals in soil that result from soil vapor migration into potential buildings could result in a slightly higher noncancer hazard. Much of the noncancer hazard for this potential exposure pathway is based on naphthalene which is infrequently detected.

Ecological Risk Assessment (ERA)

An ERA was conducted at IRP Site 1 to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. As a result of requests by regulators and comments received on the *Draft Screening ERA*, (Earth Tech 2003), four additional terrestrial species were added and the depth was increased from 0 to 2 feet to 0 to 6 feet bgs to represent the bird and mammal feeding guilds present at the site. This evaluation now uses the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and loggerhead shrike as representative birds. Additionally, to better represent potential exposure of deep burrowing animals, it was requested that soil samples from 0 to 6 feet bgs be used to represent surface soil conditions for ecological risk evaluation purposes, and that change has been made.

Although potential risk to aquatic life in surface water at IRP Site 1 is indicated for two COPCs (aluminum and barium) in the Ephemeral Pond, concentrations of these COPCs are not at levels that are likely to elicit adverse effects to the ephemeral aquatic community present. The aquatic life criteria that were used in the ecological Screening Risk Assessment (SRA) (Tier 1) and baseline

ecological risk assessment (BERA) (Tier 2, Step 3a) comparisons are for all aquatic life and are extremely conservative in nature. Given that ephemeral habitat species are well-adapted to environmental extremes, and that a viable and reproducing aquatic community existed in the pond during the 2005 sampling period, the conclusion is made that aluminum and barium do not pose risks to these aquatic life receptors in the IRP Site 1 Ephemeral Pond.

Based on refined exposure assumptions for sediment in the BERA, ecological risk from exposure to sediment at IRP Site 1 Ephemeral Pond does not present a significant threat of adverse effects to benthic receptors.

The potential risks (i.e., Hazard Quotient [HQ]) to the representative wildlife receptors were recalculated using Lowest Observable Effects Level (LOAEL)-based TRVs and reasonable maximum exposure point concentrations (EPCs) (the lesser of the 95 percent Upper Confidence Limit (UCL) of the mean estimated using the ProUCL software or the maximum reported concentration). The Tier 2 HQs for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples required for calculation and use of a 95 percent UCL). Calculated HQs for copper ranged from 2 to 3, and calculated HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPC is overestimated, and, thus the calculated HQ is overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected in less than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only three of the COPCs had calculated HQs greater than 1; calculated HQs for antimony ranged from 10 to 100, calculated HQs for total xylenes ranged from 7 to 50, and calculated HQs for 2,4-dinitrotoluene ranged from 8 to 10. The elevated HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. The HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. The HQs for 2,4-dinitrotoluene were driven by the maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. The HQs calculated for the three COPCs represent the exposure at the locations of the maximum detection only and overestimates the average exposure across the entire site and thus the risk to receptors across the entire site. Because of the low frequency of detection and limited distribution of the three COPCs, exposure of wildlife to the three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

The results of the ecological SRA and BERA evaluation suggest that the chemicals in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individual plant and invertebrates, if co-located with maximum reported detections of the COPCs, may suffer from adverse effects. No further evaluation to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1 is required.

Munitions and Explosives of Concern Risk Assessment

Based on the recovery of four safe-to-move MEC items in the Northern EOD Training Range, as well as the recovery of 776 MD items from all four investigation areas (the Northern EOD Training Range, Southern EOD Training Range, buffer zone, and Range perimeter) during the *Munitions and Explosives of Concern Range Evaluation* study, it is estimated that there are less than 2 safe-to-move energized MEC items present per acre at IRP Site 1. MEC risk was evaluated, based on the sampling results, for all four areas, assuming that the overall land use within the four areas of IRP Site 1 will remain consistent with past EOD training activities. Each area was evaluated using three risk factors

- accessibility assessment, overall hazard assessment, and exposure assessment. The explosivity risk would be higher for any activity that results in more land disturbance (such as future housing development) than the like use scenario due to higher potential for encountering MEC items.

CONCLUSIONS

Data obtained during the Phase II RI were combined with data from previous investigations to resolve the decision questions developed during the data quality objective (DQO) process in the Phase II RI Work Plan.

The following answers were obtained for the project Decision Questions. A more thorough evaluation of the conclusions follows these answers:

1. *Are the analytical data from shallow (less than 10 feet bgs) soil samples adequate to characterize the risk, or are additional data required?*

   Yes, both the HHRA and the ERA were satisfactorily completed with the soil data that was collected.

2. *Has the lateral extent of the impacted shallow soil been defined or are additional data required?*

   Yes, the results of the investigation indicated that the impacted shallow soil has been defined and is located only in the central portion of the site.

3. *Does the contamination extend beyond 10 feet bgs (i.e., is the vertical extent defined)?*

   Investigation results indicate with one exception, that COPCs are restricted to the shallow soil (less than 5 feet bgs). At one location low concentrations of COPCs were present to a maximum depth of 35 feet bgs; this is likely to be the only location where contamination has affected deeper soil.

4. *Do the existing groundwater monitoring wells adequately characterize impact to groundwater or is there a need for additional wells?*

   Yes, existing groundwater monitoring wells adequately characterize impact to groundwater; however, there may be a need for additional wells in support of the Feasibility Study (FS).

5. *Is surface water runoff an exposure pathway?*

   Yes, surface water runoff is a potentially complete pathway during significant rain events, based on observations made during the 2004-2005 winter season.

6. *Have potential human and ecological receptors been identified, and are they likely to be at risk for adverse health effects at this site?*

   Yes, all potential human and ecological receptors have been identified. Based on an evaluation of the data conducted during the risk assessment, IRP Site 1 poses low risk to human health; however, an elevated HI indicates that further evaluation of groundwater may be warranted. The results of the SRA and BERA evaluation indicate that IRP Site 1 poses low risk and no further evaluation is necessary to protect aquatic, benthic, or terrestrial ecological receptors.

7. *Do the concentrations of target analytes in the Ephemeral Pond sediments (located in the northern portion of IRP Site 1) exceed the established decision thresholds (for Riverside fairy shrimp [a Federally-endangered species])?*

   Yes, the concentrations of target analytes in the Ephemeral Pond sediments exceed the established decision thresholds. However, based on refined exposure assumptions for sediment and water within the pond, it is concluded that aquatic and benthic organisms are not at risk of adverse effects.

8. *Do the data suggest that the perchlorate detected downgradient from IRP Site 1 is related to IRP Site 1 releases?*

   Yes, the data suggests that the perchlorate detected downgradient from IRP Site 1 is likely related to IRP Site 1 releases.

Nature and Extent of Contamination

The soil investigations generated sufficient data to define the lateral and vertical extent of contamination at IRP Site 1. These investigations indicate that low concentrations of VOCs, SVOCs, explosives residues, hydrocarbons, and perchlorate are present at the site. For the most part, these COPCs are below the U.S. EPA Region 9 residential and/or industrial PRGs, and are restricted to the shallow soil (less than 5 feet bgs). However, at one location low concentration of the COPCs were present to a depth of 35 feet bgs, which is likely to be the only location where contamination has affected deep soil. The soil samples collected from the area in the vicinity of the proposed open burn facility (related to the Resource Conservation and Recovery Act [RCRA] Part B Permit Application) also indicated negligible contamination.

Negligible VOC, SVOC, and hydrocarbon contamination is present in IRP Site 1 groundwater. The only significant contaminant in the IRP Site 1 groundwater is perchlorate. The highest concentrations of perchlorate (exceeding its DWEL [EPA 2006] by over 1 order of magnitude) are present in the groundwater in the central portion of IRP Site 1. In addition, relatively high concentrations of perchlorate are present in groundwater south of IRP Site 1 and in the aquifer between IRP Site 1 and IRP Site 2, particularly along the western reach of Borrego Canyon Wash.

RCRA Facility Closure

Consistent with agreements made during the preparation of the Phase II RI Work Plan (Earth Tech 2001a), this RI Report incorporates substantive requirements of the RCRA facility closure process for the proposed Open Burn/Open Detonation (OB/OD) Unit at IRP Site 1. The Department of the Navy (DON) maintains that activities conducted at Former EOD Training Range were not regulated under RCRA.

The DON included a table cross-referencing the RCRA closure checklist into the final Phase II RI Work Plan (Earth Tech 2001a). This table provides a cross-reference of where the substantive RCRA closure requirements are addressed in the RI Report and subsequent Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents. As indicated in a Department of Toxic Substances Control (DTSC) letter dated 19 March 2001, closure and post-closure requirements apply to the OB/OD Unit located within the investigation boundary (assumed to be the CERCLA investigation). The RI encompasses the area shown in the Part A Permit Modification submitted by the Marine Corps to EPA Region 9 in June 1988. The DON will continue to evaluate this area as an integral component of the IRP Site 1 RI and will incorporate, as necessary, the substantive closure and post-closure requirements into the response action process.

Human Health Risk

To evaluate the risk for adverse health effects due to contaminants at IRP Site 1, a human-health screening risk assessment was conducted for surface and subsurface soil, sediments, groundwater, and surface water at the site. The HHRA conducted for surface and subsurface soil at IRP Site 1 indicates that health risks for a construction worker, casual trespasser, or EOD Training Range supervisor are generally acceptable. Additionally, sediments in the Ephemeral Pond do not pose a significant risk under any of the construction worker, casual trespasser, or EOD Training Range supervisor exposure scenarios. While the risk estimate for groundwater exceeds 10^{-4}, it is based on the potential presence of TCE which was reported in groundwater only during the first monitoring event. TCE has not been reported in groundwater during subsequent groundwater monitoring events suggesting that current conditions are not represented by data collected historically. Noncancer hazards for groundwater in the screening level evaluation are driven by perchlorate. However, it should be noted that there is no current use of groundwater at the site and the future use of this medium is believed to be unlikely.

In the site-specific risk-based evaluation, excess cancer risks for all receptors and considered media were below the lower bound (10^{-6}) of the cancer risk management range. The highest non-cancer HI of 3 was calculated for the construction/utility worker potentially exposed to subsurface soil. Considering the inherent protectiveness built into establishment of the reference dose (RfD), an HI value of 3 is considered only marginally greater than 1.0.

Ecological Risk

An ERA was conducted at IRP Site 1 to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. The evaluation uses the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and loggerhead shrike as representative birds. Soil samples from 0 to 6 feet bgs are used to represent potential exposure of deep burrowing animals.

The results of the SRA Tier 1 and BERA Tier 2, Step 3a ecological risk evaluation indicates no potential for adverse ecological effects to benthic organisms exposed to IRP Site 1 Ephemeral Pond sediments or aquatic organisms exposed to surface water in the pond or in runoff. Surface water chemicals were not found at concentrations that threaten adverse effects to the Riverside fairy shrimp. Chemicals in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individuals may suffer from adverse effects.

The results of the ecological SRA and BERA evaluation indicate no further evaluation is necessary to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1.

Munitions and Explosives of Concern

An explosives safety assessment was performed at IRP Site 1 to evaluate the risks due to MEC contamination at the site. The explosive safety risk assessment concluded that due to the potential for buried MEC, elevated risk is present at the Northern EOD Training Range, with slightly elevated risk at the Southern EOD Training Range caused by potential for kick-outs.

Recommendations

On the basis of results from the human-health and MEC risk assessments performed for IRP Site 1, it is recommended that an evaluation for conducting a response action for perchlorate-impacted groundwater, as well as an evaluation for removal of MEC from soil be included in the remedial alternatives evaluated in the FS for IRP Site 1. In addition, since the incremental cancer risk for

naphthalene in soil falls in the risk management range of 10^{-4} to 10^{-6}, it is also recommended that a human-health-based removal of naphthalene-impacted soil from the central portion of IRP Site 1 be included in the remedial alternatives evaluated in the FS. It is anticipated that a human-health-based removal action conducted for naphthalene-impacted soil would also likely reduce ecological risk at the site, and no further action would be required to further reduce risks to ecological receptors.

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ACRONYMS AND ABBREVIATIONS

%	percent
<	less than
±	plus or minus
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
1,2-DCE	1,2,-dichloroethene
2,3,7,8,-TCDD	2,3,7,8–tetrachlorodibenzodioxin
ABS	absorption factor
AF	adherence factor
Air SWAT	air quality solid waste assessment test
AL	action level
ALARA	as low as reasonably achievable
Am	americium
ASTM	American Society of Testing and Materials
AT	average time
B	the value is below the reporting limit but above the minimum detection limit
BAF	bioacculation factor
BCF	bioconcentration factor
BCFp	bioconcentration factor - plant
BCT	BRAC Cleanup Team
BEPH	bis(2-ethylhexyl)phthalate
BERA	baseline ecological risk assessment
bgs	below ground surface
BHHRA	baseline human health risk assessment
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, xylenes
BW	body weight
Cal-EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDHS	California Department of Health Services
CDI	chronic daily intake
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	conversion factor
CFR	Code of Federal Regulations
ClO_4-	perchlorate
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm	centimeter
cm^2	square centimeter
cm^2/event	square centimeter per event

COC	chain of custody
COPC	chemical of potential concern
CRWQCB	California Regional Water Quality Control Board
CSF_i	inhalation cancer slope factor
CSF_o	oral cancer slope factor
CSM	conceptual site model
CSS	coastal sage scrub
CTE	central tendency exposure
CTO	contract task order
DCE	dichloroethene
DCGL	derived concentration guideline level
DG	data gap
DoD	Department of Defense
DOE	Department of Energy
DON	Department of the Navy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
dup	duplicate sample
dw	dry weight
DWEL	drinking water equivalent level
Earth Tech	Earth Tech, Inc.
EBS	Environmental Baseline Survey
ECP	Environmental Condition of Property
ED	exposure duration
EF	exposure frequency
EFH	exposure factors handbook
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
EM	electromagnetic
EOD	explosive ordnance disposal
EPC	exposure point concentration
ERA	ecological risk assessment
ESS	Explosives Safety Submittal
ET	exposure time
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FFA	Federal Facilities Agreement
FI	fraction ingested
FOST	finding of suitability to transfer
FS	feasibility study
FS smoke	sulfur-trioxide chlorosulfonic acid
ft	feet
GC/MS	gas chromatography/mass spectrometry
Geochron	Geochron Laboratory

GI	gastrointestinal
GPR	ground-penetrating radar
GPS	global positioning system
G-RAM	general radioactive material
HCI	hydrochloric acid
HHRA	human health risk assessment
HI	hazard index
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient
HRA	historical radiological assessment
ID	identification
ILCR	incremental lifetime cancer risk
in	inches
IRA	inhalation factor
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IRS	ingestion rate of soil
J	the concentration is an estimated value
JATO	jet-assisted take-off
JEG	Jacobs Engineering Group, Inc.
JN	estimated value, tentative identification of this analyte was based on presumptive evidence
KEA	KEA Environmental
kg	kilograms
kg/mg	kilograms per milligram
L	liter
LA Basin	Los Angeles Basin
LLNL	Lawrence Livermore National Laboratory
LOAEL	lowest-observed-adverse-effect-level
m^3/day	cubic meters per day
m^3/hour	cubic meters per hour
m^3/kg	cubic meters per kilogram
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MD	munitions debris
MDL	method detection limit
MEC	munitions and explosives of concern
MF	modifying factor
mg-$CaCO_3$	milligrams as calcium carbonate
mg/cm^2	milligrams per square centimeters
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/kg dw	milligrams per kilogram on a dry weight basis

mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mg-N/L	milligrams per liter as nitrogen
mm	millimeter
mrem	millirem
MSL	mean sea level
mV	millivolt
mya	million years ago
N	nitrogen
n/a	not applicable
NA	not applicable
NaI	sodium iodide
NAVFAC EFD	Naval Facilities Engineering Command Engineering Field Division
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	nondetect or not detected
NDMA	N-nitrosodimethylamine
NAVFAC SW	Naval Facilities Engineering Command Southwest
NFESC	Naval Facilities Engineering Service Center
ng/kg	nanograms per kilogram
NOAEL	no-observed-adverse-effect-level
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRWQC	National Recommended Water Quality Criteria
NS	not sampled
NTP	National Toxicology Program
OB/OD	open burn/open detonation
OE	ordnance and explosives
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
PACDIV	Pacific Division, Naval Facilities Engineering Command
PAH	polycyclic aromatic hydrocarbon
PAL	provisional action level
Pb	lead
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PEF	particulate emission factor
pH	negative log of the hydrogen ion concentration
PHC	petroleum hydrocarbons
PRE	preliminary risk evaluation
PRG	preliminary remediation goal
QA	quality assurance
QC	quality control

R	rejected data
R3M	range rule risk methodology
Ra 226	radium 226
RAGS	Risk Assessment Guidance for Superfund
RASP	Radiological Affairs Support Program
RBCA	risk-based corrective action
RBS	risk-based screening
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radiation
RDX	cyclotrimethylenetrinitramine
RfC	reference concentration
RfD	reference dose
RfDo	oral reference dose
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RL	reporting limit
RME	reasonable maximum exposure
RTK	real-time kinematic
SA	skin surface area
SAIC	Science Applications International Corporation
SEA	site evaluation accomplished
SOP	standard operating procedure
SQL	sample quantitation limit
SRA	screening risk assessment
SSL	soil screening level
SSRBE	site-specific risk-based evaluation
SUF	site use factor
SVOC	semivolatile organic compound
SWAT	solid waste assessment test
SWDIV	Southwest Division, Naval Facilities Engineering Command
TAL	target analyte list
TCDD	tetrachlorodibenzodioxin
TCE	trichloroethene
TCR	target cancer risk
TEDE	total effective dose equivalent
TEF	toxicity equivalency factor
TEQ	toxicity equivalency quotient
TFH	total fuel hydrocarbons
Th	thorium
THQ	task hazard quotient
TOC	top of casing
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons as diesel fuel
TPH-G	total petroleum hydrocarbons as gasoline

TPH-MO	total petroleum hydrocarbons as motor oils
TRPH	total recoverable petroleum hydrocarbons
TRV	toxicity reference value
TU	tritium units
U	not detected above the indicated laboratory reporting limit
U^{238}:U^{235}	ratio of U^{238} to U^{235} (U= Uranium)
UF	uncertainty factor
UCL	upper confidence limit
UJ	indicates the compound or analyte was analyzed for but was not detected; and the sample detection limit is an estimated value
U.S.	United States
USACE	United States Army Corps of Engineers
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps
UXO	unexploded ordnance
VOC	volatile organic compound
Weston	Roy F. Weston
WOE	weight of evidence
WHO	World Health Organization
WHO-TEQ	World Health Organization toxicity equivalent quotient

1. Introduction

This Report documents the procedures and findings of the Phase II Remedial Investigation (RI) conducted at Installation Restoration Program (IRP) Site 1, the Explosive Ordnance Disposal (EOD) Training Range, at Former Marine Corps Air Station (MCAS), El Toro, California (Figure 1-1). This Report is a primary deliverable required under a Federal Facility Agreement (FFA) signed in October 1990 by the United States (U.S.) Marine Corps/Department of the Navy (DON), U.S. Environmental Protection Agency (EPA) Region IX, California Department of Health Services (part of which is currently the Department of Toxic Substances Control [DTSC]), and the California Regional Water Quality Control Board, Santa Ana Region (CRWQCB). The investigation was performed by Earth Tech Inc., on behalf of the Base Realignment and Closure (BRAC) Program Management Office West and Naval Facilities Engineering Command Southwest (NAVFAC SW; formerly abbreviated as SWDIV), as authorized by the Pacific Division Naval Facilities Engineering Command under contract task order (CTO) no. 0072 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048. This Report complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) in 40 Code of Federal Regulations (CFR) Part 300.

The Phase II RI was performed in accordance with the Phase II RI Work Plan (Earth Tech 2001a) finalized in November 2001, as well as Sampling and Analysis Plan Amendment No. 1 (Earth Tech 2004a), Sampling and Analysis Plan Amendment No. 2 (Earth Tech 2002), and Sampling and Analysis Plan Amendment No. 3 (Earth Tech 2005) The following guidance documents were extensively used in preparation of this Report:

- Guidance for Conducting Remedial Investigation (RI) and Feasibility Studies (FS) Under CERCLA (Interim Final) – EPA Guidance (EPA 540-G-89-004) (EPA 1988)
- Department of the Navy Installation Restoration Program Manual (Draft), 2001 Update (DON 2001a).

1.1 Report Objectives

The objectives of the Phase II RI were to further characterize the physical attributes of IRP Site 1, including geology and hydrogeology, evaluate the nature and extent of contaminants, and assess risk to human health and the environment. This Report presents the methods and conclusions of various field investigations conducted as a part of Phase II RI investigation. The results of the Phase II RI were combined with the results of previous studies at IRP Site 1 for comprehensive delineation of the nature and extent of contamination at the site. The findings and conclusions of this Report will be used to support the decision-making process for further courses of action in conjunction with future land use.

The general approach of the Phase II RI was to conduct the field investigation in stages such that each successive data collection activity was planned and conducted based on the results of the preceding stage. In this way, the site characterization efforts were continually scoped to minimize the collection of unnecessary data and maximize data quality. As described in the *Phase II RI Work Plan* (Earth Tech 2001a), the scope of Phase II RI field activities was also defined based on the results of previous investigations. This was done to ensure that the concerns and the areas of potential contamination identified by the previous studies were adequately addressed.

1.2 INTEGRATION OF RCRA CLOSURE REQUIREMENTS

Consistent with agreements during the preparation of the Phase II RI Work Plan (Earth Tech 2001a), this RI Report incorporates substantive requirements of the Resource Conservations and Recovery Act (RCRA) facility closure process for the proposed Open Burn/Open Detonation (OB/OD) Unit at IRP Site 1. The DON maintains that activities conducted at the former EOD Training Range were not regulated under the RCRA.

The DON included a table cross-referencing the RCRA closure checklist into the final Phase II RI Work Plan (Earth Tech 2001a). This table provides a cross-reference of where the substantive RCRA closure requirements are addressed in the RI Report and subsequent CERCLA documents. This table is provided as Appendix A to this Report. As indicated in a DTSC letter dated 19 March 2001, closure and post-closure requirements apply to the OB/OD unit located within the investigation boundary (assumed to be the CERCLA investigation). The RI encompasses the area shown in the Part A Permit Modification submitted by the Marine Corps to EPA Region 9 in June 1988. The DON will continue to evaluate this area as an integral component of the IRP Site 1 RI and will incorporate, as necessary, the substantive closure and post-closure requirements into the response action process.

1.3 SITE BACKGROUND

1.3.1 Site Description

Former MCAS El Toro is located in a semi-urban area of southern California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach (see Figure 1-1). Former MCAS El Toro covers approximately 4,738 acres. Land use around Former MCAS El Toro includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the BRAC Act.

IRP Site 1 is located in the northeast portion of Former MCAS El Toro in the foothills of the Santa Ana Mountains (see Figure 1-2). IRP Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above mean sea level (MSL). IRP Site 1 includes the Northern EOD Training Range (16.9 acres) and the Southern EOD Training Range (16.6 acres) (BNI 1995).

1.3.2 MCAS El Toro History

Initial work conducted by the DON at Former MCAS El Toro included an initial assessment study during 1985 (NEESA 1986). This study identified 17 potentially contaminated sites at Former MCAS El Toro, nine of which were recommended for confirmation, which included IRP Site 1.

Due to volatile organic compound (VOC) contamination at Former MCAS El Toro boundary and in agricultural wells to the west, Former MCAS El Toro was added to the National Priorities List (NPL) of the Superfund Program on 15 February 1990. The Marine Corps/DON signed a FFA in October 1990 with the EPA Region IX, DTSC, and the CRWQCB.

In March 1993, Former MCAS El Toro was placed on the list of military facilities scheduled for closure under the BRAC act. A BRAC Cleanup Team (BCT), including representatives from NFECSW SDIEGO, EPA, DTSC, and CRWQCB, was formed to oversee implementation of the FFA.

Implementation of the FFA at Former MCAS El Toro included the following investigations and studies: Air Quality Solid Waste Assessment Test (Air SWAT), Phase I RI, Phase II RI, and an FS. Groundwater sampling is conducted Stationwide on a routine basis by the Navy.

M60050_003916
MCAS EL TORO
SSIC NO. 5090.3.A

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 1-1 AND 1-2

FOR ADDITIONAL INFORMATION, CONTACT:

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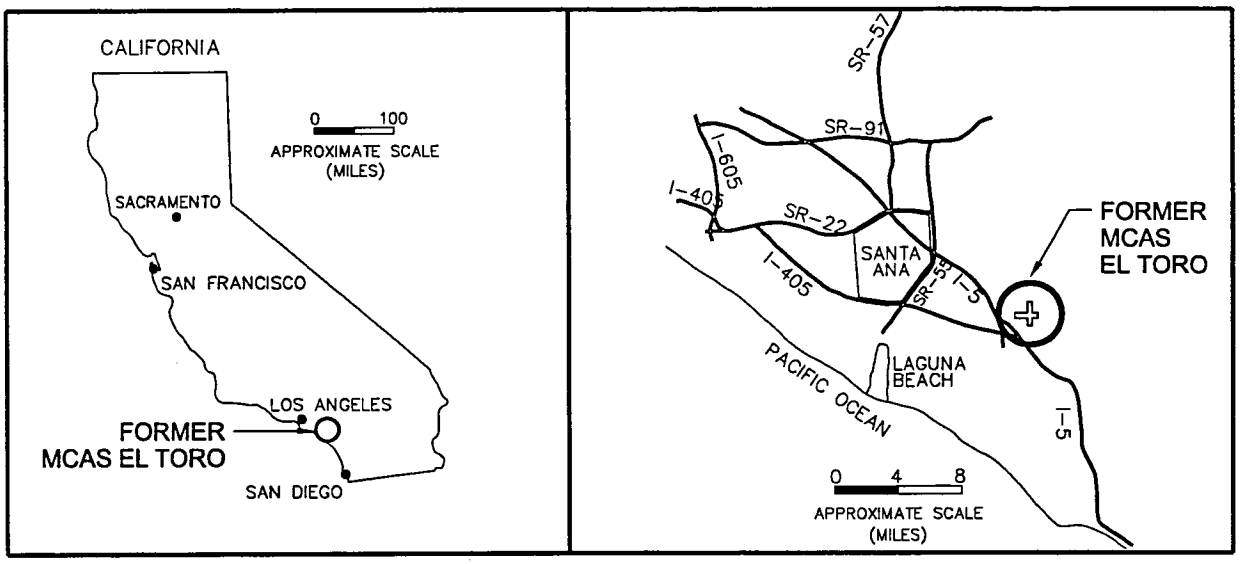

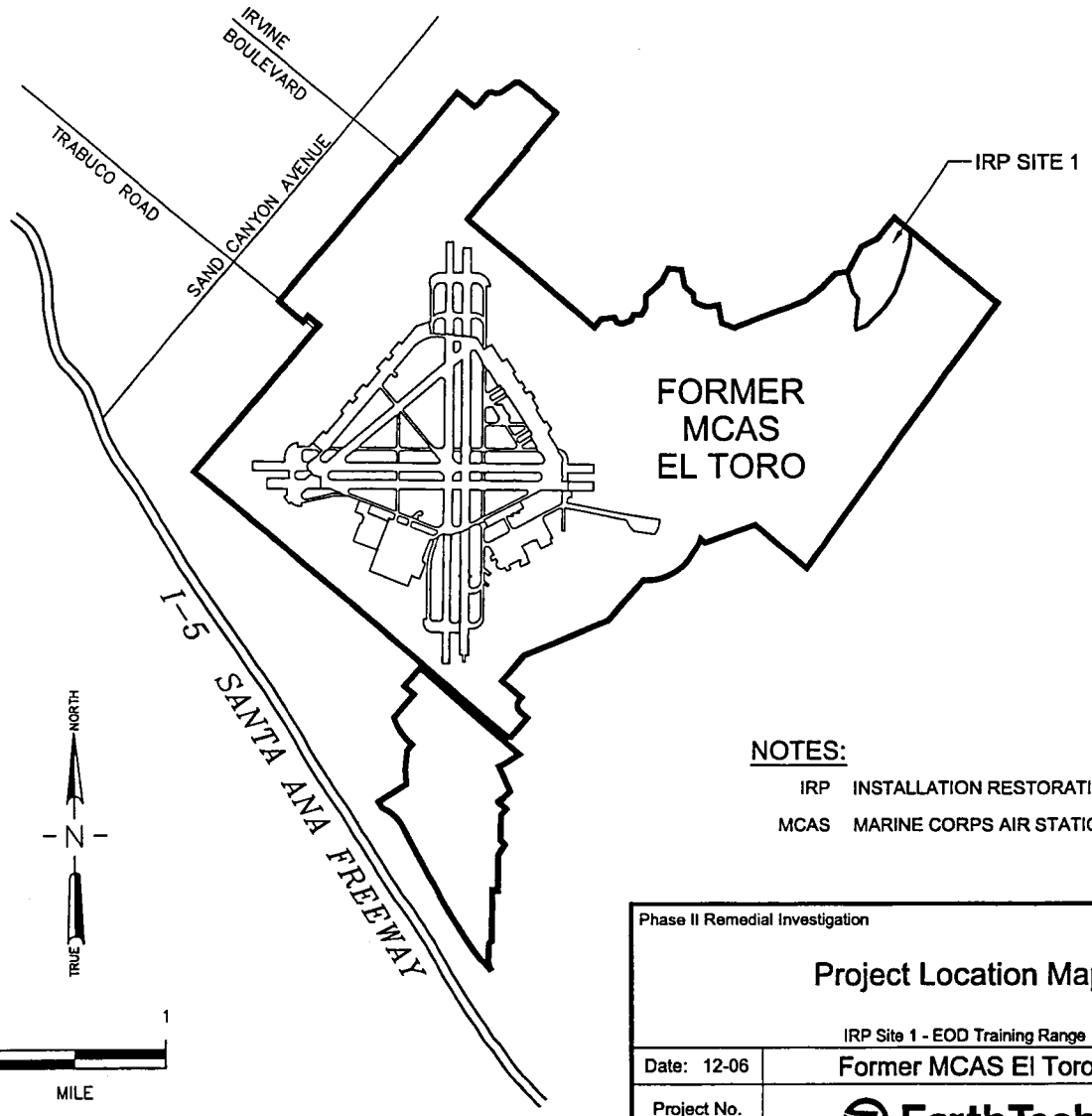

NOTES:

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

Phase II Remedial Investigation		Final
Project Location Map IRP Site 1 - EOD Training Range		
Date: 12-06	Former MCAS El Toro	Figure 1-1
Project No. 36097	EarthTech A Tyco International Ltd. Company	

File: L:\work\3c...\Site 1 RI\Final\FIGURE 1-1.dwg Time: Dec 22, 2006 - 1:39pm

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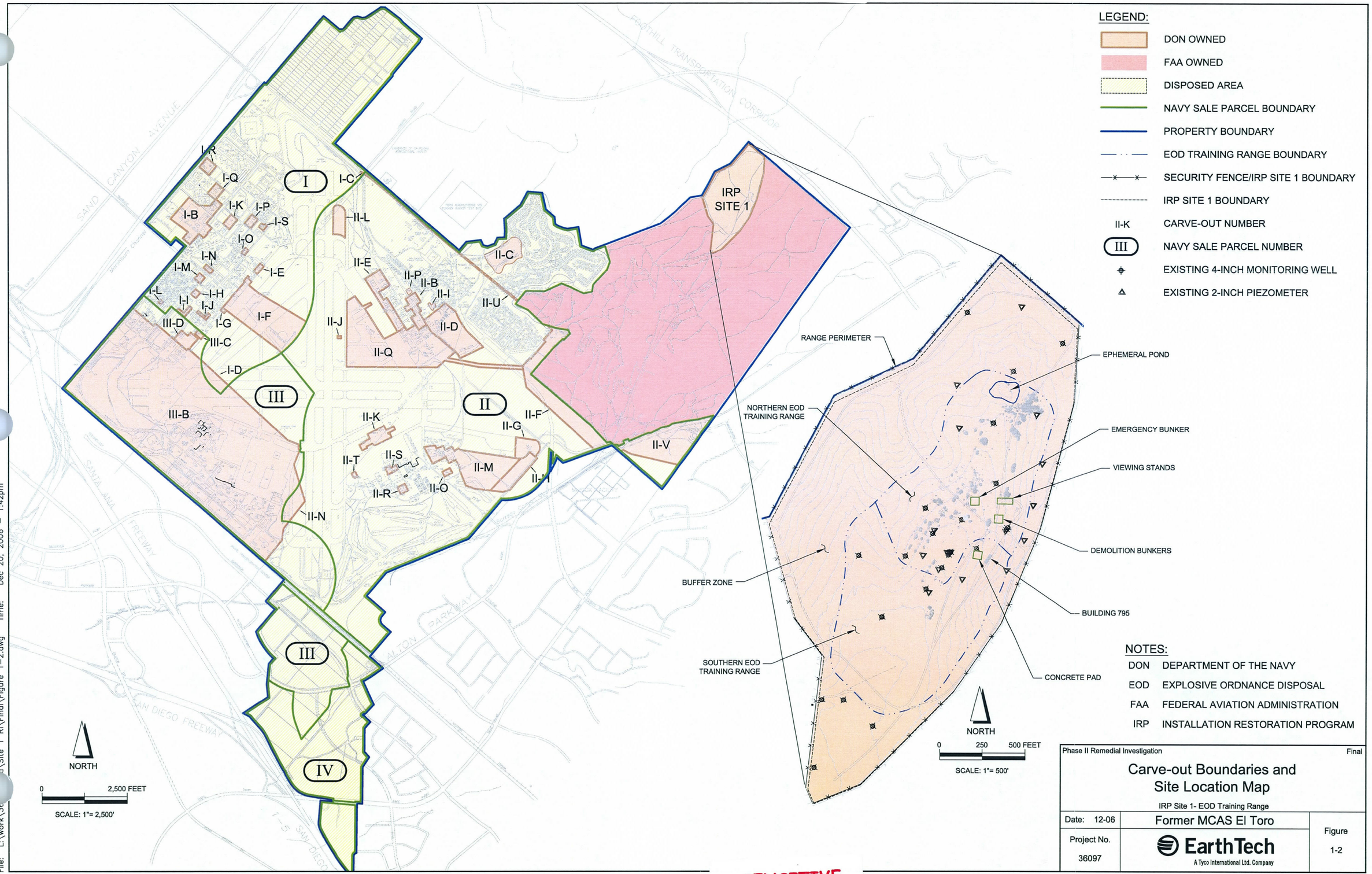

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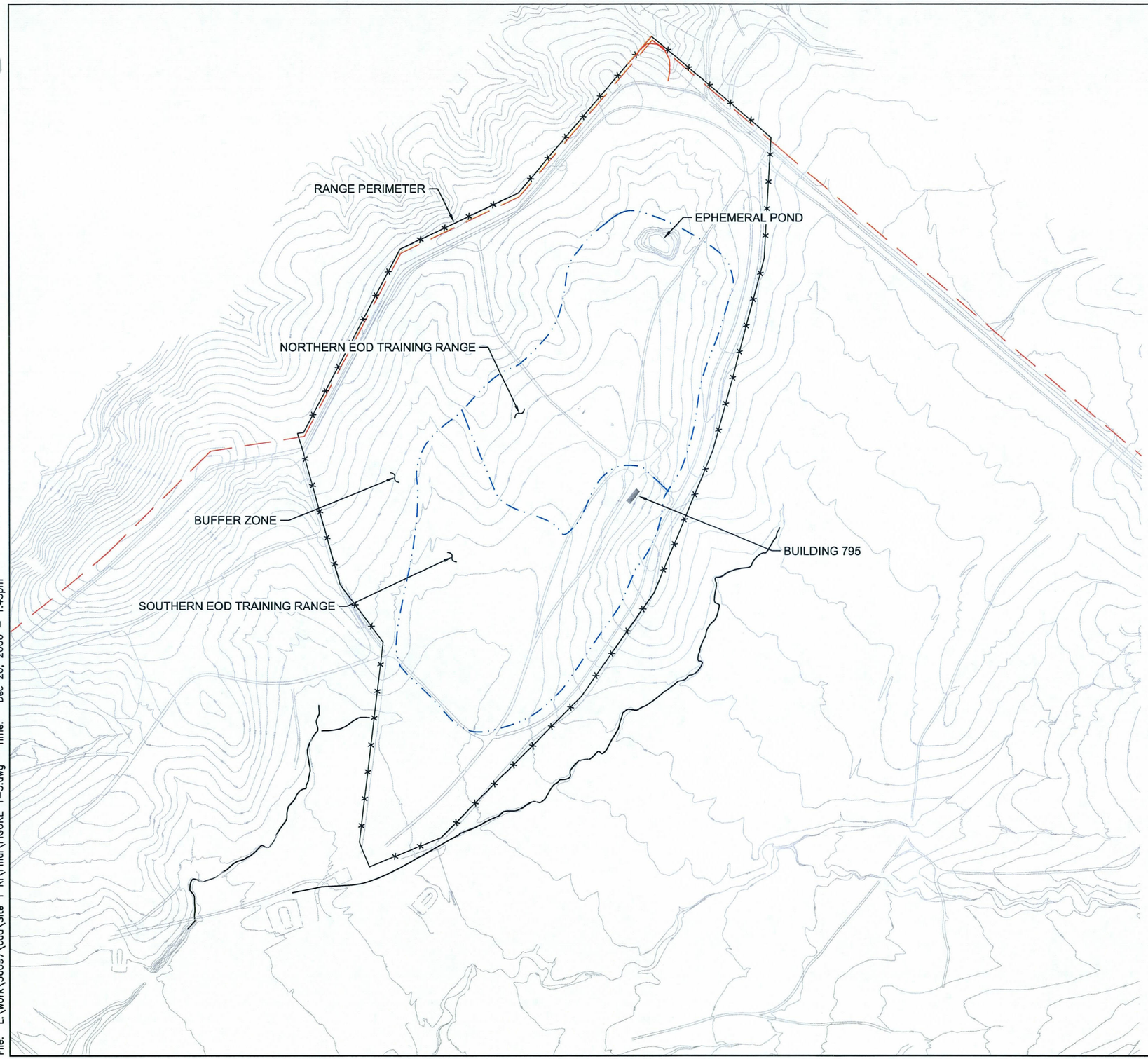

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- STREAM OR WASH

NOTES:

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Site Plan

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure 1-3
Project No. 36097	EarthTech — A Tyco International Ltd. Company	

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1.3.3 IRP Site 1 History

1.3.3.1 Explosive Ordnance Disposal Activities at IRP Site 1

Training for EOD and detonation of munitions has been conducted at IRP Site 1 since 1952 (BNI 1995). Use of the EOD Training Range has been discontinued with the closure of Former MCAS El Toro on 2 July 1999.

The majority of recent military EOD training took place at the Northern EOD Training Range. The Southern EOD Training Range was used for EOD training by the Orange County Sheriff's Department and Federal agencies (BNI 1995). Several demolition pits, a range building, and a former observation bunker constructed from metal ammunition cans are present at IRP Site 1. Many of these metal cans were reported to be filled with the burned residue of disposed munitions such as cartridge-actuated devices and 20 millimeter (mm) ammunition (USACE 1998).

Military ordnance used at the site included hand grenades, land mines, cluster bombs, smoke bombs, and rocket warheads. Civilian and commercial explosives, such as dynamite, and plastic and gelatinous explosives have been used at the EOD Training Range. Munitions were detonated in trenches and pits, which were periodically filled with soil and then reexcavated. Limited historical information suggests that rocket motors or Jet-Assisted Take-Off (JATO) units were disposed at IRP Site 1. In 1982, approximately 2,000 gallons of sulfur trioxide chlorosulfonic acid (FS smoke) were reportedly burned in trenches located in the northern portion of the site. An estimated 300,000 gallons of petroleum fuels were burned during disposal from 1952 through 1993 (JEG 1993a).

In addition, there are unconfirmed reports that low-level radioactive material was disposed at the site (NEESA 1986). Perchlorate was identified as a potential contaminant of concern at IRP Site 1 due to its use in explosives and solid rocket propellants.

1.3.3.2 Federal Bureau of Investigation Training Activities at IRP Site 1

For many years, the Department of Justice, Federal Bureau of Investigation (FBI) used IRP Site 1 for training purposes (FBI 2000). The following paragraphs summarize the FBI's training and emergency response operations.

Bomb Technician Training. Bomb technician training consisted of "hands on" explosive training one day per month. Bomb technicians demonstrated proficiency in firing both an electrical and nonelectrical charge. This training also included testing of new explosive products to determine their applicability to EOD operations. Generally, this involved only a few ounces of the material, and demolition was initiated off the ground on a hard target surface.

Post-Blast Investigation Training. Post-blast investigation training was held about four times per year and emphasized the identification, location, access, and recovery of explosive devices and any products surviving demolition. Various devices were detonated, and students secured and located, collected, and identified the fragmentation and components from the devices to reconstruct the devices.

Emergency Response Operations. The EOD Training Range at IRP Site 1 served as a technical training area for the use and study of emergency explosive device responses. However, during emergency response operations, the FBI periodically transported improvised explosive devices to IRP Site 1 and rendered them safe either by disassembly or by the use of counter-charges. These types of operations occurred intermittently when devices were located by the FBI or by local law enforcement.

1.3.3.3 PROPERTY TRANSFER AND PROPOSED REUSE

IRP Site 1 was originally going to be transferred to the FBI. Upon transfer, the FBI planned to use the property for purposes similar to the past use for EOD training (Earth Tech 2001c). To accommodate immediate use of a portion of the property, the DON planned to allow access and use of an approximately 3.3-acre area in the southern portion of the site by the FBI prior to the completion of the CERCLA process for the entire site. This area was to be made available to the FBI immediately following transfer. Since that time, the Federal Aviation Administration (FAA) has expressed interest in receiving the entire site and allowing the FBI to use the site for EOD training.

This investigation has been conducted by the DON to satisfy the requirements of the CERCLA process and includes site characterization and evaluation of baseline risk to human health and the environment. After completion of the CERCLA process, the Navy intends to transfer the site to a landowner who will use the site similar to its past use.

1.4 PREVIOUS AND CONCURRENT INVESTIGATIONS

Various environmental investigations have been performed at Former MCAS El Toro, mostly as a part of the CERCLA process. Table 1-1 briefly summarizes the studies pertinent to IRP Site 1 prior to the Phase II RI and their salient findings. Table 1-2 summarizes the various studies associated with the Phase II RI. Table 1-3 summarizes environmental studies at IRP Site 1 that were performed concurrently with the Phase II RI activities.

The methods and procedures of the significant previous and concurrent investigations, which influenced the scope of Phase II RI and defined the nature and extent of contamination at IRP Site 1 are described in the following sections. The description of the studies is divided into the following categories:

- Geophysical Surveys
- Ordnance and Explosives Range Evaluation
- Ecological Evaluation
- Soil Investigations
- Groundwater Investigations

Table 1-1: Summary of Previous Environmental Studies at IRP Site 1

Year	Investigation/Study	Objectives	Scope	Summary of Findings
1986	*Initial Assessment Study* (Brown and Caldwell 1986)	Identify and assess sites at Former MCAS El Toro posing a potential threat to human health or the environment due to contamination from past hazardous materials operations.	The study focused on past hazardous substance storage, use, and disposal practices at Former MCAS El Toro. Operations occurring at the time were investigated to determine what types and quantities of chemicals or other materials were used and the disposal methods that were practiced Stationwide.	Identified two 100-foot diameter pits. Approximately 2,000 gallons of drummed FS Smoke were burned in 1982.
1991	*Geophysical Survey* (JEG 1991)	Identify areas where training had occurred and where potential buried materials exist.	Survey covered only parts of EOD Training Range. Survey consisted of electromagnetic (EM) and ground-penetrating radar (GPR) techniques.	Geophysical anomalies were identified throughout the area surveyed based on EM techniques.
1991	Site Analysis (EPA 1991c)	Analysis of aerial photography and assessment of the site by attempting to locate potential contamination sources.	Analysis of past findings relative to disposal activities.	In 1952, trench activity and staining were noted. Until 1991, possible contamination from ordnance disposal, including low-level radioactive wastes, was visible at the site.
1993	*Phase I RI* (JEG 1993a)	Determine the nature and extent of contamination resulting from EOD Training Range and evaluate human health and ecological risks.	Sampling consisted of the collection of four surface soil samples and installation of two downgradient monitoring wells (01-DGMW57 and 01-DGMW58).	No further investigation was recommended until base closure. Investigation results indicated that human health or ecological risk thresholds were not exceeded.
1993	*Phase II RI (Basewide)* (JEG 1993b)	Further characterize potential impact to human health and environment at Former MCAS El Toro.	No work proposed due to the continued operation of the EOD Training Range.	Recommended further investigation at IRP Site 1 following the cessation of EOD training upon closure of Former MCAS El Toro.
1993	*Final Report Aerial Photograph Assessment* *(SAIC 1993)*	Analysis of aerial photography to identify areas of environmental concern.	Detailed the findings of the sites located in several areas, and the areas of potential concern outside the boundaries.	The assessment concluded that additional investigation was not recommended based on 1958 photographs. 1960 photographs showed several stains and a trench with probable liquid.
1998	*Range Identification and Preliminary Range Assessment* (USACE 1998)	Provide a historical baseline for Former MCAS El Toro's active and inactive Ranges. Provide data needed for the initial steps of the Range Rule methodology.	The study compiled information required by the Range Rule from existing sources (did not include sampling of the Ranges).	A list of the types of munitions and their estimated quantities employed to destroy unserviceable items was presented. Unexploded ordnance (UXO) was estimated at less than 1 per acre. Possibility of "kick-outs," or live munitions that are not destroyed, were considered to be unlikely due to the tilling of the Range grounds twice a year. For the past few years, the Range areas were plowed up as part of Range clearances. The depth of munitions was estimated at approximately 18 inches or less, which is the approximate depth of discing at the site.
1998	*Stationwide Perchlorate Evaluation* (BNI 1999a)	Evaluate the presence of perchlorate in groundwater beneath Former MCAS El Toro.	Evaluation included sampling of existing groundwater monitoring wells at IRP Site 1.	Evaluation revealed the presence of perchlorate above the State Provisional Action Level (PAL) (in effect in 1999) in one well (01-MW201) at IRP Site 1. Further evaluation of IRP Site 1 was recommended.

Year	Investigation/Study	Objectives	Scope	Summary of Findings
1999	*Verification of Perchlorate Technical Memorandum* (Earth Tech 2001b)	Verify the presence of perchlorate in soil and groundwater beneath IRP Site 1.	Installed six groundwater monitoring wells (01-MW202 through 01-MW207) and collected shallow and deeper soil samples. Soil and groundwater samples from new and existing wells were analyzed for perchlorate.	Investigation results confirmed the presence of perchlorate above the State and Federal PAL (in effect in 1999) in one well (01-MW201) and concluded that perchlorate in groundwater was probably localized near this well. All detected concentrations of perchlorate in the soil were below residential preliminary remediation goals (PRGs).
1999	Geophysical survey from the northern portion of the EOD Training Range, *Verification of Perchlorate Technical Memorandum* (Earth Tech 2001b)	Provide updated geophysical evaluation of buried debris at IRP Site 1.	Survey was conducted using EM techniques and focused on areas where detonation training occurred at IRP Site 1.	Several geophysical anomalies were detected. The largest anomaly, indicative of detonation pits, was detected in the northeast portion of the Northern EOD Training Range. A number of linear anomalies indicative of former trenches were also detected in the Northern EOD Training Range.
1999	*Technical Memorandum, Phase I Radionuclide Evaluation at Former Landfill Sites and the EOD Range* (Earth Tech 2000)	Evaluate uranium isotopes in groundwater beneath landfill sites and IRP Site 1.	Uranium isotope analysis of groundwater samples collected.	Low radionuclide concentrations were reported in samples from IRP Site 1. Further evaluation using higher resolution methodologies was recommended to confirm the origin of detected radionuclides.
1999	*CERCLA Groundwater Monitoring Plan for MCAS El Toro.* (BNI 1999b)	Integrate all CERCLA groundwater monitoring and reporting conducted at MCAS El Toro since 1992 into a well-defined scope of work, including a preestablished set of analytical parameters for each IRP site.	The IRP Site 1 scope consisted of quarterly water level measurements and annual sampling of existing monitoring wells for perchlorate analysis.	Based on the evaluation of groundwater sampling results for volatile organic compounds (VOCs) in existing wells at IRP Site 1 from 1992 to 1997, VOCs were eliminated as target analytes.
2000	*Historical Radiological Assessment (HRA)* (Roy F. Weston 2000)	Identify potential, likely, or known sources of radioactive material and radioactive contamination based on existing or derived information.	Reviewed documents and available records. Interviewed former and current employees, conducted site visits, and obtained informal radiation readings.	It was considered unlikely that general radioactive material (G-RAM) was disposed at the IRP Site 1 EOD Training Range. However, IRP Site 1 was concluded to be potentially impacted due to an unsubstantiated report of low-level radioactive waste disposal and was recommended for further investigation for radiological release.
2000	*Radiological Survey Plan* (Roy F. Weston, Inc. 2001)	Investigate selected buildings and areas (including IRP Site 1) at Former MCAS El Toro for the presence of radiological anomalies, based on findings from the historical radiological assessment (HRA) (Roy F. Weston, Inc. 2001).	Conducted field surveys of radiation readings at selected buildings and areas, using a field instrument to determine the isotope present.	UXO Surface Sweep Work Package (follow-up to Radiological Survey Plan) was submitted (March 2001).
2001	*Phase II Stationwide Evaluation of Radionuclides* (Earth Tech 2001e)	Confirm whether radionuclides detected in groundwater at Former MCAS El Toro are due to anthropogenic or naturally occurring sources.	In addition to selected wells at former landfill sites, three wells within IRP Site 1 (01-MW201, 01-MW203, and 01-MW207) were sampled during this investigation.	Concluded that origin of radionuclides detected in groundwater is natural.

Year	Investigation/Study	Objectives	Scope	Summary of Findings
2001	*Environmental Baseline Survey, IRP Site 1* (Earth Tech 2001c)	To update the Stationwide Environmental Baseline Survey (EBS) and the environmental condition of the IRP Site 1 property, and to provide information to facilitate the preparation of an environmental summary document to enable the transfer of IRP Site 1 to another Federal agency.	Environmental conditions at IRP Site 1 were summarized based on the: (a) visual survey, (b) review of various studies performed at Former MCAS El Toro pertinent to IRP Site 1, (c) geophysical survey and soil sampling performed in accordance with the Amendment to Draft Work Plan, Phase II RI (Earth Tech 2001d), to characterize the 3.3-acre area, located in the southwestern portion of IRP Site 1, considered for immediate use by the FBI, following transfer of the IRP Site 1 property.	IRP Site 1 can be transferred to another Federal agency for like use after completion of the requisite documentation in accordance with DON protocol. The 3.3-acre area proposed for immediate use may be used immediately following completion of the transfer process for IRP Site 1, since the environmental condition of this area has been evaluated for documentation purposes.
2001	*Federal Agency-to-Agency Property Transfer Environmental Summary Document, IRP Site 1* (Earth Tech 2001d)	To summarize the environmental condition of a parcel of property, designated Parcel 5a2 (IRP Site 1) proposed to be transferred from the U.S. Department of Navy to the Department of Justice, FBI.	The document was based on the IRP Site 1 EBS and findings of various environmental studies conducted at IRP Site 1.	The overall conclusion was, although the property potentially contains some level of contamination, Parcel 5a2 can be transferred for like use, with the specified use restrictions, and acceptable risk to human health and the environment without interference with the environmental restoration process.

Notes:

BNI = Bechtel National, Inc.
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
DoD = Department of Defense
DON = Department of the Navy
Earth Tech = Earth Tech, Inc.
EBS = environmental baseline survey
EM = electromagnetic
EOD = explosive ordnance disposal
EPA = Environmental Protection Agency
FBI = Federal Bureau of Investigation
FS smoke = sulfur-trioxide chlorosulfonic acid
GPR = ground penetrating radar
G-RAM = general radioactive material
HRA = historical radiological assessment
IRP = Installation Restoration Program
JEG = Jacobs Engineering Group
MCAS = Marine Corps Air Station
PAL = provisional action level
PRG = preliminary remediation goal
RI = remedial investigation
SAIC = Science Applications International Corporation
USACE = United States Army Corps of Engineers
UXO = unexploded ordnance
VOC = volatile organic compound

* = Range Rule Risk Methodology (R3M) – A process for managing, assessing, and communicating risk in closed, transferred, or transferring U.S. ranges (DoD 2000). Developed by representatives from the DoD, EPA, and State and tribal regulatory authorities.

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Table 1-2: Summary of Phase II Remedial Investigation

Year	Investigation/Study	Objectives	Scope
1995	*Phase II RI/FS Work Plan* (BNI 1995)	Further characterize potential impact to human health and environment due to past EOD Training Range operations because Phase I RI soil sampling locations were not representative of areas used for active EOD training.	Three-tiered approach to investigate shallow and deeper subsurface soil and groundwater. Installed three monitoring wells (01-MW101, 01-MW102, and 01-MW201). Soil investigation was deferred until cessation of EOD training.
2001	*Phase II RI Workplan* (Earth Tech 2001a)	To establish baseline risk to human health and the environment.	Tiered approach to field investigations for soil and groundwater to further characterize the site conditions, document the nature of contamination, and assess the risk to human health and the environment.
2002	*Munitions and Explosives of Concern Range Evaluation* (Earth Tech 2002)	To evaluate explosives safety risk at IRP Site 1 (due to remnant munitions and explosives of concern (MEC) items originating from past EOD training) using procedures consistent with the Department of Defense's Range Rule Risk Methodology (R3M) Interim Procedures Manual (DoD 2000).	Evaluation included characterization of the types of MEC and the location and depth of MEC at the site.
2002	*Amendment No. 2 to Phase II RI Work Plan* (Earth Tech 2002)	To evaluate the extent of groundwater perchlorate contamination beneath IRP Site 1, as well as to evaluate the groundwater gradient directions in the northern portion of IRP Site 1.	Sixteen piezometers (2-inch monitoring wells) were installed within IRP Site 1, as well as south of IRP Site 1, between IRP Site 1 and IRP Site 2. Groundwater samples were collected from all piezometers, as well as selected previously-existing wells, for 5 rounds.
2004	*Sampling and Analysis Plan Amendment No. 1 to Phase II RI Work Plan* (Earth Tech 2004a)	To determine risk to Riverside fairy shrimp due to Navy activities near the Ephemeral Pond in the northern portion of the Northern EOD Training Range.	Sediment samples were collected from 21 locations, and analyzed for various chemical groups.
2005	*Sampling and Analysis Plan Amendment No. 3 to Phase II RI Work Plan* (Earth Tech 2005)	To evaluate perchlorate contamination in the areas south of IRP Site 1, between IRP Site 1 and IRP Site 2.	Thirty-one boreholes were advanced in the area south of IRP Site 1; continuous cores were collected from all locations. Twenty-three shallow and seventeen bedrock groundwater samples were collected using Hydropunch™ technology.

Notes:

BNI = Bechtel National, Inc.
DoD = Department of Defense
Earth Tech = Earth Tech, Inc.
EOD = explosive ordnance disposal
FS = feasibility study
IRP = Installation Restoration Program
MEC = munitions and explosives of concern
RI = remedial investigation
R3M = Range Rule Risk Methodology

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Table 1-3: Summary of Concurrent Environmental Studies at IRP Site 1

Year	Investigation/Study	Objectives	Scope	Summary of Findings
1992 through August 2005	*Stationwide Groundwater Monitoring* (CDM 1997 through 2004)	To conduct groundwater monitoring for all the Installation Restoration Program (IRP) Sites at Former MCAS El Toro.	The scope pertinent to IRP Site 1 included sampling and analysis for perchlorate and/or VOCs in groundwater samples from the Monitoring Wells, 01-DGMW57, 01-DGMW58, 01-MW101, 01-MW102, and 01-MW201.	VOCs and semivolatile organic compounds (SVOCs) were detected at very low frequencies and concentrations in the samples from some of the IRP Site 1 monitoring wells. Perchlorate was repeatedly detected above the California public health goal of 6 micrograms per liter (µg/L) in the samples from the Monitoring Well 01-MW201.
2001 through 2006	*Radiological Release Report* (Weston 2006) (The draft version of this document is currently being reviewed by the regulatory agencies)	To evaluate if release of Ra-226 has occurred at IRP Site 1.	Conducted radiological scan surveys and soil sampling to evaluate extent of Ra-226. Risk and dose were estimated due to exposure to detected concentrations of Ra-226.	Based on the results of the scan surveys, soil sampling, risk screening, and dose assessment, it was concluded that occurrence and distribution of Ra-226 at IRP Site 1 is consistent with background. Therefore, Site Evaluation Accomplished (SEA) recommendation was made for IRP Site 1. This recommendation removes radionuclides from the list of chemicals of potential concern (COPCs) at IRP Site 1 and further consideration under CERCLA.
2003	*Base Realignment and Closure Business Plan* (DON 2003)	Current summary information on the status of and strategies for the cleanup of Former MCAS El Toro.		IRP Site 1: Environmental Condition of Property was categorized as Environmental Condition of Property (ECP) Type 6. ECP Type 6 means areas of known contamination where required response actions have not been implemented.

Notes:

µg/L = microgram per liter
CDM = Camp Dresser & McKee
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
COPC = chemical of potential concern
DON = Department of the Navy
ECP = Environmental Condition of Property
IRP = Installation Restoration Program
MCAS = Marine Corps Air Station
Ra-226 = radium 226
SEA = site evaluation accomplished
SVOC = semivolatile organic compound
VOC = volatile organic compound
Weston = Roy F. Weston

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1.4.1 Geophysical Surveys

Several geophysical surveys have been conducted at IRP Site 1 to identify subsurface anomalies indicative of buried wastes or buried munitions. The first geophysical survey at IRP Site 1 was performed in 1991 (JEG 1991) (Phase I Geophysical Survey). This survey covered 16.7 acres and involved the use of electromagnetic (EM) and ground-penetrating radar (GPR) methods. A large portion of the EOD Training Range was not investigated during this survey. Figure 1-3 shows the boundary of this survey grid.

As a part of the *Verification of Perchlorate* study (Earth Tech 2001b) (see Table 1-1) and a Munitions and Explosives of Concern (MEC) clearance/avoidance exercise, a second geophysical survey (Phase II Geophysical Survey) was performed at IRP Site 1 during October and November 1999. This survey was conducted using an EM-61 electromagnetic instrument. Data were collected along an approximately 500-foot by 600-foot grid at traverses spaced 3 feet apart. Figure 1-3 shows the boundary of the survey grid.

The third geophysical survey was performed at IRP Site 1 as a part of the Ordnance and Explosives Range Evaluation (Earth Tech 2002) (Table 1-2). This survey was conducted using two Geonics, Ltd., EM-61 Mk2 High Sensitivity Metal Detectors at four areas: Northern EOD Training Range, Southern EOD Training Range, Buffer Zone (a 40.1-acre area immediately surrounding the Northern and Southern EOD Training Ranges), and the Range Perimeter (defined by the security fence). Digital geophysical data were collected along three transects radiating from the Northern and Southern EOD Training Ranges, and along a 3-foot-wide swath around the inside perimeter of IRP Site 1 (Figure 1-4).

In addition to the above-mentioned surveys, a geophysical survey was conducted to investigate the 3.3-acre area located in the southern portion of IRP Site 1. This survey was conducted in September 2000 to identify subsurface anomalies that would be indicative of any buried MEC and other metallic debris associated with past EOD training.

The findings of all the above-mentioned geophysical surveys are presented in Section 4.1 of this Report.

1.4.2 Range Evaluation for Munitions and Explosives of Concern

A Range Evaluation for MEC was performed concurrent with the Phase II RI field activities (Earth Tech 2002). The scope of this investigation was to evaluate explosives safety risk at IRP Site 1 (due to remnant MEC items originating from past EOD training) by characterizing the types, locations and depths of MEC at the site. The following sections describe the field activities conducted as a part of MEC Range Evaluation while the results are presented in Section 4.2.

1.4.2.1 Field Investigation Activities

Field investigation activities in support of the Range Evaluation for MEC were initiated in January 2002 and concluded in April 2002. Four areas were investigated: the Northern EOD Training Range, the Southern EOD Training Range, the Buffer Zone, and the Range Perimeter (Figure 1-4).

Northern and Southern Explosive Ordnance Disposal Training Ranges

Both Northern and Southern EOD Training Ranges were divided into twelve 1-acre grids, and grids with the highest densities of anomalies (based on geophysical surveys) were selected for investigation. A total of nine grids were selected in both the Northern and Southern EOD Training Ranges for investigation.

Buffer Zone

The 40.1-acre area immediately to the northwest, north, and southwest of the impact area (Northern and Southern EOD Training Ranges) was referred to as the "buffer zone." Transects were established to characterize the Buffer Zone. These transects were approximately 25 feet wide and originated from a central area of the Northern EOD Training Range, radiating outward toward the site boundary in all directions, at 15-degree intervals (where feasible).

Range Perimeter

The security fence enclosing IRP Site 1 served as a boundary and the Range Perimeter. One hundred percent of the Range Perimeter was surveyed to evaluate the kick-outs.

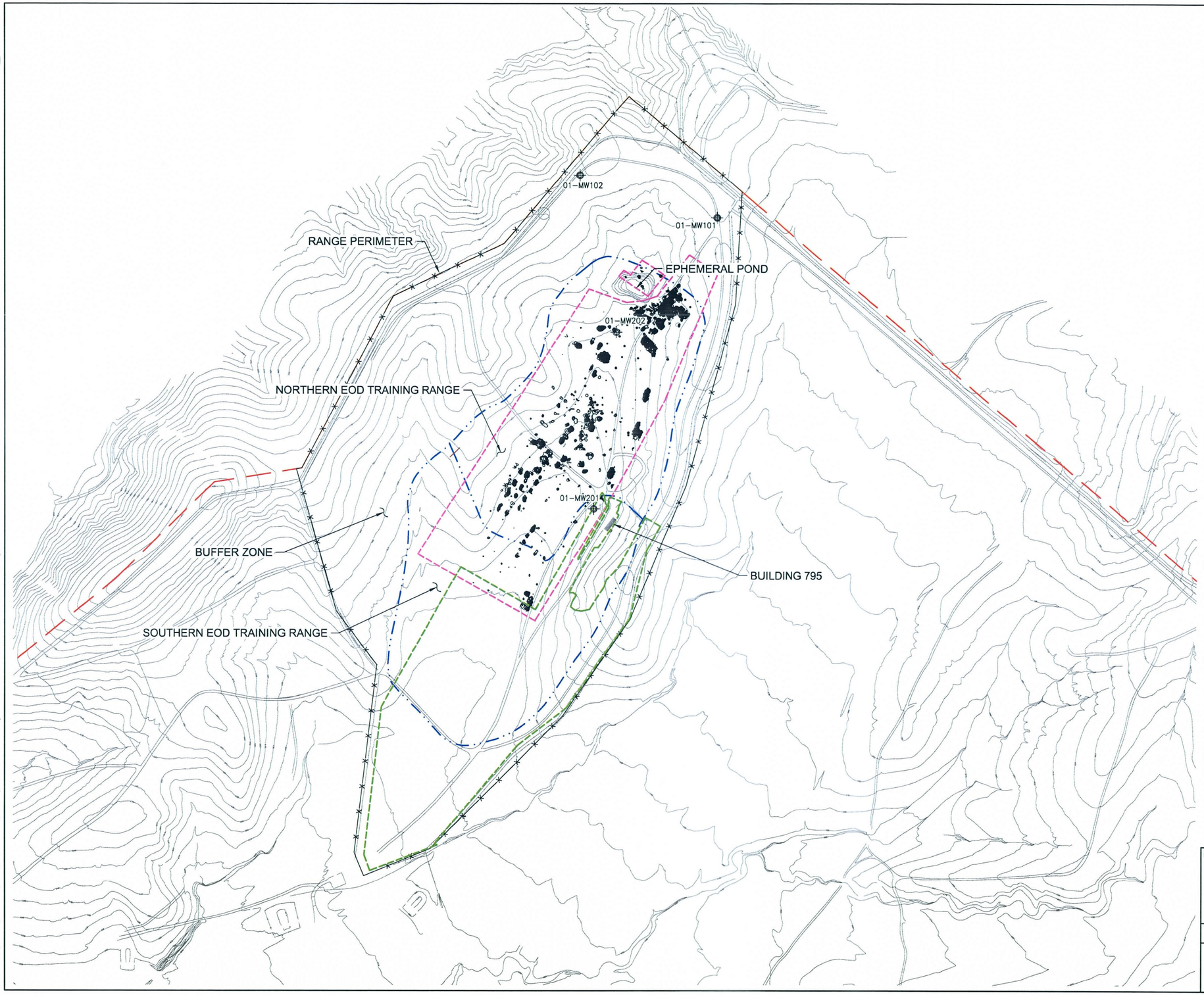
Total acreage investigated was determined using the Unexploded Ordnance (UXO) Calculator, a statistical tool developed by the U.S. Army Engineering and Support Center, Huntsville, Alabama, using the test density of 0.5 MEC per acre. For each of the four areas investigated, a surface survey, a geophysical survey, and subsurface MEC sampling were conducted.

Surface Survey. A Surface Survey was conducted to identify and remove any near-surface MEC and Munitions Debris (MD) and metallic debris larger than 1-inch by 2 inches that would interfere with geophysical mapping or be a physical hazard for the field crew.

A Surface Survey was also performed at each of the pothole locations to be investigated during the intrusive MEC investigation to identify and remove any near-surface MEC or MD that may interfere with the geophysical equipment.

Geophysical Survey. A geophysical survey was conducted at four areas: the Northern and Southern EOD Training Ranges, Buffer Zone, and Range Perimeter, as a part of the MEC Range Evaluation (see Section 1.4.1). The purpose of the survey was to identify subsurface anomalies indicative of buried wastes or buried munitions, for intrusive MEC investigation.

Intrusive Munitions and Explosives of Concern Investigation. An Intrusive MEC Investigation was performed at the locations of subsurface anomalies identified in the geophysical surveys (Figure 1-5). Subsurface MEC sampling was conducted at 99 pothole locations in the Northern and Southern EOD Training Ranges. Seventy-three of these locations were identified from the geophysical survey conducted during the *Verification of Perchlorate* study performed in 1999, and 26 were identified during the geophysical survey conducted during the MEC Range Evaluation in 2002. An additional 95 locations were intrusively investigated in the Buffer Zone, and 89 discrete geophysical anomalies in the Range Perimeter were investigated.



LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW202 GROUNDWATER MONITORING WELL
- 01-PZ02 EXISTING PIEZOMETER
- GEOPHYSICAL ANOMALY
- BOUNDARY OF PHASE I GEOPHYSICAL SURVEY
- BOUNDARY OF PHASE II GEOPHYSICAL SURVEY

NOTES:

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Boundary of Phase I and Phase II Geophysical Investigations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure 1-4
Project No. 36097	EarthTech — A Tyco International Ltd. Company	

File: L:\work\30...\cad\Site 1 RI\Final\FIGURE 1-4.dwg Time: Dec 20, 2006 - 1:46pm

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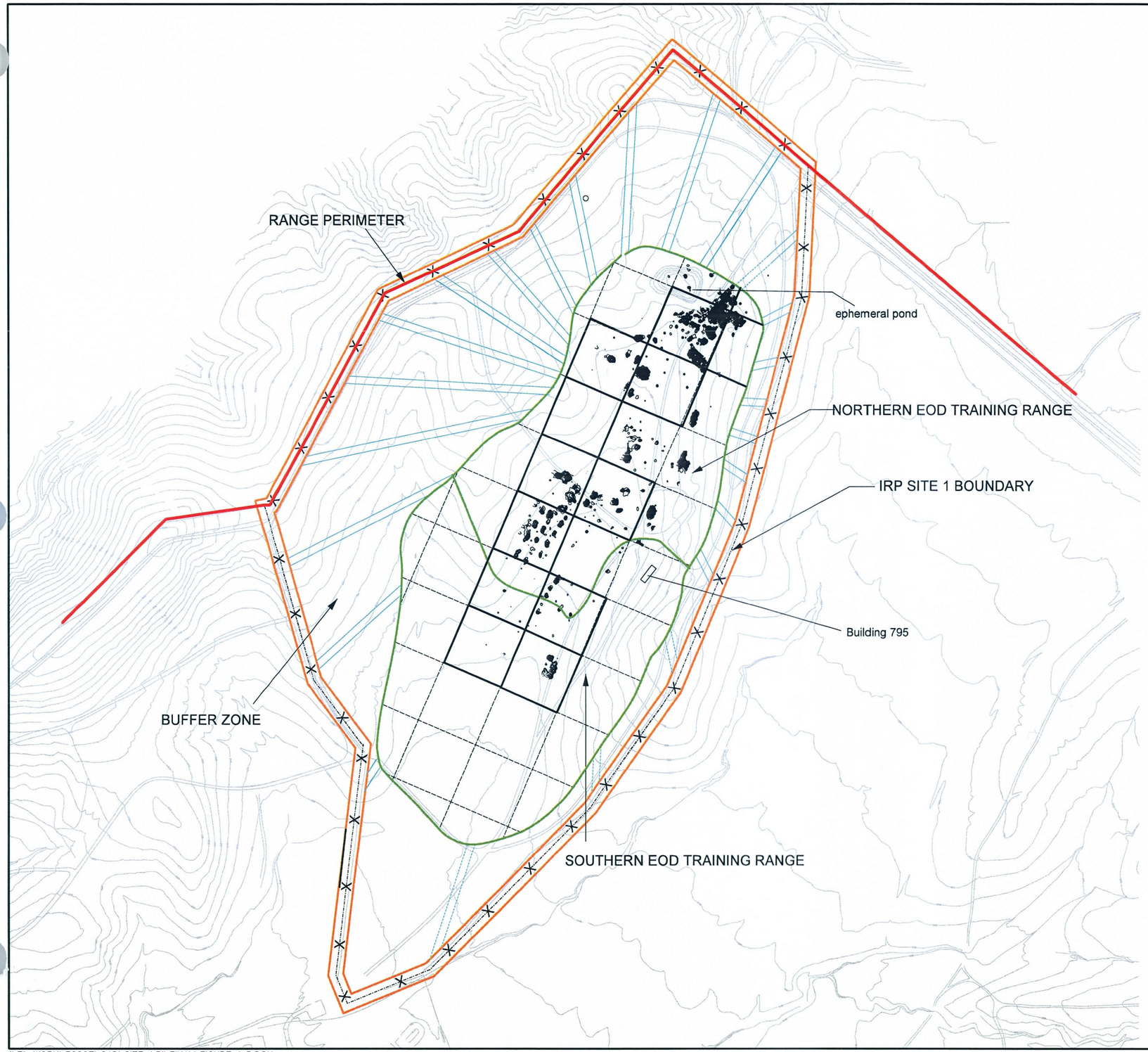

LEGEND:

- PREVIOUSLY IDENTIFIED GEOPHYSICAL ANOMALY
- MCAS EL TORO BOUNDARY
- SECURITY FENCE/IRP SITE 1 BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- 25 FEET WIDE GEOPHYSICAL SURVEY RADIAL LANES (SHOWN DASHED IN AREAS COVERED BY PREVIOUS GEOPHYSICAL SURVEYS)
- SURFACE AND GEOPHYSICAL SURVEY PATHS INSIDE AND OUTSIDE RANGE PERIMETER
- 1-ACRE GRID SELECTED FOR INTRUSIVE INVESTIGATION OF ALL ANOMALIES WITHIN GRID (ONLY GRIDS SHOWN WITH SOLID LINES REQUIRED TO BE INTRUSIVELY SAMPLED FOR MEC)

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
OE	ORDNANCE AND EXPLOSIVES

NOTE: THE MEC INVESTIGATION APPROACH WAS PRESENTED IN THE FINAL OE RANGE EVALUATION WORK PLAN (EARTH TECH 2001A) AND APPROVED BY THE BASE REALIGNMENT AND CLOSURE (BRAC) CLEANUP TEAM (BCT) AFTER PUBLIC NOTIFICATION.

NORTH

0 350 FEET

SCALE: 1"= 350'

Phase II Remedial Investigation — Final

MEC Investigation Areas

IRP Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A tyco International Ltd. Company	1-5

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\FIGURE 1-5.DGN

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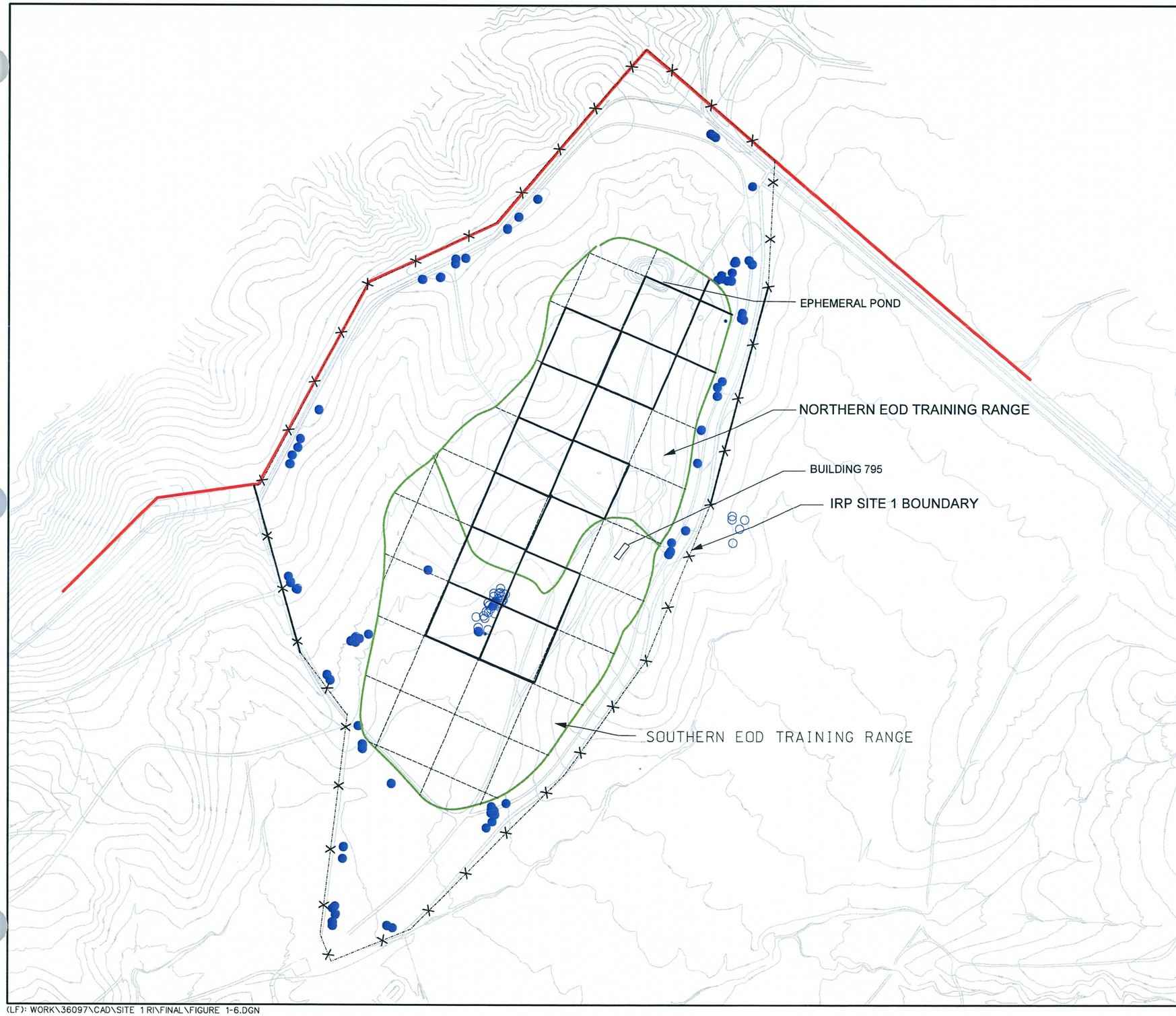

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/IRP SITE 1 BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- ANOMALY DETECTED REAL-TIME USING EM-61
- ANOMALY DETECTED THROUGH GEOPHYSICAL ANALYSIS OF EM-61 DATA
- 1-ACRE GRID SELECTED FOR INTRUSIVE INVESTIGATION OF ALL ANOMALIES WITHIN GRID (ONLY GRIDS SHOWN WITH SOLID LINES WERE INTRUSIVELY SAMPLED FOR MEC)

NOTES:

EM	ELECTROMAGNETIC
EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN

NORTH

0 350 FEET

SCALE: 1"= 350'

Phase II Remedial Investigation — Final

MEC Range Evaluation Geophysical Anomaly Locations

IRP Site 1 - EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech A Tyco International Ltd. Company	1-6

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\FIGURE 1-6.DGN

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1.4.3 Soil Investigations

Prior to the Phase II RI, soil investigations were conducted at IRP Site 1 as a part of Phase I RI, *Verification of Perchlorate* study (Earth Tech 2001b), an investigation of the 3.3-acre area located in the southern portion of the site in support of the site-specific Environmental Baseline Survey (EBS) (Earth Tech 2001c), and radiological characterization of IRP Site 1. The following sections present the methods and procedures for these investigations while the results are presented in Section 4.3.

1.4.3.1 PHASE I REMEDIAL INVESTIGATION

A Phase 1 RI was conducted at Former MCAS El Toro which included the collection of four surface soil samples at IRP Site 1 (01-GN1 through 01-GN3, 01-UGS) (JEG 1993a). Soil samples were collected at depths up to 6 inches below ground surface (bgs) at locations shown on Figure 1-6. Three samples were collected at randomly selected locations within the EOD Training Range, and one was collected upgradient of the site. All samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), total recoverable petroleum hydrocarbons (TRPH), total fuel hydrocarbons (TFH), target analyte list (TAL) metals, general chemistry, and dioxins/furans.

1.4.3.2 VERIFICATION OF PERCHLORATE

As a part of *Verification of Perchlorate* study (Earth Tech 2001b), three types of soil samples were collected to assess potential contaminant sources:

1. Subsurface samples (5 feet bgs to 35 feet bgs) during the installation of Monitoring Wells 01-MW202, 01-MW203, 01-MW204, 01-MW205, 01-MW206 and 01-MW207.
2. Shallow samples (1.5 feet bgs to 4.5 feet bgs) at anomalous locations identified by the Phase 1 geophysical survey (see Section 1.4.1).
3. Surface samples from topographic depressions.

Fifty-five soil samples were collected during well borehole drilling in accordance with CLEAN Standard Operating Procedure (SOP) 4, Soil Sampling (BNI 2002) of which 11 were analyzed for perchlorate. The soil samples were collected in stainless steel sleeves, using a split-spoon sampler at depth intervals of 5 feet. At the prescribed sampling interval, the sampler was attached to a drive rod and driven 18 inches into undisturbed soil below the lead auger, with a 140-pound slidehammer. Sampling equipment was thoroughly decontaminated before each use by washing with a detergent solution and double rinsed with potable and deionized water.

Twenty-eight shallow soil samples (and one duplicate) were collected from depths of approximately 1.5 feet to 4.0 feet bgs at anomalies identified by the Phase 1 geophysical survey (see Section 1.4.1). The samples were collected at shallow depths to identify potential perchlorate sources in the soil using a hand auger, in accordance with CLEAN SOP 4, Soil Sampling (BNI 2002). Samples analyzed for perchlorate, metals, total petroleum hydrocarbons (TPH), SVOCs, explosives residues, and dioxins/furans were collected in glass jars. Samples collected for VOC analysis were collected using an En Core sampling device.

Three surface samples were collected at topographic depressions to evaluate the presence of contaminants deposited by surface runoff. The samples were collected with a stainless steel trowel and placed into glass jars in accordance with CLEAN SOP 4, Soil Sampling (BNI 2002). These samples were analyzed for negative log of the hydrogen ion concentrations (pH) and perchlorate. Figure 1-6 presents the locations of the soil samples.

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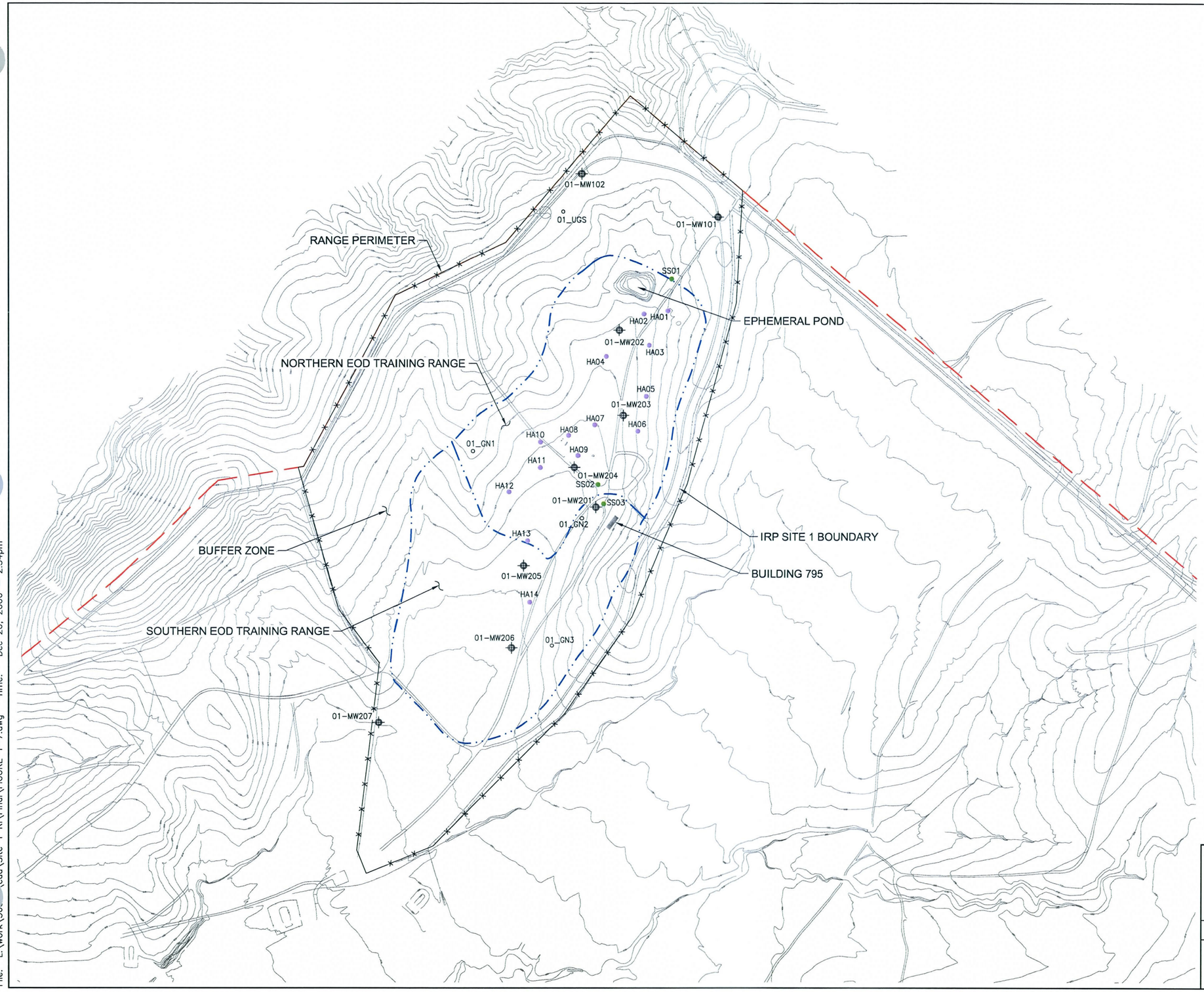

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW207 GROUNDWATER MONITORING WELL
- HA12 PERCHLORATE INVESTIGATION HAND AUGER SAMPLING LOCATION
- SS03 PERCHLORATE INVESTIGATION SURFACE SOIL SAMPLING LOCATION
- 01_GN1 PHASE I RI SURFACE SOIL SAMPLING LOCATION

NOTES:

IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
RI	REMEDIAL INVESTIGATION

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Phase 1 RI and Perchlorate Investigation Sampling Locations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure 1-7
Project No. 36097	EarthTech — A Tyco International Ltd. Company	

File: L:\work\36...\cad\Site 1 RI\Final\FIGURE 1-7.dwg Time: Dec 20, 2006 - 2:54pm

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1.4.3.3 ENVIRONMENTAL BASELINE SURVEY SOIL INVESTIGATION

Soil sampling was conducted at the 3.3-acre area in the southern portion of IRP Site 1 in February 2001 in support of the *Site-Specific EBS* (Earth Tech 2001c). Direct-push samples were collected at 17 locations at depths of 1.5 feet and 5 feet bgs. A total of 34 soil samples and 4 duplicates were collected at 17 locations evenly distributed over the established study grid (Figure 1-7).

Samples were collected in accordance with CLEAN II SOP 4 (BNI 2002) using a California-modified split-spoon sampler lined with three 6-inch-long brass sleeve liners. Soil from the first (or leading) sample liner from each depth interval was submitted for analysis of VOCs in accordance with EPA Method 8260. Six disposable En Core® samplers provided by the laboratory were used to collect aliquots for VOC analyses. The sample liner containing the remaining soil was sealed with Teflon paper and plastic caps and retained for dioxins/furans analysis. Soil from the second liner was used for the remaining suite of target analytes. All sample containers were labeled and preserved in an ice-filled cooler for delivery to a fixed-base laboratory under chain-of-custody procedures in accordance with CLEAN II SOP 10 (BNI 2002).

Analytes that were characteristic of releases during EOD operations served as chemicals of potential concern (COPCs) including metals, general chemistry, explosives residues, VOCs, SVOCs, dioxins/furans, and petroleum hydrocarbons. Samples submitted for analysis of dioxins/furans were selected based on the detection of other target analytes. Although SVOCs were reported below detectable levels, a total of five samples (LE003, LE009, LE010, LE025, and LE027) were submitted for dioxin and furan analysis based on the detection of TPH as diesel (TPH-D) and TPH as motor oil (TPH-MO).

1.4.3.4 RADIOLOGICAL CHARACTERIZATION OF IRP SITE 1

Historical Radiological Assessment

The radiological evaluation at IRP Site 1 began with the Stationwide Historical Radiological Assessment (HRA) conducted for Former MCAS El Toro in 1999 and 2000 (Weston 2000). A HRA was prepared for Former MCAS El Toro addressing general radioactive material (G-RAM), including Radiological Affairs Support Program (RASP) material, and unregulated consumer products. The objectives of this HRA were to:

- Identify potential, likely, or known sources of radioactive material and radioactive contamination based on existing or derived information and identify sites that need further action as opposed to those posing no threat to human health.
- Assess likelihood of contaminant migration.
- Provide initial classification of the sites or survey units as impacted or non-impacted.

The HRA included the review of Navy, Former MCAS El Toro, and NAVFAC SW correspondence, historical files and related reports, personnel interviews, site inspections, and limited informal surveys.

Radiological Survey and Investigative Actions at IRP Site 1

The HRA classified IRP Site 1 as potentially radiologically impacted and recommended it for further radiological investigation. Subsequent to the issuance of the HRA, onsite radiological characterization surveys and sampling were conducted at IRP Site 1 between June and October 2001. These investigations were performed in accordance with the Radiological Survey Plan for Former MCAS El Toro (Weston 2001) and the results have been documented in the *Draft Radiological Release Report, Former Explosive Ordnance Disposal (EOD) Range – IRP Site 1, Defense Reutilization and Marketing Office (DRMO) Yard 3, Nuclear, Biological & Chemical (NBC)*

Complex, including Aerial Photograph Anomaly (APHO) 38 and Paved Area South of Building 295, Former Marine Corps Air Station (MCAS) El Toro, CA (Weston 2006).

Radiological investigations at IRP Site 1 included radiological scan surveys and soil sampling. The radiological scan surveys were conducted using a multi-detector array mounted on a tractor-drawn trailer (8 detectors) and performing a high-density scan. For areas where access did not permit the use of the eight-detector array, a surveyor, carrying a single detector, performed scan and/or stationary surveys. The instruments used for the surveys were portable scaler/ratemeters equipped with sodium iodide (NaI) crystal scintillation probes; i.e., 2-inch by 2-inch (unshielded) and/or 3-inch by 3-inch (shielded) detectors, for gamma detection. When elevated gamma scan measurements were encountered, a soil sample was collected from that location and analyzed for Ra-226 in the laboratory.

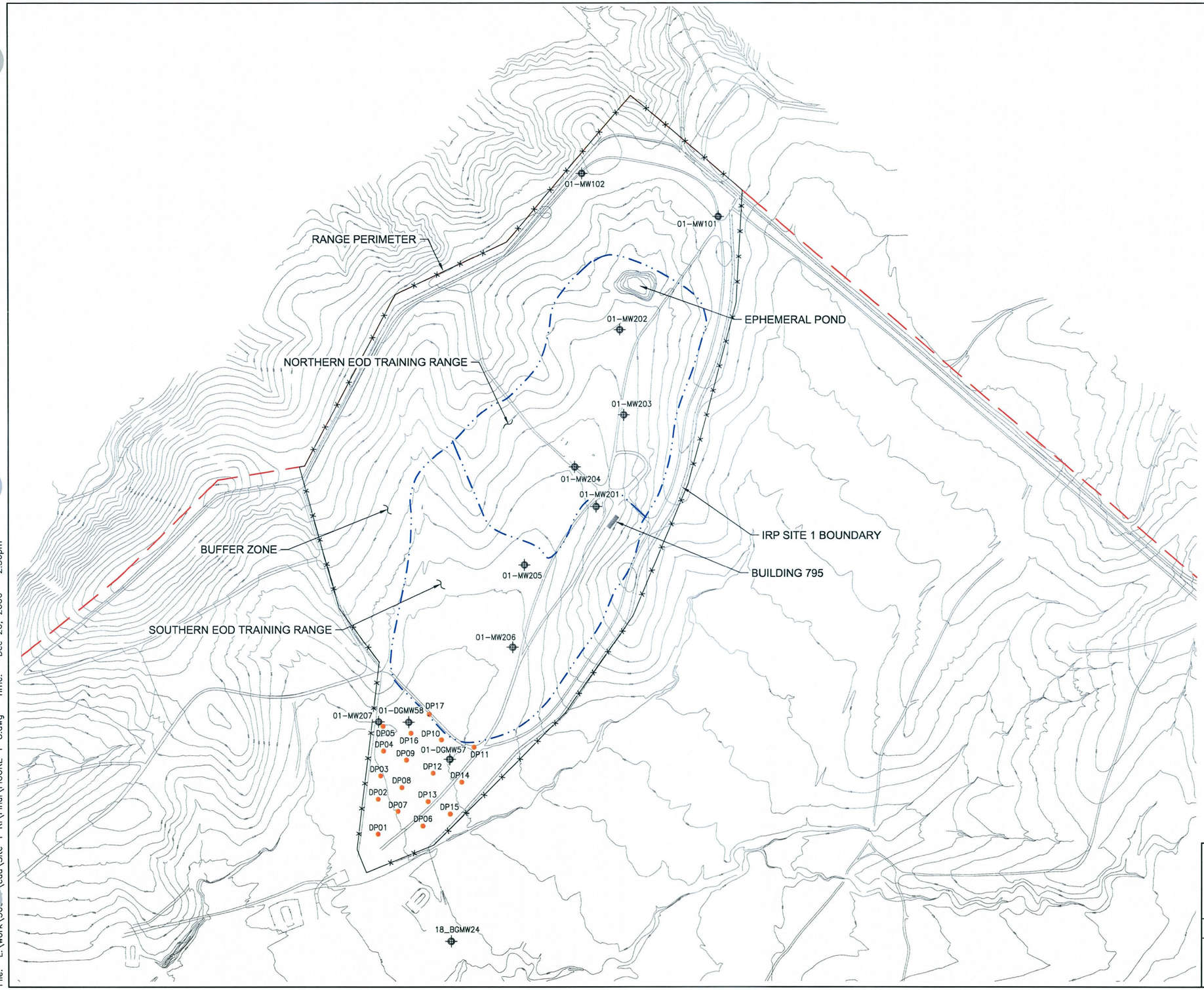
The majority of the IRP Site 1 area was surveyed using the eight-detector, high-density process with 700,228 radiation readings taken. In addition, 9,787 data readings were recorded using a single detector. A total of 28 soil samples were collected and sent to a certified laboratory for Ra-226 analyses (Weston 2006). If, during sampling, a radiological anomaly was encountered, it was collected, visually inspected, counted for radiation level, and sealed inside double plastic bags.

Station background radiation levels, measured in reference areas, were used as the basis for determining comparative natural background radiation levels at IRP Site 1. Non-impacted reference areas were selected from locations with similar characteristics (chemically, physically, biologically, and geologically) to IRP Site 1. The reference areas were separate from the IRP Site 1 and were located upgradient or cross-gradient from the site.

The following criteria were used to evaluate whether a release of Ra-226 occurred at IRP Site 1:

- Radionuclide Concentration – The site release level, as defined in Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (EPA 2000a), is known as derived concentration guideline level (DCGL). Based on the discussions with EPA and the California Department of Health Services (CDHS) the Navy established the $DCGL_W$, for Ra-226 at 1 picocurie per gram (pCi/g) above background.
- Radiological analyses performed on 15 background reference area soil samples collected throughout Former MCAS El Toro yielded a mean background soil concentration for Ra-226 of 1.05 pCi/g. Using a $DCGL_W$ of 1 pCi/g above the mean background, the total Ra-226 DCGL for the Station was therefore set at 2.05 pCi/g.
- Dose – Residual radioactivity (due to Ra-226) that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group (residential receptor) that does not exceed 25 millirem per year (mrem/year), and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA) (Title 10 CFR Section 20.1402).
- Risk – Residual Ra-226 corresponds to the NCP defined carcinogenic risk management range of 10^{-6} to 10^{-4}. Consideration of uncertainties, including inherent spatial and measurement variabilities in Ra-226 concentrations, and uncertainties in risk assessment, indicate that the level of Ra-226 exposure at the sites is in the range of background for a residential receptor.

The radiological surveys at IRP Site 1 were designed considering the DCGL for Ra-226 of 1 pCi/g above the mean value of the background measurements. This DCGL was also used for statistical evaluation of the radiological investigation data to assess if a release of Ra-226 had occurred.



LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- DP16 EBS INVESTIGATION DIRECT-PUSH SAMPLING LOCATION

NOTES:

EBS	ENVIRONMENTAL BASELINE SURVEY
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

EBS Investigation Sampling Locations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	1-8

File: L:\work\30... \cad\Site 1 RI\Final\FIGURE 1-8.dwg Time: Dec 20, 2006 - 2:56pm

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Screening level risk and dose assessments were conducted to quantify adverse human health effects associated with exposure to Ra-226 at IRP Site 1. The risk screening consisted of calculation of incremental risk to a residential receptor due to exposure to average concentration of Ra-226 above background, using EPA's Preliminary Remediation Goal (PRG) Calculator for radionuclides (EPA 2004a). The dose assessment was conducted by calculating the TEDE for a residential receptor using the Nuclear Regulatory Commission (NRC) and Department of Energy (DOE) Residual Radiation (RESRAD) Program, Version 6.3 dose modeling software, default "Resident Farmer" scenario.

1.4.4 Groundwater Investigations

Prior to the Phase II RI, groundwater sampling and analysis was conducted at IRP Site 1 as a part of Stationwide groundwater monitoring, the Phase 1 RI (JEG 1993a), the Stationwide perchlorate evaluation (BNI 1999a), the *Verification of Perchlorate* study (Earth Tech 2001b), and the Radionuclide Investigation (Earth Tech 2000).

1.4.4.1 Stationwide Groundwater Monitoring

Nineteen rounds of groundwater sampling have been conducted at Former MCAS El Toro from 1992 until March 2004, to provide an evaluation of Stationwide groundwater quality and groundwater elevation data. The IRP Site 1 monitoring wells that have been sampled during these sampling events include 01-DGMW57, 01-DGMW58, 01-MW101, 01-MW102, and 01-MW201. Following sampling round 11 in July-August 1999, only one IRP Site 1 monitoring well (01-MW201) has been sampled. The groundwater samples collected during Stationwide sampling were analyzed for VOCs, SVOCs, explosives residues, and/or perchlorate (CDM 1997a, b, c; 1998; 2000a, b; 2001a, b; and 2002a, b).

1.4.4.2 Phase 1 Remedial Investigation

Two groundwater monitoring wells, 01-DGMW57 and 01-DGMW58, were installed as a part of the Phase 1 RI (JEG 1993a). Groundwater samples were collected from these monitoring wells and were analyzed for VOCs, SVOCs, TRPH, TPH, metals, pesticides/polychlorinated biphenyls (PCBs), general chemistry, dioxins/furans, and gross alpha and gross beta.

1.4.4.3 Stationwide Evaluation of Perchlorate in Groundwater

A Stationwide evaluation (which included IRP Site 1) for the presence of perchlorate in the groundwater was conducted during 1998. In October 1998, groundwater monitoring wells at IRP Site 1 (01-DGMW57, 01-MW101, and 01-MW201) were sampled and analyzed for perchlorate. The results of the investigation were presented in the *Draft Evaluation of Perchlorate in Groundwater* (BNI 1999a).

1.4.4.4 Verification of Perchlorate Study

A perchlorate verification study was conducted at IRP Site 1 during 1999 (Earth Tech 2001b). Six groundwater monitoring wells (01-MW202, 01-MW203, 01-MW204, 01-MW205, 01-MW206, and 01-MW207) were installed and sampled for perchlorate.

1.4.4.5 Radionuclide Investigation

A Phase I evaluation of radionuclides was conducted at IRP Site 1 and four former landfills (IRP Sites 2, 3, 5, and 17) at Former MCAS El Toro during October and November 1999 (Earth Tech 2000). Groundwater samples were analyzed for gross alpha and gross beta emissions, uranium^{234}, uranium^{235}, uranium^{238}, thorium^{228}, thorium^{230}, thorium^{232}, radium^{226}, radium^{228}, lead^{210}, americium^{241},

and strontium^{90}. A total of 17 monitoring wells were sampled, which included three IRP Site 1 monitoring wells (01-MW201, 01-MW203, and 01-MW207).

Due to the low radionuclide concentrations and analytical uncertainty associated with the laboratory method used (American Society for Testing and Materials [ASTM] Method D3972), the isotope evaluation conclusions from the data obtained during the above-mentioned radionuclide study were not definitive. Therefore, to verify that the radionuclides at Former MCAS El Toro are naturally occurring a Phase II evaluation of radionuclides in groundwater was conducted in January 2001 (Earth Tech 2001e). In addition to IRP Site 1, this study included evaluation of groundwater at four former landfills (IRP Sites 2, 3, 5, 17) and the on-Station portion of the VOC (primarily trichloroethene [TCE]) plume at IRP Sites 18 and 24. Samples were collected from 23 monitoring wells, which included three IRP Site 1 monitoring wells (01-MW201, 01-MW203, and 01-MW207) using low-flow sampling procedures. These samples were analyzed for uranium^{238} to uranium^{235} ratio, uranium isotopes (uranium^{235}, uranium^{236} and uranium^{238}), isotopic hydrogen, oxygen, and tritium, and general chemistry parameters including calcium, magnesium, sodium, chloride, sulfate, and alkalinity.

1.5 REPORT ORGANIZATION

This Report conforms to the suggested RI report format provided in the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). The description of the organization of this Report into ten sections and eight appendices is provided as follows:

Section 1 – Introduction to the RI Report including purpose of the Report, site background and overview of previous investigations

Section 2 – Discussion of the project activities conducted as a part of Phase II RI including the Phase II RI approach and sampling rationale

Section 3 – Description of the physical characteristics of IRP Site 1

Section 4 – Discussion of the nature and extent of contamination based on the data obtained from the Phase II RI activities and other previous investigations

Section 5 – Contaminant Fate and Transport

Section 6 – Methods and Findings of the Human Health Risk Assessment

Section 7 – Methods and Findings of the Ecological Risk Assessment

Section 8 – Methods and Findings of the Munitions and Explosives of Concern Risk Assessment

Section 9 – Summary and Conclusions

Section 10 – References

Appendix A – CERCLA Documentation Process and RCRA Facility Closure Comparison

Appendix B – Borehole and Interpretive Logs

Appendix C – Munitions and Explosives of Concern Range Evaluation Technical Memorandum

Appendix D – IRP Site 1 Explosive Safety Submission

Appendix E – Analytical Results

Appendix F – Validation Reports

Appendix G – Human Health Risk Assessment Tables

Appendix H – Ecological Risk Assessment

Appendix I – Responses to Comments Received on Draft and Draft Final RI Report

2. Study Area Investigation

Various field investigations were conducted at IRP Site 1 as part of the Phase II RI to collect data pertaining to soil and groundwater contamination at the site. Section 2.1 presents the rationale for the design of these investigations, and Section 2.2 presents the methods and procedures for these investigations.

2.1 SAMPLING DESIGN RATIONALE

The Phase II RI field activities were designed to address the data quality objective (DQO) decisions presented in the *Phase II RI Work Plan* (Earth Tech 2001a), *Sampling and Analysis Plan Amendment No. 1* (Earth Tech 2004), Amendment No. 2 to Work Plan (Earth Tech 2002), and *Sampling and Analysis Plan Amendment No. 3* (Earth Tech 2005). The basic decision questions for this study were: Does the site pose an unacceptable risk to human health or the environment? Is a remedial response consistent with CERCLA and the Navy's IRP/BRAC process required?

To resolve the principal study question, the following decision questions were considered in the Phase II RI Work Plan:

1. Are the analytical data from shallow (less than 10 feet bgs) soil samples adequate to characterize the risk, or are additional data required?
2. Has the lateral extent of the impacted shallow soil been defined or are additional data required?
3. Does the contamination extend beyond 10 feet bgs (i.e., is the vertical extent defined)?
4. Do the existing groundwater monitoring wells adequately characterize impact to groundwater or is there a need for additional wells?
5. Is surface water runoff an exposure pathway?
6. Have potential human and ecological receptors been identified, and are they likely to be at risk for adverse health effects at this site?

The following decision question was considered in the *Sampling and Analysis Plan Amendment No. 1* (Earth Tech 2004):

1. Do the concentrations of target analytes in the Ephemeral Pond sediments (located in the northern portion of IRP Site 1) exceed the established decision thresholds (for Riverside fairy shrimp [a Federally-endangered species])?

The following decision question was considered in the *Sampling and Analysis Plan Amendment No. 3* (Earth Tech 2005):

1. Do the data suggest that the perchlorate detected downgradient from IRP Site 1 is related to IRP Site 1 releases?

The sampling design for the Phase II RI was developed based on both probability and judgmental sampling, to address the preceding decision questions. The field investigation activities were performed in accordance with the *Phase II RI Work Plan* (Earth Tech 2001a) and subsequent amendments to the Work Plan (Earth Tech 2002, 2004, and 2005). Any deviation from the sampling design and Field Sampling Plan presented in the Phase II RI Work Plan (Earth Tech 2001a), along with the rationale for the deviation, was presented in the following Field Change Justifications and Sampling and Analysis Plan Amendments:

- Field Change Justification No. 1 (November 2002). Proposed soil sampling to be conducted within the Ephemeral Pond area at IRP Site 1.
- Field Change Justification No. 2 (November 2002). Proposed Hydropunch™ sampling and piezometer installation and sampling to be conducted at IRP Site 1.
- Amendment No. 2 to Work Plan, Phase II RI (December 2002). Proposed additional monitoring well installation and continuous coring at locations within IRP Site 1 and downgradient between IRP Site 1 and IRP Site 2.
- Field Change Justification No. 3, Revision 1 (June 2004). Proposed additional soil boreholes and monitoring well installation at IRP Site 1 and downgradient between IRP Site 1 and IRP Site 2.
- Final Sampling and Analysis Plan Amendment No. 1 (December 2004). Proposed additional soil sampling to be conducted within the Ephemeral Pond area at IRP Site 1. The document was prepared as a more detailed update to Field Change Justification No. 1 (November 2002).
- Field Change Justification No. 4 (January 2005). Proposed additional surface water sampling within the Ephemeral Pond at IRP Site 1.
- Sampling and Analysis Plan Amendment No. 3, Phase II RI (January 2005). Proposed additional soil boreholes and Hydropunch samples in the area between IRP Site 1 and IRP Site 2, in order to obtain additional lithologic and geochemical information.

The field change requests were reviewed and approved by the BCT.

Along with the Work Plan, the following documents provided guidance to conduct field activities:

CLEAN Field Health and Safety Manual (Earth Tech 1998)

CLEAN II Standard Operating Procedure (SOP) 3, Borehole Logging (BNI 2002)

CLEAN II SOP 4, Soil Sampling (BNI 2002)

CLEAN II SOP 5, Monitoring Well Installation and Development (BNI 2002)

CLEAN II SOP 6, Instrument Calibration and Use (BNI 2002)

CLEAN II SOP 7, Water and Free-Product Level Measurements in Wells (BNI 2002)

CLEAN II SOP 8, Groundwater Sampling (BNI 2002)

CLEAN II SOP 9, Sample Containers, Preservation and Handling (BNI 2002)

CLEAN II SOP 10, Sample Custody, Transfer and Shipment (BNI 2002)

CLEAN II SOP 11, Decontamination of Equipment (BNI 2002)

CLEAN II SOP 13, Abandonment of Boreholes and Wells (BNI 2002)

CLEAN II SOP 16, gINT™ System: Boreholes and Wells (BNI 2002)

CLEAN II SOP 17, Logbook Protocols (BNI 2002)

CLEAN II SOP 22, Investigation-Derived Waste (BNI 2002)

In order to continually scope site characterization efforts to minimize the collection of unnecessary data and maximize data quality, a tiered approach to the field investigation was adopted for the Phase II RI activities. Data collection activities in each successive tier were planned based on the results of the preceding tier.

2.1.1 Tier I

The principal objective of Tier I was to collect adequate data for soil and groundwater to complete a screening level human health and ecological risk evaluation for IRP Site 1. Systematic sampling, using a central-aligned grid was used at IRP Site 1 to allow uniform coverage of the Northern and Southern EOD Training Ranges. The number of sampling locations was calculated by dividing the initial number of samples (50 per study area) by the number of samples per location (at multiple depths). During the preliminary soil sampling conducted in the geophysical anomaly areas (identified during the perchlorate verification study [Earth Tech 2001]), two samples were obtained at each location at depths ranging from 1 to 5 feet bgs. Based on this sampling method, two samples per location, at depths of approximately 1.5 feet and 5 feet bgs were to be collected during the Phase II sampling. Accordingly, 25 sample locations per study area were required. This resulted in equal-sized blocks, each of which was approximately 170 feet by 170 feet square. Sample locations were at the centers of the blocks.

To optimize the sampling design, the locations of samples collected at the geophysical anomaly areas were overlain on the 25 blocks for each study area.

No sampling was conducted during the Phase II RI in blocks where previous samples were located. This optimization resulted in a judgmental sampling design for those specific areas suspected of EOD activity, with the advantage of identifying locations of elevated contamination, and the disadvantage of possibly causing the site to appear more contaminated than it really is.

The analysis approach for the soil samples collected during Tier I was to cover all the analytes expected to be characteristic of releases during the EOD operations. Table 2-1 lists the type of materials used during training activities, and the corresponding analysis approach.

Table 2-1: Soil Analysis Approach

Contaminant Group	Analysis
Ordnance/munitions/explosives residues	Explosives residues, metals, perchlorate
Fuels	Fuel hydrocarbons, VOCs, SVOCs
Combustion byproducts	Dioxins/furans, SVOCs
FS smoke	pH

Notes:
FS smoke = sulfur-trioxide chlorosulfonic acid
pH = negative logarithm of hydrogen ion concentration
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds

All soil samples collected during the Tier I sampling event were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals. The Work Plan specified that 10 percent of the soil samples were to be selected for analysis of dioxins/furans based on the SVOC data. Since no SVOCs except low concentrations of phenol were detected in any of the soil samples analyzed during the Tier I sampling events, dioxins/furans were not analyzed during Tier I field activities.

The Work Plan specified that sampling of surface water runoff be attempted during the three storm events. However, there was no measurable surface runoff during the three consecutive storm events during field activities for Tier I. Subsequently in January 2005, however, there was sufficient rainfall to collect surface water samples from the Ephemeral Pond, and from the downgradient sampling location near Monitoring Well 01-MW207, in the southern portion of IRP Site 1. The surface water sampling is summarized under Tier III-C.

To establish the baseline conditions, groundwater samples were collected from existing monitoring wells and analyzed for perchlorate, VOCs, SVOCs, hydrocarbons, explosives residues, nitrate, pH and metals, and N-nitrosodimethylamine (NDMA).

2.1.2 Tier II

The objectives of the Tier II sampling were to investigate the localized contamination, or "hot spots" (defined as exceeding the threshold levels listed in the decision inputs and evaluated based on the decision rules specified in the DQOs in the *Phase II RI Work Plan* [Earth Tech 2001a]), and to further evaluate the previously identified geophysical anomaly areas, by trenching and sampling. Since Tier I sampling results did not identify any hot spots, Tier II sampling conducted in January to April 2002 primarily investigated the previously defined geophysical anomaly areas in conjunction with the MEC characterization sampling. Groundwater sampling was not conducted as part of Tier II. As a part of the MEC Range evaluation, geophysical anomalies were identified using real-time kinematic (RTK) global positioning system (GPS), EM system, or magnetometer. In Tier II sampling, these anomalies were investigated either by trenching or potholing lengthwise or across each selected anomaly. Trenches or potholes were excavated until the bottom of the anomaly source was located. During the excavation, all located MEC or MD scrap data were logged and soil samples were collected in accordance with procedures described in the *Phase II RI Work Plan* (Earth Tech 2001a). All soil samples collected during the Tier II sampling event were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals. In addition, nine of the soil samples were analyzed for dioxins/furans.

2.1.3 Tier III

Specific objectives of the Tier III sampling were to:

- Investigate the vertical extent of soil contamination at any Tier II locations that indicated potential for contamination greater than 10 feet bgs.
- Evaluate potential impact to groundwater at locations where the Tier I and Tier II data indicated potential impact.
- Determine potential risk to Riverside fairy shrimp (a Federally endangered species) in the Ephemeral Pond in the northern portion of the Northern EOD Training Range.
- Delineate perchlorate contamination in groundwater within the central portion of IRP Site 1
- Delineate perchlorate contamination in groundwater in the areas south of IRP Site 1

Tier III activities were divided into several sub-investigations:

Tier III-A. As a part of Tier III-A sampling, one trench/pothole (Trench 34) was selected for additional soil sampling where the soil samples collected at 6 and 10 feet bgs, during Tier II sampling events, reported concentrations of petroleum hydrocarbons, VOCs, and metals. This was the only location that exhibited increasing concentrations (petroleum hydrocarbons and naphthalene) to a depth of 10 feet bgs (the bottom of the trench). One borehole (B-1) was advanced to a depth of

35 feet bgs at this location. Soil samples collected as a part of Tier III-A were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals.

Three new groundwater monitoring wells (01-MW208, 01-MW209, and 01-MW210) were installed upgradient and downgradient from Monitoring Well 01-MW201, which had historically yielded elevated concentrations of perchlorate. New wells were installed to better define the extent of elevated perchlorate concentrations and to refine the groundwater flow direction and gradient in the vicinity of 01-MW201.

Tier III-B. Tier III-B sampling included installation of 16 piezometers (2-inch groundwater monitoring wells), 01-PZ01 through 01-PZ16, throughout IRP Site 1 and south of IRP Site 1 in order to delineate perchlorate concentrations in the central portion of IRP Site 1, as well as to determine whether perchlorate was present in groundwater in the areas south of the site. After installation of the piezometers, the wells, along with selected previously installed wells at IRP Site 1, were sampled for five rounds to verify sampling results. The groundwater samples were analyzed for perchlorate only.

Tier III-C. Tier III-C activities included a surface-to-borehole seismic investigation, which was conducted in order to determine whether there were subsurface fractures or other features that may be effecting groundwater flow throughout IRP Site 1. The investigation was conducted on six wells at IRP Site 1 (01-MW101, 01-MW201, 01-MW202, 01-MW205, 01-MW209, and 01-DGMW58).

Tier III-C also involved the installation of 12 additional monitoring wells, whose purpose was to further delineate the perchlorate contamination in the central portion of IRP Site 1, as well as to delineate elevated perchlorate concentrations in Piezometers 01-PZ15 and 01-PZ16, which were installed to the south of IRP Site 1 as part of Tier III-B activities. Continuous lithologic cores were collected from all 12 monitoring wells in order to better characterize the subsurface geologic and hydrogeologic conditions. Groundwater samples were collected from all 12 newly installed wells, and from selected previously installed wells.

The final portion of Tier III-C investigations included sediment sampling within the Ephemeral Pond at IRP Site 1. Twenty-one sediment samples were collected from 19 locations. The sampling was conducted in response to a request from the United States Fish and Wildlife Service (USFWS), in order to evaluate risk, if any, to the Federally endangered Riverside fairy shrimp (*Streptocephalus woottoni*).

Tier III-D. Tier III-D involved advancing 31 soil boreholes in the southern portion of IRP Site 1 and in the areas south of IRP Site 1, to further characterize the geologic and hydrogeologic conditions. Additionally, 23 Hydropunch™ groundwater samples were collected from the alluvium and 17 Hydropunch™ samples were collected from the weathered bedrock, which were analyzed for perchlorate only.

2.2 SAMPLING ACTIVITIES

The following sections describe the sampling and analysis activities conducted at IRP Site 1 as a part of Tier I, Tier II, and Tier III, arranged by media. Table 2-2 summarizes all of the sampling and analysis activities.

2.2.1 Soil Sampling

Soil sampling and analysis was conducted at various locations at IRP Site 1 as a part of Tier I, II, and III investigations.

2.2.1.1 TIER I

Tier I soil sampling was completed in January 2002 at locations shown on Figure 2-1. Samples were collected using direct-push techniques at depths of 1.5 and 5 feet bgs at each location. A total of 77 shallow soil samples and eight duplicates were collected from 39 locations (both Northern and Southern EOD Training Ranges) in accordance with CLEAN SOP 4, Soil Sampling (BNI 2002). Samples for analysis of VOCs were collected in accordance with EPA Method 5035. All samples were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals.

2.2.1.2 TIER II

Tier II soil sampling was completed in January and February 2002 at locations shown in Figure 2-2. Tier II soil sampling involved trenching or potholing lengthwise across the selected anomalies identified during the geophysical survey conducted as a part of MEC Range Evaluation (see Section 1.4.2). All trenching was accomplished in accordance with Section 5.4, Excavation Safety, of the *Earth Tech CLEAN Field Health and Safety Manual* (Earth Tech 1998). Trench alignments were measured with a Brunton® or other compass and a standard 100-foot tape, to a resolution of ± 0.5-foot. Descriptions of the trenches including cross-sections were recorded in a field trench log. Field personnel identified the types of soil collected following CLEAN SOP 3, Borehole Logging (BNI 2002) and ASTM Method D 2487/2488.

Trenches or potholes were excavated until the bottom of the anomaly source was located. During the excavation, all located MEC or MD data were logged and soil samples were collected. Trenches or potholes were approximately 4 to 45 feet long, 2 to 6 feet wide, and soil samples were collected from depths ranging from 0.5-foot bgs to 10 feet bgs. Thirty-three soil samples and four duplicates were collected and analyzed for VOCs. Twenty-five soil samples and four duplicates were collected and analyzed for SVOCs. Thirty-two soil samples and four duplicates were collected and analyzed for petroleum hydrocarbons. Twenty-six samples and three duplicates were analyzed for SVOCs, explosives residues, perchlorate, nitrate, pH, and metals. Seven soil samples and two duplicates were analyzed for dioxins/furans.

All trenches were backfilled and compacted upon completion of logging, and no trench was left unattended or open overnight during the entire investigation.

2.2.1.3 TIER III

Tier III-A. Tier III-A soil sampling was completed in May 2002. As a part of Tier III-A sampling events, one Tier II sampling location (Trench 34) was selected for deeper investigation (greater than 10 feet bgs) due to elevated concentrations of petroleum hydrocarbons, VOCs, and metals in the samples taken from 6 feet and 10 feet bgs. This was the only location that exhibited increasing concentrations (petroleum hydrocarbons and naphthalene) to a depth of 10 feet bgs (the bottom of the trench). At this location (see Figure 2-2), a borehole (B-1) was drilled using a rotary-auger drill rig up to a depth of 35 feet bgs. Seven soil samples and one duplicate were collected at intervals of 5 feet and were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals. The borehole was backfilled following sampling.

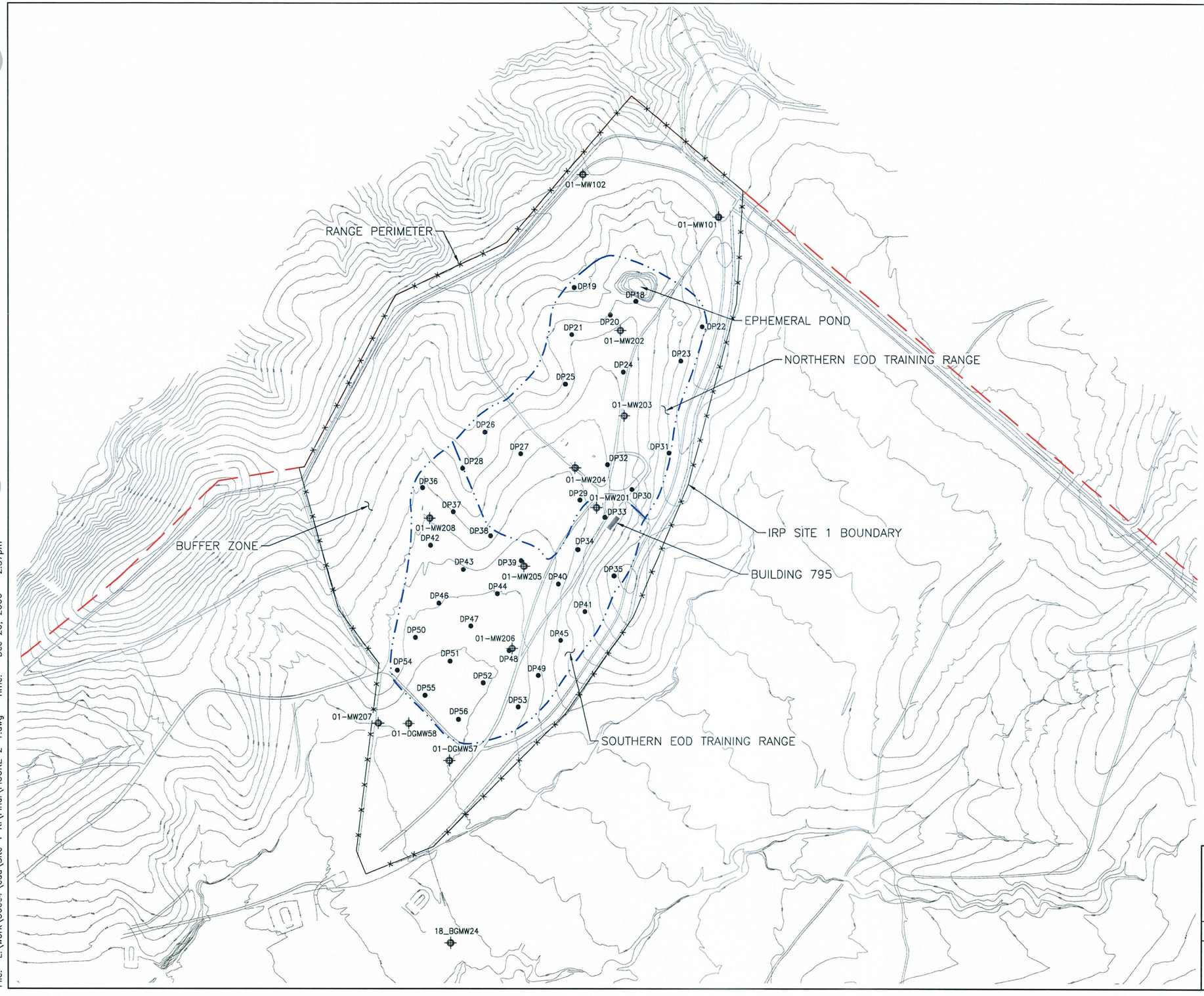
Table 2-2: Summary of Phase II Remedial Investigation Sampling Activities

Tier	Soil Investigations	Sediment Investigations	Groundwater Investigations	Surface Water Investigations
Tier I	• *Soil Sampling* ▪ Number of samples: 85 (including 8 duplicates) ▪ Sampling Depth: 1.5 to 5 feet bgs ▪ Analyses: VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals.	None	• *Groundwater Sampling* ▪ Number of wells sampled: 12 ▪ Analyses: VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, NDMA, nitrate, pH, and metals	None
Tier II	• *Trenching and Potholing at the Locations of Geophysical Anomalies* • *Soil Sampling* ▪ Number of samples: 37 (including 4 duplicates) ▪ Sampling Depth: 0.5 to 10 feet bgs ▪ Analyses: VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, metals, and dioxins/furans.	None	None	None
Tier III-A	• *Borehole Advanced to a Depth of 35 feet bgs* • *Soil Sampling* ▪ Number of samples: 8 (including 1 duplicate) ▪ Sampling Depth: 5 to 35 feet bgs ▪ Analyses: VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, nitrate, pH, and metals.	None	• *Groundwater Monitoring Well Installation* ▪ Number of wells: 3 • *Groundwater Sampling* ▪ Number of rounds: 1 ▪ Number of wells sampled: 8 ▪ Analyses: VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, NDMA, nitrate, pH, and metals	None
Tier III-B	None	None	• *Piezometer (2-inch groundwater monitoring wells) Installation* ▪ Number of piezometers: 16 • *Groundwater Sampling* ▪ Number of rounds: 5 ▪ Number of wells sampled – Sampling Round 1 (Feb-Mar 2003): 24 ▪ Number of wells sampled – Sampling Round 2 (Jun 2003): 23 ▪ Number of wells sampled – Sampling Round 3 (Oct-Nov 2003):	None

Table 2-2: Summary of Phase II Remedial Investigation Sampling Activities

Tier	Soil Investigations	Sediment Investigations	Groundwater Investigations	Surface Water Investigations
			23 ▪ Number of wells sampled – Sampling Round 4 (Mar 2004): 25 ▪ Number of wells sampled – Sampling Round 5 (July-Aug 2004): 25 ▪ Analyses: Perchlorate	
Tier III-C	None	• Sediment Sampling ▪ Number of samples: 21 (including 2 duplicates) ▪ Sampling Depth: 0 to 0.5 feet bgs ▪ Analyses: VOCs, SVOCs, PAHs, petroleum hydrocarbons, explosives residues, perchlorate, total organic carbon, pH, and metals.	• *Groundwater Monitoring Well Installation* ▪ Number of wells: 12 • *Groundwater Sampling* ▪ Number of rounds: 2 ▪ Number of wells sampled – Sampling Round 1 (Sep 2004): 12 ▪ Number of wells sampled – Sampling Round 2 (Nov 2004): 15 ▪ Analyses: Perchlorate	• Surface Water Sampling ▪ Number of samples: 5 ▪ Analyses: VOCs, SVOCs, PAHs, explosives residues, petroleum hydrocarbons, perchlorate, general chemistry parameters (alkalinity, hardness, ammonia, pH, chloride, fluoride, nitrate, nitrite, and sulfate), and metals.
Tier III-D	None	None	• *Boreholes for Hydropunch™ Sampling and Characterizing Hydrogeology and Geology* ▪ Number of continuous cores collected: 31 • *Groundwater Monitoring Well Installation* ▪ Number of wells: 2 • *Hydropunch™ Sampling* ▪ Number of Hydropunch samples: 44 (including 4 duplicates) ▪ Analyses: Perchlorate • *Groundwater Sampling* ▪ Number of rounds: 1 ▪ Number of wells sampled: 2 ▪ Analyses: Perchlorate	None

Notes:
bgs = below ground surface
NDMA = N-nitrosodimethylamine
PAHs = polycyclic aromatic hydrocarbons
pH = negative log of the hydrogen ion concentration
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds



LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- DP56 DIRECT-PUSH SAMPLING LOCATION - 2002

NOTES:

IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
RI	REMEDIAL INVESTIGATION

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Phase II RI Tier I Sampling Locations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	2-1

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 2-1.dwg Time: Dec 20, 2006 - 2:57pm

PAGE NO. 2-10

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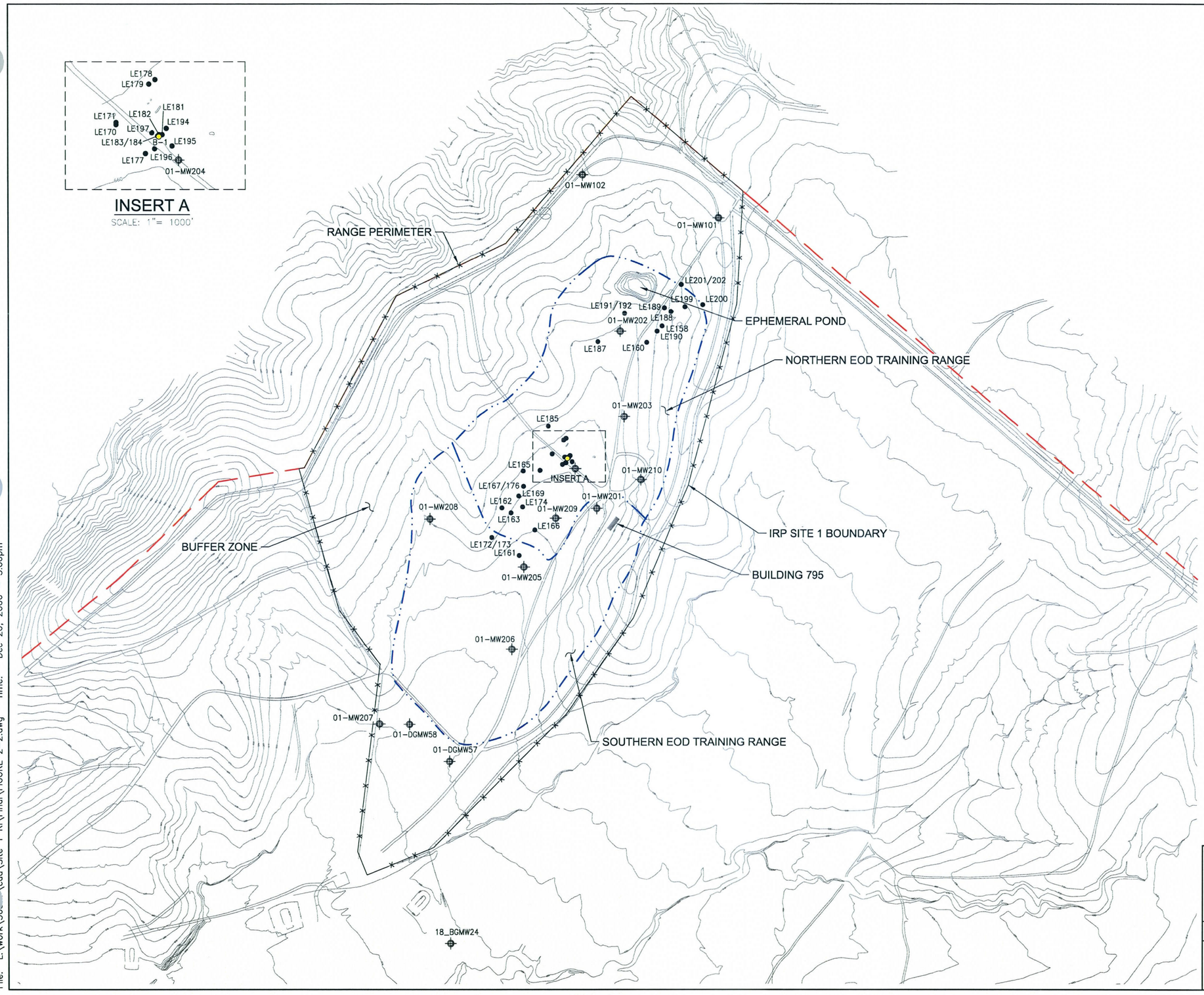

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- B-1 DEEP SOIL BORING
- LE158 SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

NOTES:

IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
RI	REMEDIAL INVESTIGATION

NORTH

0 200' 400'
SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Phase II RI Tier II and Tier III-A Sampling Locations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	2-2

File: L:\work\3c...cad\Site 1 RI\Final\FIGURE 2-2.dwg Time: Dec 20, 2006 - 3:00pm

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2.2.2 Sediment Sampling

Tier III-C. Sediment sampling at IRP Site 1 was conducted as part of Tier III-C investigations. Tier III-C involved the collection of 19 sediment samples and two duplicates from the bottom of the Ephemeral Pond at IRP Site 1 (Figure 2-3). Sixteen samples and two duplicates were surface samples (collected at 0-foot bgs), and the remaining three samples were collected from 0.5-foot bgs using a hand auger. The hand auger samples at locations, 01-HA-15, 01-HA16, and 01HA-17, were collected at the locations of previously identified geophysical anomalies. The samples were analyzed for VOCs, SVOCs, polycyclic aromatic hydrocarbons (PAHs), explosives residues, petroleum hydrocarbons, perchlorate, total organic carbon, pH, and metals.

All soil borehole sampling was performed in accordance with the following CLEAN II SOPs (BNI 2002):

- CLEAN SOP 3, Borehole Logging
- CLEAN SOP 4, Soil Sampling
- CLEAN SOP 11, Decontamination of Equipment

2.2.3 Groundwater Sampling and Monitoring Well Installation

Groundwater sampling was conducted at IRP Site 1 during the Tier I investigations. Tier III investigations involved installation of new monitoring wells at the site to better evaluate the groundwater flow gradient and elevated perchlorate concentrations. Figure 2-4 shows the locations of all groundwater monitoring wells at IRP Site 1.

2.2.3.1 TIER I

The Tier I groundwater investigation involved one round of groundwater sampling and groundwater level monitoring to establish the baseline conditions. This monitoring was conducted in January and February 2002, in accordance with the CLEAN SOP 8, Groundwater Sampling (BNI 2002), and involved 12 existing monitoring wells (18_BGMW24, 01-DGMW57, 01-DGMW58, 01-MW101, 01-MW102, and 01-MW201 through 01-MW207) (see Figure 2-4 and Table 2-3).

In January 2002, samples were collected from 12 existing monitoring wells and analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, NDMA, nitrate, and metals. Analysis results from three wells (01-DGMW57, 01-MW207, and 01-MW202) showed the presence of VOCs that were inconsistent with the historical results. To confirm detections of these VOCs, these wells were resampled for VOCs on 14 and 15 February 2002.

The Tier I groundwater investigation showed a potential for more widespread perchlorate contamination; therefore, subsequent groundwater investigations at IRP Site 1 were conducted as a part of Tier III.

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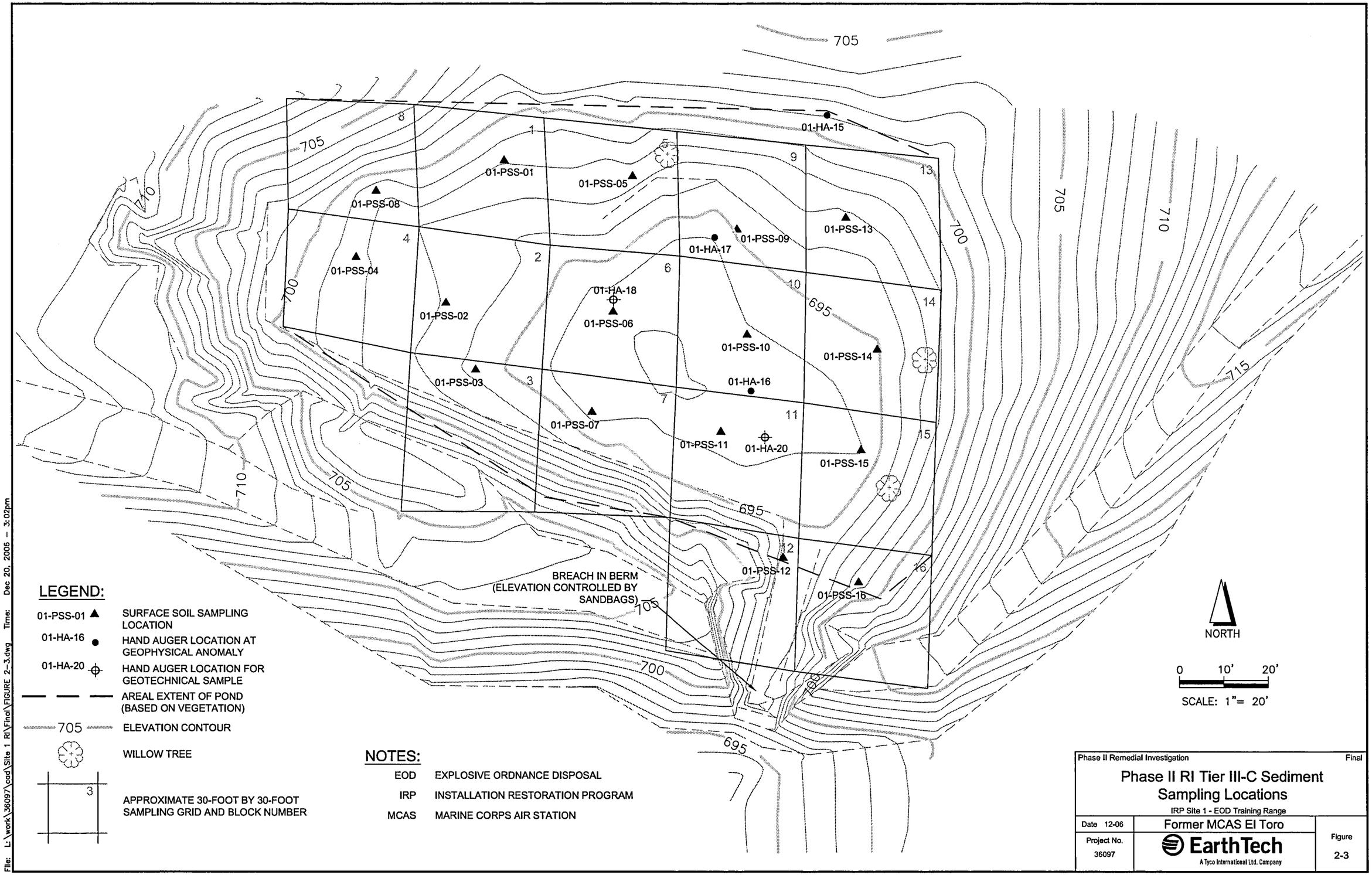

LEGEND:

01-PSS-01 ▲	SURFACE SOIL SAMPLING LOCATION
01-HA-16 ●	HAND AUGER LOCATION AT GEOPHYSICAL ANOMALY
01-HA-20 ⊕	HAND AUGER LOCATION FOR GEOTECHNICAL SAMPLE
— — —	AREAL EXTENT OF POND (BASED ON VEGETATION)
705	ELEVATION CONTOUR
	WILLOW TREE
3	APPROXIMATE 30-FOOT BY 30-FOOT SAMPLING GRID AND BLOCK NUMBER

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

Phase II Remedial Investigation — Final

Phase II RI Tier III-C Sediment Sampling Locations

IRP Site 1 - EOD Training Range

Date 12-06	Former MCAS El Toro	
Project No. 36097	EarthTech — A Tyco International Ltd. Company	Figure 2-3

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 2-3.dwg Time: Dec 20, 2006 - 3:02pm

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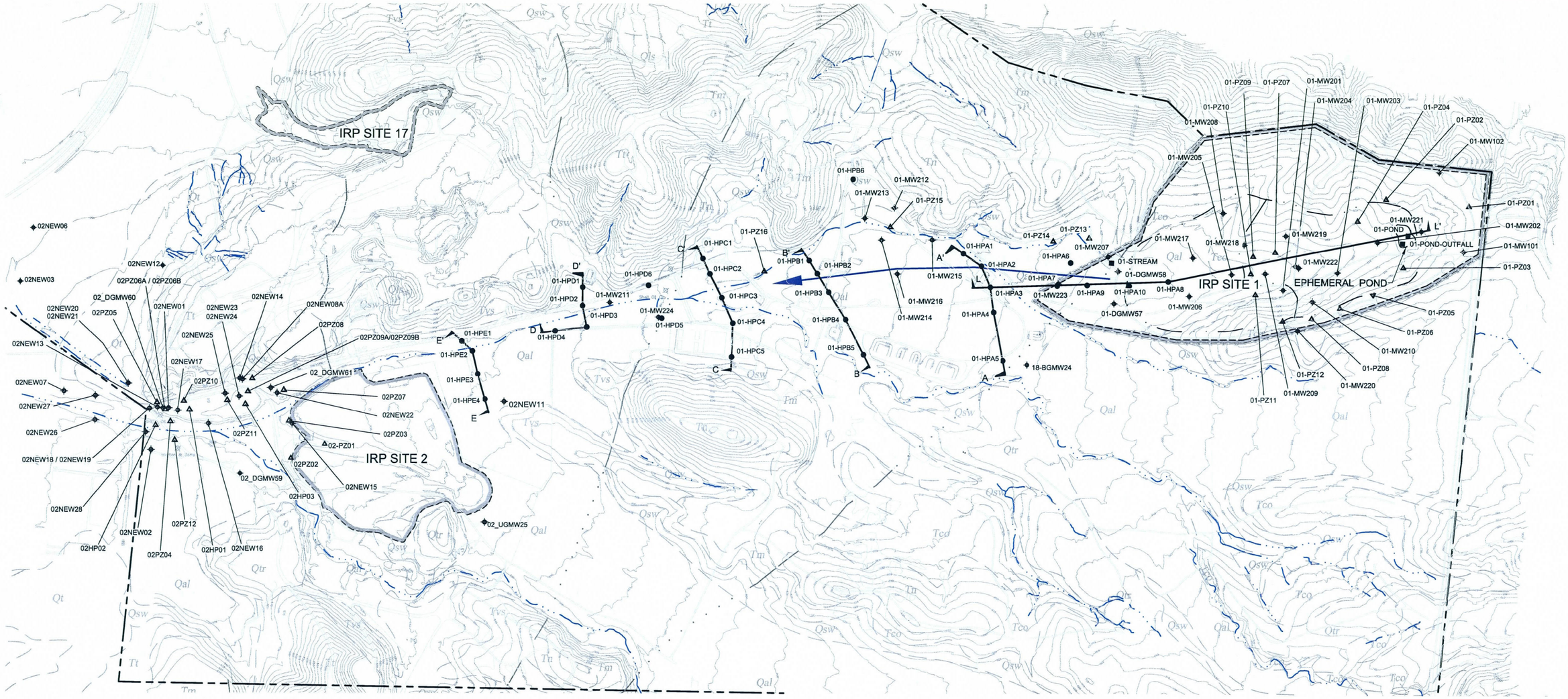

LEGEND:

01-HPE1 ●	HYDROPUNCH SAMPLING LOCATION
01-MW209 ✦	EXISTING GROUNDWATER MONITORING WELL
01-PZ11 △	EXISTING PIEZOMETER
01-POND ■	SURFACE WATER SAMPLING LOCATIONS
	MCAS EL TORO BOUNDARY
	EOD TRAINING RANGE BOUNDARY
	IRP SITE BOUNDARY (1, 2, AND 17)
	STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
	GENERAL GROUNDWATER GRADIENT DIRECTION
	GEOLOGIC FAULT, DOTTED WHERE INFERRED
	EXISTING FENCE
A A'	CROSS-SECTION LOCATION

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
RI	REMEDIAL INVESTIGATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Phase II RI Tier III-B, III-C, and III-D Groundwater and Surface Water Sampling Locations

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	2-4

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 2-4.dwg Time: Dec 20, 2006 - 3:04pm

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Table 2-3: Summary of Wells/Boreholes Sampled During Different Tiers of Phase II Remedial Investigation

Tier I Jan 2002	Tier III-A Jun 2002	Tier III-B Feb-Mar 2003	Tier III-B Jun 2003	Tier III-B Oct/Nov 2003	Tier III-B Mar 2004	Tier III-B Jul-Aug 2004	Tier III-C Sep 2004	Tier III-C Nov 2004	Tier III-D Jan-Feb 2005	Tier III-D Mar 2005
01-MW101	01-MW102	01-PZ01	01-PZ01	01-PZ01	01-PZ01	01-PZ01	01-MW211	01-PZ13	01-HPA1	01-HPA9
01-MW102	01-MW201	01-PZ02	01-PZ02	01-PZ02	01-PZ02	01-PZ02	01-MW212	01-PZ14	01-HPA2	01-HP10
01-MW201	01-MW202	01-PZ03	01-PZ03	01-PZ03	01-PZ03	01-PZ03	01-MW213	01-PZ15	01-HPA3	01-MW223
01-MW202	01-MW207	01-PZ04	01-PZ04	01-PZ04	01-PZ04	01-PZ04	01-MW214	01-PZ16	01-HPA4	01-MW224
01-MW203	01-MW208	01-PZ05	01-PZ05	01-PZ05	01-PZ05	01-PZ05	01-MW215	01-MW206	01-HPA5	
01-MW204	01-MW209	01-PZ06	01-PZ06	01-PZ06	01-PZ06	01-PZ06	01-MW216	01-MW207	01-HPA6	
01-MW205	01-MW210	01-PZ07	01-PZ07	01-PZ07	01-PZ07	01-PZ07	01-MW217	01-MW211	01-HPA7	
01-MW206	01-DGMW57	01-PZ08	01-PZ08	01-PZ08	01-PZ08	01-PZ08	01-MW218	01-MW212	01-HPA8	
01-MW207		01-PZ09	01-PZ09	01-PZ09	01-PZ09	01-PZ09	01-MW219	01-MW213	01-HPA9	
01-DGMW57		01-PZ10	01-PZ10	01-PZ10	01-PZ10	01-PZ10	01-MW220	01-MW214	01-HP10	
01-DGMW58		01-PZ11	01-PZ11	01-PZ11	01-PZ11	01-PZ11	01-MW221	01-MW215	01-HPB1	
18BGMW24		01-PZ12	01-PZ12	01-PZ12	01-PZ12	01-PZ12	01-MW222	01-MW216	01-HPB2	
		01-PZ13	01-PZ13	01-PZ13	01-PZ13	01-PZ13		01-DGMW57	01-HPB3	
		01-PZ14	01-PZ14	01-PZ14	01-PZ14	01-PZ14		01-DGMW58	01-HPB4	
		01-PZ15	01-PZ15	01-PZ15	01-PZ15	01-PZ15		18BGMW24	01-HPB5	
		01-PZ16	01-PZ16	01-PZ16	01-PZ16	01-PZ16			01-HPB6	
		01-MW102	01-MW102	01-MW102	01-MW102	01-MW102			01-HPC2	
		01-MW201	01-MW201	01-MW201	01-MW201	01-MW201			01-HPC3	
		01-MW202	01-MW202	01-MW202	01-MW202	01-MW202			01-HPC4	
		01-MW207	01-MW207	01-MW207	01-MW204	01-MW204			01-HPC5	
		01-MW208	01-MW208	01-MW208	01-MW205	01-MW205			01-HPD1	
		01-MW209	01-MW209	01-MW209	01-MW207	01-MW207			01-HPD2	
		01-MW210	01-MW210	01-MW210	01-MW208	01-MW208			01-HPD2	
		18BGMW24			01-MW209	01-MW209			01-HPD3	
					01-MW210	01-MW210			01-HPD4	
									01-HPD5	
									01-HPE1	
									01-HPE2	
									01-HPE3	
									01-HPE4	
									01-MW223	
									01-MW224	

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2.2.3.2 TIER III

Tier III-A. The Tier III-A groundwater investigation involved the installation of three new monitoring wells (01-MW208, 01-MW209 and 01-MW210), to refine the groundwater flow direction and gradient, and delineate the perchlorate contamination in the central portion of IRP Site 1 (see Figure 2-4). Table 2-4 presents the construction details of these wells along with the other wells installed during subsequent tiers.

Following the installation of three new monitoring wells, groundwater samples were collected from these wells in June 2002 and analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, perchlorate, NDMA, nitrate, pH, and metals. In addition, the Wells 01-DGMW57, 01-MW102, 01-MW201, 01-MW202, and 01-MW207 were sampled for perchlorate. Since perchlorate was unexpectedly detected above the State provisional action level (PAL) (in effect in 2002) in newly installed Well 01-MW210 located upgradient from the suspected source area, a confirmation sample was collected from this well in July 2002 (one month after the initial sample).

Tier III-B. The Tier III-B groundwater investigation involved the installation of 16 new piezometers (2-inch groundwater monitoring wells), 01-PZ01 through 01-PZ16, to further delineate the perchlorate contamination in the central portion of IRP Site 1, as well as to determine whether perchlorate was present in the areas south of IRP Site 1 (Figure 2-4 and Table 2-4). The newly installed wells, and selected previously installed wells, were sampled for five rounds to confirm the perchlorate sampling results (see Table 2-3).

Tier III-C. The Tier III-C groundwater investigation involved the installation of 12 additional groundwater monitoring wells (01-MW211 through 01-MW222), to further delineate the perchlorate contamination in the central portion of IRP Site 1, as well as to further delineate perchlorate contamination south of IRP Site 1 (Figure 2-4 and Table 2-4). A total of 14 groundwater samples (including two duplicates) were collected from the newly installed wells following completion, and 16 groundwater samples (including one duplicate) were collected from selected wells in the areas south of IRP Site 1 for confirmation purposes (see Table 2-3 and Figure 2-4).

Tier III-D. As a part of Tier III-D groundwater investigation, 27 boreholes were advanced in the areas south of IRP Site 1 and two boreholes were installed in the southern portion of IRP Site 1 (01-HPA7 and 01-HPA8), in January and February 2005 (see Figure 2-4 and Table 2-3). Continuous cores were collected from surface to total depth during advancement of these boreholes for characterization of site geology and hydrogeology. Chemical analyses were not conducted on the core samples.

In addition to collection of continuous cores, Hydropunch™ samples were collected from the boreholes for further assessment of the extent of perchlorate in groundwater. Twenty-five Hydropunch™ samples (including four duplicates) were collected from the saturated alluvium, and 17 Hydropunch™ samples were collected from the saturated bedrock. All Hydropunch™ samples were analyzed for perchlorate.

In March to April 2005, two additional boreholes (01-HPA9 and 01-HPA10) were advanced in the southern portion of IRP Site 1 (see Figure 2-4). Hydropunch™ samples were collected from saturated alluvium from these boreholes and analyzed for perchlorate (see Table 2-3). Additionally, two groundwater monitoring wells were installed in the southern portion of IRP Site 1 (01-MW223) and along the aquifer south of IRP Site 1 (01-MW224). Groundwater samples were collected from the two wells for analysis of perchlorate (see Figure 2-4 and Table 2-4).

The operating procedures used for various field activities were as follows:

- CLEAN SOP 5, Monitoring Well Installation and Development (BNI 2002), and Sections 4.2.4.1 and 4.2.4.1 of the *Phase II RI Work Plan* (Earth Tech 2001a) for well construction and development.
- CLEAN SOP 3, Borehole Logging (BNI 2002) for description of lithology, including all soil classification information during borehole drilling.
- CLEAN SOP 11, Decontamination of Equipment (BNI 2002) and Section 4.2.6 of the Work Plan (Earth Tech 2001a) for decontamination of all equipment before each use.
- CLEAN SOP 4, Soil Sampling (BNI 2002) for soil sampling.

2.2.4 Surface Water Sampling

During Tier III-C investigations (January and February 2005), five surface water samples were collected at IRP Site 1 for the assessment of nature and extent of surface water contamination. One of the five samples was collected from the Ephemeral Pond and two samples (one of which was filtered) were collected near the Ephemeral Pond outfall. In addition, two surface water samples (one of which was filtered) were collected from the downgradient location near Monitoring Well 01-MW207 (Figure 2-4). Two surface water samples collected from the Ephemeral Pond and one sample collected near the western reach of Borrego Canyon Wash were analyzed for VOCs, SVOCs, PAHs, explosives residues, petroleum hydrocarbons, perchlorate, general chemistry parameters (alkalinity, hardness, ammonia, pH, chloride, fluoride, nitrate, nitrite, and sulfate), and metals. The remaining two filtered samples were analyzed for metals only.

Table 2-4. IRP Site 1 Monitoring Well Details

Well ID	Northing	Easting	TOC Elevation (feet above msl)	Ground Surface Elevation (feet above msl)	Well Total Depth (ft bgs)	Screened Interval (ft bgs)	Casing Radius (in)	Screen Slot Size (ft)	Sand Pack	Bentonite Seal Interval (ft)	Sand Pack Interval (ft)	Borehole Radius (in)
01-MW101	2197826.90	6124760.45	752.61	752.00	159	118-148	4	0.020	#3 Monterey	106 - 111	111 - 159	9
01-MW102	2198004.75	6124203.59	759.89	759.40	140.5	95-135	4	0.020	#3 Monterey	82 - 87	87 - 140.5	9
01-MW201	2196633.43	6124260.76	667.91	667.20	62	27-57	4	0.020	#3 Monterey	17 - 22	22 - 62	10.5
01-MW202	2197362.95	6124357.83	691.87	689.50	60	10-35	4	0.020	#3 Monterey	4.5 - 7.5	7.5 - 35	10
01-MW203	2197012.48	6124374.32	684.85	682.10	60	33-58	4	0.020	#3 Monterey	27.5 - 31	31 - 60.5	10
01-MW204	2196799.70	6124173.10	666.01	663.50	57	24-54	4	0.020	#3 Monterey	18 - 21	21 - 57.0	10
01-MW205	2196396.70	6123963.75	648.10	645.40	60	18-53	4	0.020	#3 Monterey	9 -13	13 - 60	10
01-MW206	2196059.38	6123914.71	639.35	636.90	60	17-47	4	0.020	#3 Monterey	10.5 - 13.5	13.5 - 47	10
01-MW207	2195753.68	6123365.12	623.72	621.50	56	20-55	4	0.020	#3 Monterey	13.5 - 16	16 - 56.0	10
01-MW208	2196593.00	6123574.78	663.63	661.20	65	30-55	4	0.020	#3 Monterey	22 - 25	25 - 55	10
01-MW209	2196596.26	6124094.32	657.22	654.70	55	25-45	4	0.020	#3 Monterey	15 - 18.5	18.5 - 45	10
01-MW210	2196754.97	6124443.36	695.53	692.90	70	30-55	4	0.020	#3 Monterey	24.5 - 26.5	26.5 - 55	10
01-MW211	2192697.51	6121623.71	547.57	545.20	70	50-60	4	0.020	#3 Monterey	46 - 48	48 - 61	10
01-MW212	2194720.54	6122226.70	588.91	586.50	35	20-35	4	0.020	#3 Monterey	16 - 18	18 - 35	10
01-MW213	2194507.66	6122167.07	582.96	580.10	45	25-40	4	0.020	#3 Monterey	21 - 23	23 - 41	10
01-MW214	2194517.36	6122360.26	590.80	587.70	50	33-48	4	0.020	#3 Monterey	29 - 31	31- 50	10
01-MW215	2194807.62	6122561.70	595.36	593.20	50	35-50	4	0.020	#3 Monterey	31 - 33	33 - 50	10
01-MW216	2194471.96	6122619.00	593.34	591.30	40	25-40	4	0.020	#3 Monterey	21 - 23	23 - 40	10
01-MW217	2196234.89	6123708.28	642.05	639.00	70	55-70	4	0.020	#3 Monterey	51 - 53	53 - 70	10
01-MW218	2196589.35	6123842.79	671.57	669.30	60	45-60	4	0.020	#3 Monterey	41 - 43	43 - 60	10
01-MW219	2196867.19	6123959.19	678.13	675.70	70	40-55	4	0.020	#3 Monterey	36 - 38	38 - 55.5	10
01-MW220	2196553.27	6124552.52	712.77	710.69	110	100-110	4	0.020	#3 Monterey	96 - 98	98 - 110	10
01-MW221	2197662.38	6124472.16	712.44	710.10	80	60-80	4	0.020	#3 Monterey	56 - 58	58 - 80	10
01-MW222	2196810.67	6124194.12	666.26	664.00	130	115-130	4	0.020	#3 Monterey	107 - 112	112 - 130	10
01-MW223	2195359.55	6123319.72	619.89	617.40	76	35-70	4	0.020	#3 Monterey	27-32	32-70	10
01-MW224	2192922.33	6121906.24	555.49	553.40	91	28-88	4	0.020	#3 Monterey	20-25	25-88	10
01-DGMW57	2195599.83	6123657.35	633.18	632.70	93	63-83	4	0.020	#3 Monterey	NA	NA	10
01-DGMW58	2195751.90	6123489.06	624.80	624.30	86	57-77	4	0.020	#3 Monterey	NA	NA	10
18-DGMW24	2194852.94	6123662.32	618.13	617.50	61.5	51-71	4	0.020	#3 Monterey	NA	NA	10
01-PZ01	2198038.64	6124520.73	755.89	754.10	100	65-90	2	0.020	#3 Monterey	58 - 62	62 - 90	8
01-PZ02	2197584.17	6124144.20	733.16	731.50	90	60-85	2	0.020	#3 Monterey	53 - 57	57 - 85	8
01-PZ03	2197411.37	6124609.33	721.05	718.90	60	30-55	2	0.020	#3 Monterey	24 - 28	28 - 55	8
01-PZ04	2197334.45	6124157.85	693.96	692.40	60	30-55	2	0.020	#3 Monterey	24 - 28	28 - 55	8
01-PZ05	2197126.54	6124643.46	740.36	739.20	105	60-85	2	0.020	#3 Monterey	54 - 58	58 - 85	8
01-PZ06	2196884.71	6124590.37	732.67	731.30	85	55-80	2	0.020	#3 Monterey	47 - 52	52 - 80	8
01-PZ07	2196739.09	6124011.75	663.17	662.10	55	30-55	2	0.020	#3 Monterey	24 - 28	28 - 55	8
01-PZ08	2196682.32	6124539.49	722.34	720.40	80	55-80	2	0.020	#3 Monterey	49 - 53	53 - 80	8
01-PZ09	2196595.04	6123946.50	658.05	656.40	55	30-55	2	0.020	#3 Monterey	24 - 28	28 - 55	8
01-PZ10	2196511.63	6124038.03	652.66	650.70	50	25-50	2	0.020	#3 Monterey	20 - 22	22 - 50	8
01-PZ11	2196454.61	6124176.50	664.83	662.90	65	35-60	2	0.020	#3 Monterey	29 - 33	33 - 60	8
01-PZ12	2196505.46	6124437.68	715.37	714.10	100	70-95	2	0.020	#3 Monterey	63 - 67	67 - 95	8
01-PZ13	2195718.76	6123182.24	619.81	618.00	55	30-55	2	0.020	#3 Monterey	24 - 28	28 - 55	8
01-PZ14	2195500.06	6123055.76	613.42	610.80	50	25-50	2	0.020	#3 Monterey	18 - 22	22 - 50	8
01-PZ15	2194620.04	6122321.11	581.82	579.80	40	15-40	2	0.020	#3 Monterey	9 - 13	13 - 40	8
01-PZ16	2193709.79	6122066.74	564.24	562.60	40	15-40	2	0.020	#3 Monterey	8 - 12	12 - 40	8

Notes:
bgs = below ground surface
ft = feet
ID = identification
in = inches
IRP = Installation Restoration Program
msl = mean sea level
NA = not available
TOC = top of casing

3. Physical Characteristics of the Study Area

3.1 LAND USE AND NATURAL RESOURCES

A great portion of the land immediately surrounding Former MCAS El Toro, including areas adjacent to IRP Site 1 has been used for nursery and agricultural activities. Continued urbanization, however, has brought housing developments about 0.5-mile to the northeast of IRP Site 1. The land located further north and northeast of the site near the foothills of the Santa Ana Mountains remains essentially undeveloped. Areas located to the south, southeast, and southwest have been developed for commercial, light industrial, and residential uses.

According to the Santa Ana Region Basin Plan (CRWQCB 1995), the beneficial uses for groundwater beneath Former MCAS El Toro include municipal water supply, agricultural and industrial supplies, and industrial process supply. Groundwater in the vicinity of Former MCAS El Toro is mostly used for irrigation of agricultural and greenbelt areas (i.e., parkways and parks). Potable water in the area is imported from various sources, and the remainder comes from local resources, including groundwater. The nearest municipal wells used as drinking water sources are associated with the recently installed Irvine Desalter project and are located within approximately 5 miles of IRP Site 1, near the intersection of Irvine Center Drive and Culver Drive. It is anticipated that the new wells will be operational by October 2006.

3.2 GEOLOGY

3.2.1 Lithology and Structure

The study area represents a portion of shelf and tidal deposits eroded from the Santa Ana Mountains and deposited offshore since the late Cretaceous (approximately 60 million years ago [mya]). Figures 2-4 and 3-1 provide a site map, which details the topography, surface geology, and all assessment locations at IRP Site 1 through IRP Site 2 during the various investigations. Figures 3-2 and 3-3 present the generalized Orange County structural and stratigraphic relationships. Highlighted in Figure 3-2 are the six stratigraphic units represented in the study area, which encompasses IRP Site 1 to IRP Site 2, and the intervening western reach of Borrego Canyon Wash. The six units represent deposition from approximately 20 mya to the present time, although, due to structural and erosion events, which have affected the area, not all of the intervening units are preserved within the study area.

The local stratigraphy within the IRP Site 1 boundary is mapped by Morton, et al, (1999) as late Miocene/early Pliocene Capistrano Formation overlain in the southern portion by recent Quaternary (or Holocene) alluvium. Also present near the southern IRP Site 1 boundary is the projected trace of an unnamed fault passing beneath the alluvium and possibly between groundwater Monitoring Wells 01-MW207 and 01-DGMW58 (Figure 3-1). For purposes of this report this fault is referred to as unnamed fault #1 (UF#1). South of UF#1, Morton, et al, (1999) have mapped the middle to late Miocene Monterey Formation and early Pliocene Niguel Formation. The Capistrano Formation at this location is missing, although it is mapped at other locations in the general vicinity. Approximately 2,700 feet southwest and downgradient of UF#1 is another unnamed fault, referred to in this report as UF#2. Monitoring Well 01-MW211 is sited approximately 500 feet southwest and downgradient of UF#2 in alluvium, which in this area overlies the lower-Miocene Vaqueros and middle-Miocene Topanga Formation. Approximately 2500 feet southwest and downgradient of UF#2 are two discontinuous faults UF #3 and UF#4 trending northwest, possibly across IRP Site 2. IRP Site 2 overlies alluvium and dipping structural blocks of Topanga Formation and Vaqueros Formations.

Figure 3-2 shows the stratigraphic interval from the time of deposition of the Vaqueros Formation, the oldest exposed bedrock in the study area, to Holocene aged alluvium, the youngest material present. The oldest unit, the Vaqueros Formation, records deposition, which occurred during the earliest structural events associated with inception of the Los Angeles Basin (LA Basin). Nearly continuous structural downwarping since the late Miocene accompanied deposition of clastics derived from the rising highlands of the Santa Ana, San Bernardino and San Gabriel mountains.

Although no specific structural interpretations of the study area are known to exist, it is clear from the sedimentary record (Figures 3-2 and 3-3) that the southernmost block (beneath IRP Site 2) received the greatest uplift juxtaposing the oldest bedrock stratigraphic unit (Vaqueros Formation) next to the youngest (Niguel Formation). Loss or absence of the intervening strata is interpreted to represent a period of post-depositional erosion, which preceded the final Basin Filling and Disruption phase.

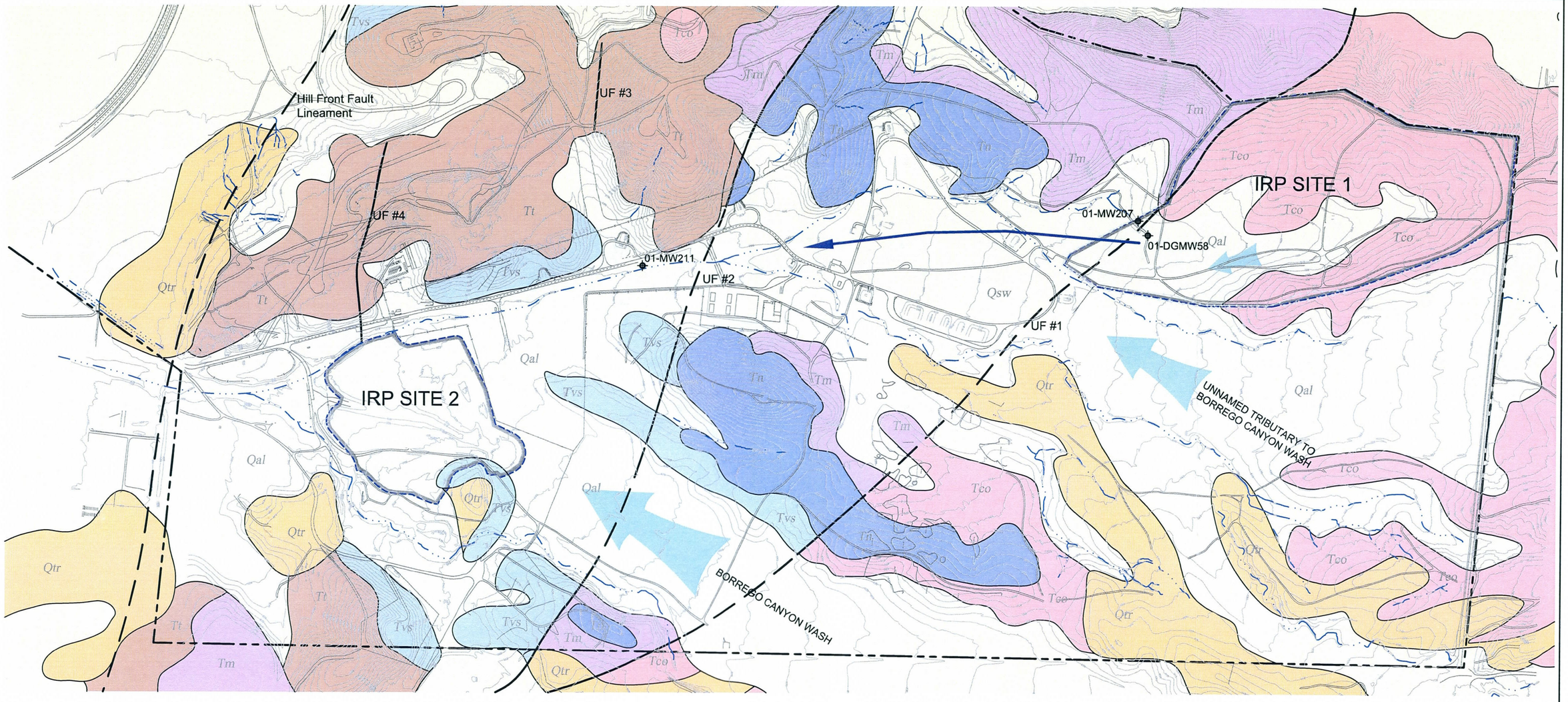
Stratigraphically, the reported maximum thickness of strata above the Vaqueros Formation includes 500 feet for the Topanga Formation, 8,500 feet for the Monterey Formation, 1,500 feet for the Capistrano Formation, and 350 feet for the Niguel Formation. Although these are maximum thicknesses, and may not be representative of thicknesses of these units deposited in this area, it underscores the fact that the IRP Site 2 bedrock block could have experienced the loss of approximately 10,000 feet of stratigraphic section (sediment thickness) from erosion that the nearby intermediate and IRP Site 1 blocks still retain. Given that the horizontal distance between IRP Site 1 and IRP Site 2 is on the order of 7,000 to 8,000 feet, the structural displacement on the fault separating IRP Site 2 from the intermediate block could be quite significant. By the same inference, given that the Niguel Formation is exposed in the intermediate block and the Capistrano Formation in the IRP Site 1 block, the stratigraphic offset across the fault separating these blocks would be substantially less.

These structural and stratigraphic relationships suggest the loss of considerable sediments from the IRP Site 2 block which are still present beneath the surfaces of the intermediate and IRP Site 1 blocks. As the IRP Site 2 block is topographically lower and downgradient from the intermediate and IRP Site 1 blocks, this would tend to suggest that the majority of this structural uplift and erosion had transpired long before the present day topography evolved. This event was likely related to the late stage structural evolution of the LA Basin, which dropped the Irvine sub-basin and raised the Santa Ana's once again.

3.2.2 Holocene Erosion and Deposition

The IRP Site 1 area is surrounded by ridges of feldspathic sandstone of the Capistrano Formation and is its own watershed, meaning that all of the water that falls as precipitation within this enclosed valley drains from it, is lost due to evaporation and evapotranspiration, or is absorbed by its soil or bedrock. IRP Site 1 drains into a larger western reach of Borrego Canyon Wash, which in turn drains into the even larger Borrego Canyon Wash, which drains into the much larger catchment areas of the Santa Ana foothills in the Irvine Groundwater Management Zone. Analysis of Figure 3-1 suggests that these washes are filled with varying widths of gently sloped (virtually flat) alluvium deposited as these drainages matured to their present state.

However, these washes were also cut into the bedrock by these same drainages before conditions evolved to the point where deposition, rather than erosion, dominated. Therefore, both the Borrego Canyon Wash, and its tributary wash that IRP Site 1 drains into, most likely have one or more "V-cut" channels carved into the underlying bedrock, just like the eroded bedrock surface of IRP Site 1 has today.



LEGEND:

- MCAS EL TORO BOUNDARY
- IRP SITE BOUNDARY (1 AND 2)
- STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
- GEOLOGIC FAULT, DASHED WHERE INFERRED
- UF #1 — UNNAMED FAULT #1
- 01-MW224 — 4-INCH GROUNDWATER MONITORING WELL
- GENERAL GROUNDWATER GRADIENT DIRECTION

- Qal — FLOOD PLAIN AND STREAM CHANNEL DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)
- Qsw — SHEETWASH DEPOSITS (HOLOCENE TO MIDDLE PLEISTOCENE)
- Qtr — TRAIL RIDGE SANDS (PLEISTOCENE)
- Tn — NIGUEL FORMATION
- Tco — OSO MEMBER
- Tm — MONTEREY FORMATION (MIOCENE)
- Tt — TOPANGA FORMATION (MIDDLE MIOCENE)
- Tvs — SESPE AND VAQUEROS FORMATIONS

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Site Geology

IRP Site 1 - EOD Training Range

Former MCAS El Toro

Date: 12-06

Project No. 36097

EarthTech — A Tyco International Ltd. Company

Figure 3-1

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-1.dwg Time: Dec 20, 2006 - 3:07pm

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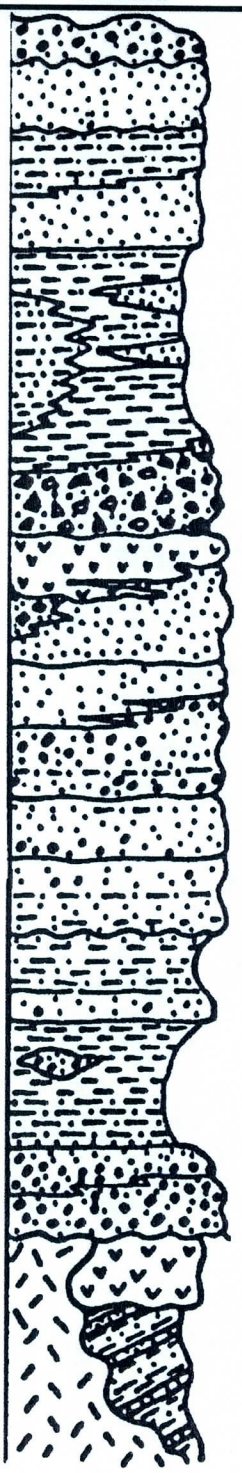
Figure 3-2: LA Basin Structural and Stratigraphic Relationships

L.A. Basin History	Geologic Age	Lithostratigraphic Unit	Stratigraphic Column	Remarks
Basin Filling and Disruption Phase	Holocene	Holocene Alluvium		Sands and gravels
	Pleistocene	San Pedro Fm. and Palos Verdes Sand		Marine terrace deposits
Basin Deposition Phase	Pliocene	Fernando Formation		Marine to terrestrial
	Late Miocene	Niguel Formation		Poorly consolidated deep marine sandstones and siltstones. Known to contain gypsum cement on fractures and joints.
		Capistrano Formation		
	Middle to late Miocene	Monterey Formation		Deep marine diatomite mudstones w/chert.
Basin Inception Phase	Mid. Miocene	San Onofre Breccia		Chaotic debris
	Mid. Miocene	El Modeno Volcanics		Basaltic to andesitic
	Mid. Miocene	Topanga Formation		Shallow marine sandstones
	Lwr. Miocene	Vaqueros Formation		Shallow marine sandstones
Pre-Basin Depositional Phase	Oligocene	Sespe Formation		Nonmarine redbeds fluvial
	Eocene	Santiago Formation		Marine and nonmarine sandstone/conglomerate
	Paleocene	Silverado Formation		Marine and nonmarine sandstone/claystone
	Late Cretaceous (Campanian)	Williams Formation		Sandstones, siltstones and conglomerates
	Late Cretaceous (Turonian - Campanian)	Ladd Formation		Nonmarine to marine conglomerates to shales
	Late Cretaceous (Turonian)	Trabuco Formation		Reddish conglomerates alluvial fan fluvial
Pre-Basin Tectonic Phase	E. Cretaceous	Peninsular Ranges Batholith		Granites and related extrusives
	Late Jurassic E. Cretaceous	Santiago Peak Volcanics		Andesitic breccias and shallow intrusives
	Mid. to Late Jurassic	Bedford Canyon Formation		Turbidites, sandstones, shales - deep marine
	Trassic?			

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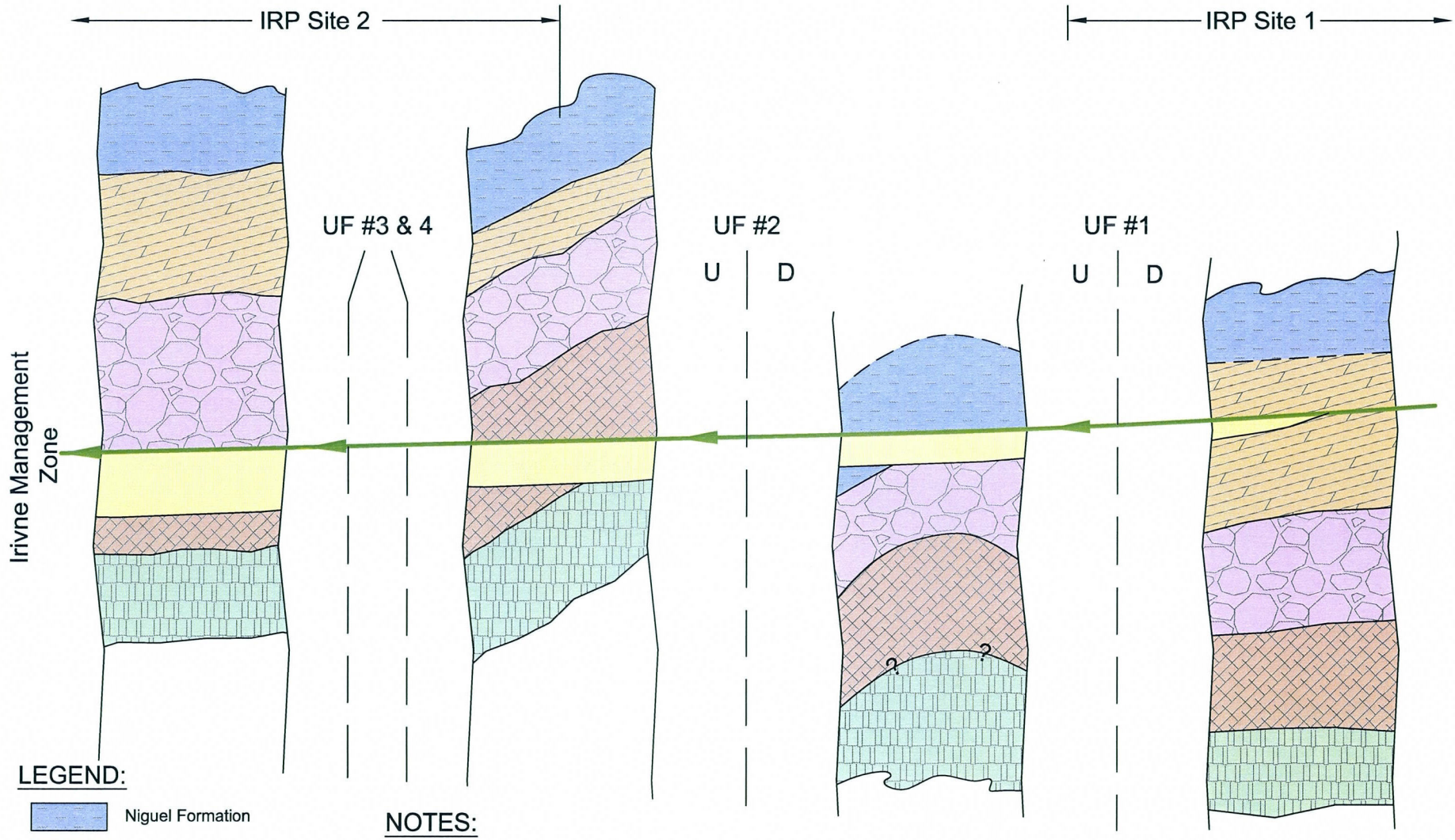
File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-3.dwg Time: Dec 22, 2006 – 1:44pm



LEGEND:

- Niguel Formation
- Capistrano Formation
- Monterey Formation
- Topanga Formation
- Vaqueros Formation
- Quaternary Alluvium
- Current Ground Surface

NOTES:

D	Downthrown
EOD	Explosive Ordnance Disposal
IRP	Installation Restoration Program
MCAS	Marine Corps Air Station
U	Upthrown
UF #1	Unamed Fault #1

Phase II Remedial Investigation — Final

IRP Site 1 to IRP Site 2
Structural and Stratigraphic Relationships

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech, A Tyco International Ltd. Company	3-3

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The alluvium, which fills these washes, is derived from the exposed materials within their catchment areas.

3.2.3 Hydrogeology

The EOD Training Range is within a tributary canyon to Borrego Canyon Wash. The site lies within the watershed of the Irvine Groundwater Management Zone, which is located southeast and adjacent to the Main Orange County Groundwater Basin. The Irvine Groundwater Management Zone has been divided into a forebay area and a pressure area. The forebay area lies along the margin of the basin where relatively shallow and coarse-grained sediments overlie semiconsolidated rock. The forebay area encompasses most of Former MCAS El Toro (Brown and Caldwell 1986). Recharge to the regional system takes place in the forebay area, primarily along washes such as the Borrego Canyon Wash that exit the Santa Ana Foothills and Mountains. The pressure area lies in the central portion of the basin where productive aquifers are present mainly in deeper zones (BNI 1995). The IRP Site 1 area is predominantly composed of poorly consolidated massive marine sandstone (bedrock) of the Oso Member of the Capistrano Formation. In the Tier III-C investigation, the siltstone facies of the Capistrano was also encountered.

Groundwater within this bedrock matrix averaged about 48 feet bgs during the September and November 2004 monitoring well gauging (Table 3-1). In general, groundwater reflects a south-southwest flow with a gradient averaging 0.05-feet-per-foot within the saturated bedrock portion of IRP Site 1. Figure 3-4 shows the groundwater equipotential map for the September 2004 gauging event. Within the saturated bedrock area of IRP Site 1, the gradient was 0.05, as was the case with the March 2005 (Figure 3-5) gauging event. Groundwater levels went up by approximately 10 feet between these two events in response to the second highest rainfall amounts recorded in Los Angeles history. As is observed on both Figures 3-4 and 3-5, the gradient reduced to the 0.01 to 0.02 range as flow transitions from the sandstone bedrock to the alluvial channel connecting IRP Site 1 and IRP Site 2.

The Tier III-C investigation involved installation of 12 additional groundwater monitoring wells both within the IRP Site 1 boundaries and south along the watershed between IRP Sites 1 and 2. These 12 wells were drilled and installed with continuous coring methods. These wells penetrated both feldspathic sandstone bedrock as well as locally generated alluvium (south of IRP Site 1), with wells screened in both.

As continuous cores were removed from each borehole during the Tier III-C investigation, they were immediately logged by the attending geologist, and such properties as reactivity to hydrochloric acid (HCl), degree of moisture saturation, as well as color and grain size features were noted in the logs. Initial examination of the logs indicated that there were other properties which might better aid the interpretive efforts; therefore, the entire core from each borehole was further examined within a week of collection for characteristics such as geologic unit (e.g., alluvium versus bedrock), degree of weathering of the bedrock, and the presence or absence of moisture and degree of saturation.

Groundwater levels found in the feldspathic sandstone tend to reflect a regionally gradual potentiometric surface, generally reflecting the surface topography, throughout IRP Site 1. This surface does not necessarily correspond to where saturations were initially identified in the sandstone during drilling, but often rise above these levels to the site-wide potentiometric surface. This would tend to suggest some mechanism of confinement. This hydrogeologic environment appears to be complicated by the development of secondary porosity within the feldspathic sandstone, which is suspected of being responsible for the variable water saturations found there. Secondary porosity refers to development of a subsequent or separate system of openings (porosity) that are not part of

the native matrix, such as dissolution or leaching. In this case, the secondary porosity may be related to a lack of HCl-reactive mineralization.

The borehole for Well 01-MW222 was intended to explore the possibility of lower water-bearing units within the bedrock, and was to be screened in the second water-bearing unit if one was identified. The borehole for this well was advanced to 190 feet bgs. The first 25 feet of this borehole were composed of dry, highly weathered feldspathic sandstone that did not react with HCl. The remaining 165 feet of core (from 25 feet bgs to 190 feet bgs) were composed of 150 feet of visually similar feldspathic sandstone with only minor variations, and 15 feet of the siltstone facies in two beds. However, this same section of core contained 10 zones of sandstone which reacted with HCl, 4 short zones interpreted as "wet" or relatively saturated with water, 11 zones interpreted as "moist" (or less saturated with water), and nine zones that were dry but did not react with HCl. These zones are more or less randomly distributed through the core. The well screen was set between 115 and 130 feet bgs, which included a 1-foot saturated (wet) zone and one 2-foot "moist" zone. Water was subsequently gauged at approximately 75 feet above the screen in this well (encompassing some nine dry zones of core). The groundwater sample collected from this well was found not to contain perchlorate above the reporting limit indicating that perchlorate had not penetrated to this depth in the aquifer. The subsurface of IRP Site 1, though composed predominately of ostensibly massive feldspathic sandstone, is a complex hydraulic environment that appears to be composed of zones of randomly oriented secondary solution porosity, which comprises the "aquifer" in this area.

These features probably relate to the degree of weathering of the sandstone, presence or absence of moisture as noted in detail as the core was retrieved, and the relationship that appears to exist regarding HCl reactivity. In only one instance (01-MW219 between 45 and 50 feet bgs) moisture was observed to be associated with the sandstone where reactions with HCl were observed. In all other cases, where the sandstone reacted with HCl, visible evidence of moisture was absent. The moisture or water-bearing zones range from less than 1-foot to nearly 30 feet in thickness; however, they do not appear to correlate between the wells. This suggests that secondary porosity, possibly manifested by the absence of HCl reactivity, may be a factor in the hydrodynamics of the feldspathic sandstone aquifer. The best example of this may be found in the interpretive log for Well 01-MW222 (Figure 3-6). Additional examples may be observed on the interpretive logs for Wells 01-MW215, 01-MW-217, 01-MW218, 01-MW219, 01-MW220, 01-MW221 and 01-MW222. Interpretive logs have also been prepared for Wells 01-MW211, 01-MW212, 01-MW213, 01-MW215 and 01-MW216; however, these wells are predominantly installed in alluvium. Interpretive logs for all Tier III-C wells may be found immediately behind the relevant standard well log in Appendix B.

Wells screened within the bedrock (probably across several secondary porosity zones) typically yield little water, with slow recharge times during purging and sampling. This is consistent with the slug test data collected in the central portion of IRP Site 1 as a component of the Tier III-C investigation in June 2004. The slug test data indicates that hydraulic conductivities range from 4.8×10^{-3} feet per day (feet/day) to 2.2×10^{-4} feet/day. Using an average hydraulic conductivity of 1.9×10^{-3} feet/day (4.8×10^{-3}, 2.2×10^{-4} and 7.9×10^{-4} feet/day), an average hydraulic gradient of 0.05-feet-per-foot (from current groundwater elevations), and an assumed effective porosity of 0.1 (10 percent), the average linear groundwater velocity at IRP Site 1 is estimated to be 1×10^{-3} feet/day, or 0.4 feet per year. Using the most productive of the three wells (01-PZ07 with hydraulic conductivity of 4.8×10^{-3} feet/day) would give a result of about 0.9-foot-per-year. This suggests that hydraulic conductivities may be very low within the IRP Site 1 feldspathic sandstone.

Table 3-1. Groundwater Elevations

Well ID	7/16/2004		9/8/2004		11/5/2004		3/9/2005		6/2/2005		6/8/2005		7/7/2005		8/3/2005		8/23/2005	
	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)
01-MW101	67.35	685.26	67.76	684.85	67.77	684.84	66.12	686.49	63.26	689.35	68.29	684.32	62.98	689.63	62.94	689.67	62.94	689.67
01-MW102	111.9	647.99	112.24	647.65	112.5	647.39	112.6	647.29	110.93	648.96	111.05	648.84	110.65	649.24	110.47	649.42	110.2	649.69
01-MW201	46.66	621.25	46.94	620.97	46.91	621	42.4	625.51	37.75	630.16	37.66	630.25	37.73	630.18	37.22	630.69	37.89	630.02
01-MW202	24.21	667.66	24.47	667.4	24.3	667.57	14.08	677.79	17.08	674.79	17.31	674.56	17.97	673.90	18.55	673.32	18.76	673.11
01-MW203	33.57	651.28	33.64	651.21	33.81	651.04	30.22	654.63	24.77	660.08	24.85	660	24.93	659.92	25.22	659.63	25.4	659.45
01-MW204	40.29	625.72	40.45	625.56	40.42	625.59	17.62	648.39	21.37	644.64	21.77	644.24	24.31	641.70	26.67	639.34	28.35	637.66
01-MW205	38.07	610.03	38.21	609.89	38.21	609.89	18.93	629.17	23.15	624.95	23.05	625.05	24.88	623.22	26.47	621.63	27.35	620.75
01-MW206	37.1	602.25	37.24	602.11	37.21	602.14	21.65	617.7	25.82	613.53	26.04	613.31	27.25	612.10	28.32	611.03	29.15	610.20
01-MW207	52.2	571.52	52.47	571.25	52.55	571.17	45.62	578.1	43.91	579.81	43.96	579.76	43.56	580.16	43.43	580.29	43.12	580.60
01-MW208	44.72	618.91	44.98	618.65	44.98	618.65	17.4	646.23	22.17	641.46	22.78	640.85	25.05	638.58	26.6	637.03	27.67	635.96
01-MW209	38.36	618.86	38.51	618.71	38.44	618.78	18.8	638.42	20.86	636.36	20.95	636.27	23.1	634.12	24.88	632.34	26.08	631.14
01-MW210	46.36	649.17	46.65	648.88	47.07	648.46	46.51	649.02	44.72	650.81	44.68	650.85	44.31	651.22	43.97	651.56	43.6	651.93
01-MW211	–	–	45.48	502.09	45.13	502.44	28.18	519.39	–	–	26.33	521.24	–	–	–	–	–	–
01-MW212	–	–	32.3	556.61	32.35	556.56	25.13	563.78	–	–	24.92	563.99	–	–	–	–	–	–
01-MW213	–	–	28.82	554.14	28.44	554.52	12.08	570.88	–	–	21.86	561.1	–	–	–	–	–	–
01-MW214	–	–	34.76	556.04	34.61	556.19	24.69	566.11	–	–	27.86	562.94	–	–	–	–	–	–
01-MW215	–	–	35.47	559.89	35.48	559.88	32.46	562.9	–	–	29.88	565.48	–	–	–	–	–	–
01-MW216	–	–	35.16	558.18	35.01	558.33	30.7	562.64	–	–	28.68	564.66	–	–	–	–	–	–
01-MW217	–	–	33.55	608.5	33.55	608.5	25.79	616.26	21.29	620.76	21.45	620.6	22.58	619.47	23.65	618.40	24.36	617.69
01-MW218	–	–	48.8	622.77	48.99	622.58	43.2	628.37	33.72	637.85	33.7	637.87	33.88	637.69	34.19	637.38	34.38	637.19
01-MW219	–	–	53.61	624.52	47.42	630.71	45.09	633.04	33.41	644.72	36.84	641.29	33.18	644.95	33.16	644.97	33.15	644.98
01-MW220	–	–	78.38	634.39	78.68	634.09	78.06	634.71	–	–	75.66	637.11	–	–	74.96	637.81	-	-
01-MW221	–	–	31.76	680.68	32.1	680.34	31.44	681	29.78	682.66	29.54	682.9	29.33	683.11	29.22	683.22	28.96	683.48
01-MW222	–	–	41.96	624.3	41.98	624.28	35.13	631.13	30.43	635.83	30.43	635.83	30.96	635.30	31.42	634.84	31.79	634.47
01-MW223	–	–	–	–	–	–	–	–	42.58	577.31	42.49	577.4	42.01	577.88	41.71	578.18	41.55	578.34
01-MW224	–	–	–	–	–	–	–	–	–	–	30.39	525.1	–	–	–	–	–	–
01-DGMW57	60.25	572.93	60.5	572.68	60.49	572.69	51.06	582.12	50.92	582.26	50.89	582.29	50.76	582.42	50.87	582.31	50.85	582.33
01-DGMW58	53.25	571.55	53.51	571.29	53.47	571.33	45.87	578.93	44.47	580.33	44.52	580.28	44.14	580.66	44.12	580.68	43.98	580.82
18-DGMW24	45.81	572.32	46.15	571.98	45.71	572.42	39.04	579.09	–	–	37.91	580.22	–	–	–	–	–	–
01-PZ01	67.61	688.28	67.78	688.11	68.01	687.88	68.13	687.76	67.46	688.43	67.43	688.46	67.38	688.51	67.25	688.64	67.05	688.84
01-PZ02	70.12	663.04	70.49	662.67	70.93	662.23	71.38	661.78	70.29	662.87	71.11	662.05	69.89	663.27	69.49	663.67	69.19	663.97
01-PZ03	42.25	678.8	42.52	678.53	42.79	678.26	47.2	673.85	38.04	683.01	38.02	683.03	37.1	683.95	36.59	684.46	36.27	684.78
01-PZ04	37.86	656.1	38.12	655.84	38.44	655.52	34.33	659.63	29.46	664.50	29.52	664.44	29.7	664.26	29.95	664.01	30.07	663.89
01-PZ05	67.48	672.88	67.79	672.57	68.23	672.13	68.41	671.95	67.48	672.88	67.48	672.88	67.35	673.01	67.14	673.22	66.93	673.43
01-PZ06	69.16	663.51	69.4	663.27	69.8	662.87	70.28	662.39	69.62	663.05	69.6	663.07	69.48	663.19	69.31	663.36	69.11	663.56
01-PZ07	39.06	624.11	39.3	623.87	39.33	623.84	31.55	631.62	26.07	637.10	26.05	637.12	26.68	636.49	27.23	635.94	27.69	635.48
01-PZ08	76.65	645.69	76.32	646.02	76.7	645.64	77.12	645.22	76.18	646.16	76.15	646.19	76.25	646.09	76.41	645.93	75.6	646.74
01-PZ09	35.85	622.2	36.07	621.98	36.2	621.85	32.64	625.41	25.91	632.14	26.05	632	25.48	632.57	25.18	632.87	25	633.05
01-PZ10	40.6	612.06	40.86	611.8	40.86	611.8	18.38	634.28	21.93	630.73	22.23	630.43	24.03	628.63	25.68	626.98	27.1	625.56
01-PZ11	44.37	620.46	44.59	620.24	44.64	620.19	39.95	624.88	34.74	630.09	34.56	630.27	34.68	630.15	34.75	630.08	34.89	629.94
01-PZ12	87.38	627.99	87.63	627.74	87.90	627.47	87.03	628.34	83.93	631.44	83.81	631.56	83.41	631.96	82.92	632.45	82.64	632.73
01-PZ13	48.89	570.92	49.17	570.64	49.34	570.47	47.85	571.96	–	–	45.85	573.96	–	–	–	–	–	–
01-PZ14	43.74	569.68	44	569.42	44.08	569.34	42.78	570.64	–	–	39.82	573.6	–	–	–	–	–	–
01-PZ15	25.61	556.21	25.87	555.95	25.27	556.55	12.77	569.05	–	–	18.39	563.43	–	–	–	–	–	–
01-PZ16	21.88	542.36	22.11	542.13	21.22	543.02	11.41	552.83	–	–	14.42	549.82	–	–	–	–	–	–

Notes:

TOC = top of casing

msl = mean sea level

– = No measurement was taken

Table 3-1. Groundwater Elevations

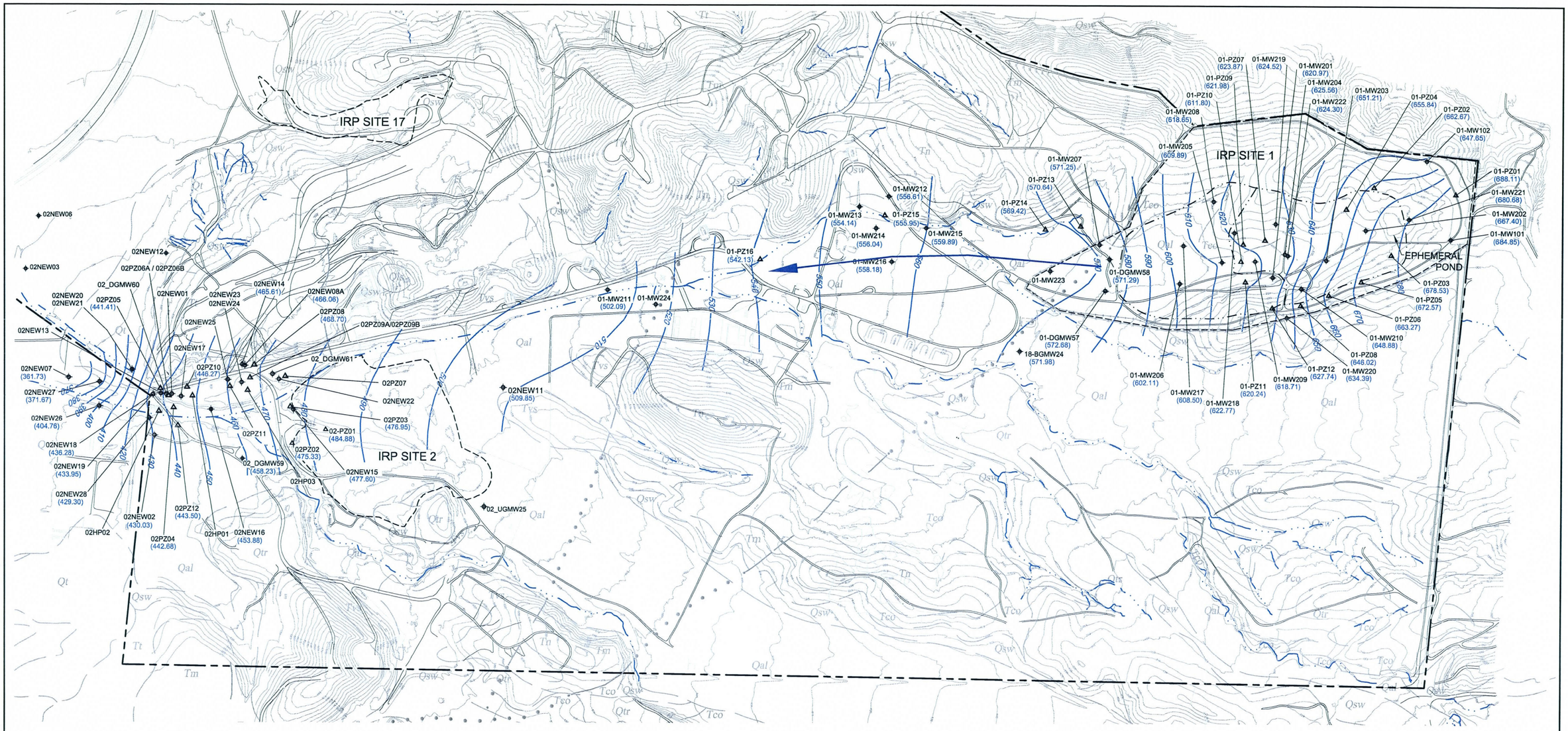
Well ID	2/12/2002		8/1/2002		1/29/2003		2/6/2003		2/13/2003		2/17/2003		6/5/2003		10/20/2003		3/11/2004	
	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)	Depth to Water (feet below TOC)	Elevation (feet above MSL)
01-MW101	64.02	688.59	65.4	687.21	--	--	65.87	686.74	65.82	686.79	--	--	--	--	65.9	686.71	66.6	686.01
01-MW102	107.93	651.96	108.87	651.02	--	--	109.75	650.14	109.67	650.22	--	--	110.16	649.73	110.92	648.97	111.13	648.76
01-MW201	43.23	624.68	44.33	623.58	--	--	43.3	624.61	45.24	622.67	--	--	--	--	45.95	621.96	46.14	621.77
01-MW202	21.51	670.36	22.36	669.51	--	--	22.9	668.97	22.76	669.11	--	--	22.06	669.81	23.31	668.56	23.55	668.32
01-MW203	29.65	655.2	30.97	653.88	--	--	31.7	653.15	31.58	653.27	--	--	--	--	32.43	652.42	32.81	652.04
01-MW204	38.65	627.36	39.25	626.76	--	--	39.64	626.37	39.62	626.39	--	--	--	--	39.8	626.21	40	626.01
01-MW205	36.35	611.75	36.97	611.13	--	--	37.36	610.74	37.36	610.74	--	--	--	--	37.59	610.51	37.81	610.29
01-MW206	35.37	603.98	35.9	603.45	--	--	36.3	603.05	36.23	603.12	--	--	--	--	36.8	602.55	36.91	602.44
01-MW207	48.13	575.59	49.19	574.53	--	--	50.55	573.17	50.66	573.06	--	--	50.96	572.76	51.48	572.24	51.96	571.76
01-MW208	--	--	42.32	621.31	--	--	43.05	620.58	43.03	620.6	--	--	43.4	620.23	44.01	619.62	44.26	619.37
01-MW209	--	--	36.94	620.28	--	--	37.52	619.7	37.51	619.71	--	--	--	--	37.87	619.35	38.13	619.09
01-MW210	--	--	42.95	652.58	--	--	44.07	651.46	44.00	651.53	--	--	44.3	651.23	45.11	650.42	45.58	649.95
01-MW211	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW212	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW214	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW215	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW216	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW217	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW218	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW219	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW220	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW221	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW222	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW223	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-MW224	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
01-DGMW57	56.65	576.53	57.67	575.51	--	--	58.92	574.26	59.00	574.18	--	--	--	--	--	--	60	573.18
01-DGMW58	49.09	575.71	50.19	574.61	--	--	51.59	573.21	51.69	573.11	--	--	--	--	--	--	52.97	571.83
18-DGMW24	42.44	575.69	43.49	574.64	--	--	44.85	573.28	44.95	573.18	--	--	--	--	--	--	45.09	573.04
01-PZ01	--	--	--	--	66.92	688.97	66.66	689.23	66.55	689.34	66.83	689.06	66.9	688.99	67.26	688.63	67.26	688.63
01-PZ02	--	--	--	--	73.32	659.84	70.98	662.18	68.87	664.29	68.49	664.67	67.76	665.4	68.7	664.46	69.44	663.72
01-PZ03	--	--	--	--	40.11	680.94	40.02	681.03	39.90	681.15	40.17	680.88	40.52	680.53	40.98	680.07	41.44	679.61
01-PZ04	--	--	--	--	36.02	657.94	35.84	658.12	35.78	658.18	36.03	657.93	36.04	657.92	36.7	657.26	37.6	656.36
01-PZ05	--	--	--	--	64.41	675.95	64.75	675.61	64.61	675.75	64.91	675.45	65.46	674.9	66.2	674.16	66.7	673.66
01-PZ06	--	--	--	--	66.89	665.78	66.9	665.77	66.77	665.9	67.04	665.63	67.39	665.28	68.12	664.55	68.54	664.13
01-PZ07	--	--	--	--	37.57	625.6	37.46	625.71	37.39	625.78	37.6	625.57	37.72	625.45	38.22	624.95	38.57	624.6
01-PZ08	--	--	--	--	73.91	648.43	74.16	648.18	73.78	648.56	74.04	648.3	74.42	647.92	75.2	647.14	75.6	646.74
01-PZ09	--	--	--	--	33.86	624.19	33.81	624.24	33.72	624.33	33.99	624.06	34.42	623.63	34.9	623.15	35.22	622.83
01-PZ10	--	--	--	--	39.77	612.89	39.73	612.93	39.80	612.86	39.81	612.85	39.57	613.09	39.98	612.68	40.38	612.28
01-PZ11	--	--	--	--	43.03	621.8	42.95	621.88	42.81	622.02	43.01	621.82	43.04	621.79	43.58	621.25	43.79	621.04
01-PZ12	--	--	--	--	85.79	629.58	85.82	629.55	85.68	629.69	85.93	629.44	86.04	629.33	86.63	628.74	86.90	628.47
01-PZ13	--	--	--	--	46.95	572.86	46.96	572.85	--	--	47.07	572.74	47.68	572.13	48.02	571.79	48.53	571.28
01-PZ14	--	--	--	--	41.95	571.47	41.96	571.46	--	--	42.08	571.34	42.54	570.88	42.98	570.44	43.4	570.02
01-PZ15	--	--	--	--	23.78	558.04	23.71	558.11	23.86	557.96	23.87	557.95	23.9	557.92	24.72	557.1	25.05	556.77
01-PZ16	--	--	--	--	20.84	543.4	20.82	543.42	--	--	20.5	543.74	20.45	543.79	21.35	542.89	20.84	543.4

Notes:

TOC = top of casing

msl = mean sea level

-- = No measurement was taken



LEGEND:

- MCAS EL TORO BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- OPERABLE UNIT (IRP SITES 1, 2 AND 17) COVER BOUNDARIES
- STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
- EXISTING FENCE
- 550 — GROUNDWATER CONTOUR ELEVATION, DASHED WHERE INFERRED (GROUNDWATER ELEVATIONS COLLECTED ON SEPTEMBER 8, 2004)
- GENERAL GROUNDWATER GRADIENT DIRECTION
- 01-MW209 (624.52) — 4-INCH GROUNDWATER MONITORING WELL WITH GROUNDWATER ELEVATION
- 01-PZ11 (620.24) — 2-INCH PIEZOMETER WITH GROUNDWATER ELEVATION
- GEOLOGIC FAULT, DOTTED WHERE INFERRED

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Groundwater Equipotential Map (September 2004)

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	3-4

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-4.dwg Time: Dec 20, 2006 - 3:12pm

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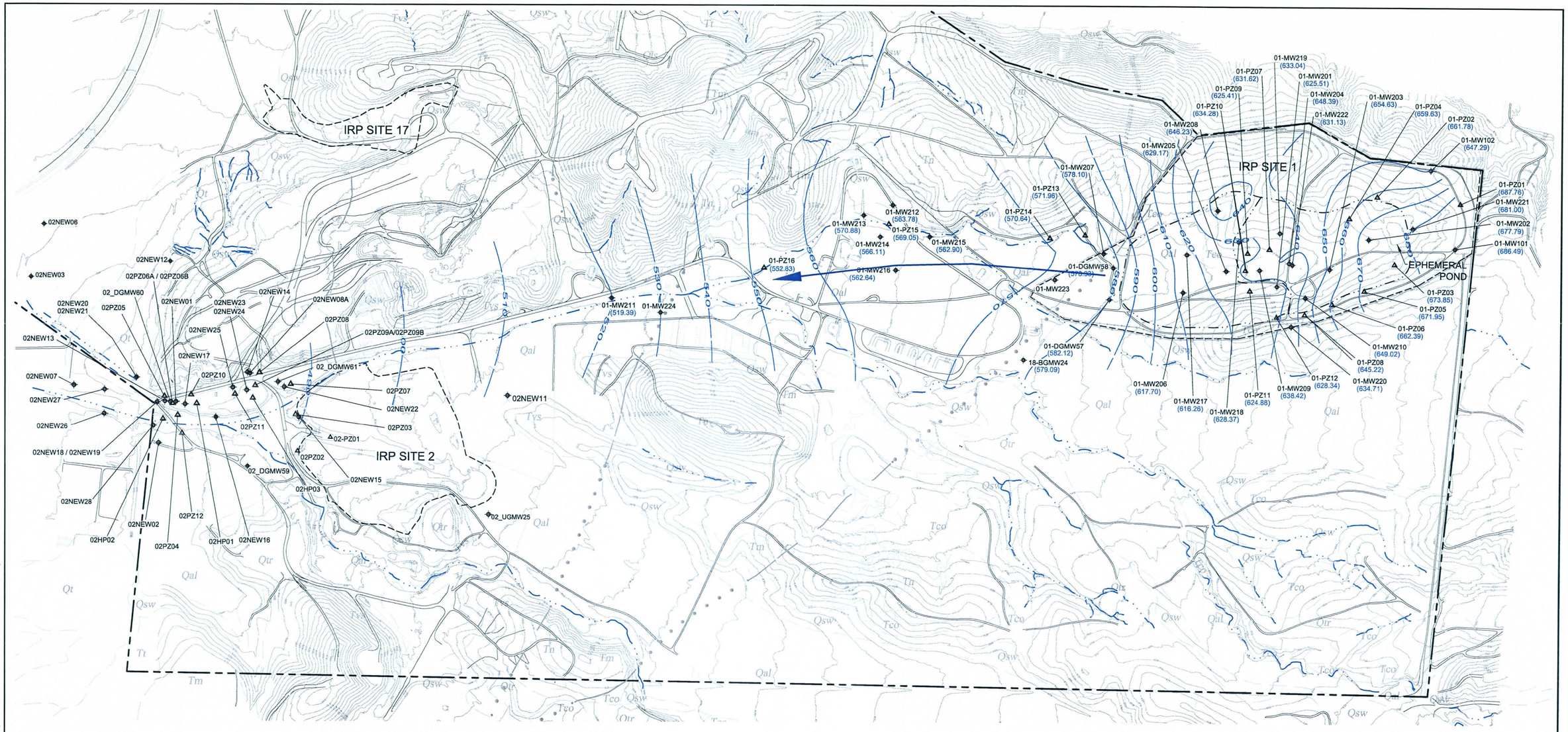

LEGEND:

- MCAS EL TORO BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- OPERABLE UNIT (IRP SITES 1, 2 AND 17) COVER BOUNDARIES
- STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
- EXISTING FENCE
- 530 — GROUNDWATER CONTOUR ELEVATION, DASHED WHERE INFERRED (GROUNDWATER ELEVATIONS COLLECTED ON MARCH 9, 2005)
- GENERAL GROUNDWATER GRADIENT DIRECTION
- 01-MW209 (638.42) — 4-INCH GROUNDWATER MONITORING WELL WITH GROUNDWATER ELEVATION
- 01-PZ11 (624.88) — 2-INCH PIEZOMETER WITH GROUNDWATER ELEVATION
- GEOLOGIC FAULT, DOTTED WHERE INFERRED

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Groundwater Equipotential Map (March 2005)

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	3-5

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-5.dwg Time: Dec 20, 2006 - 3:14pm

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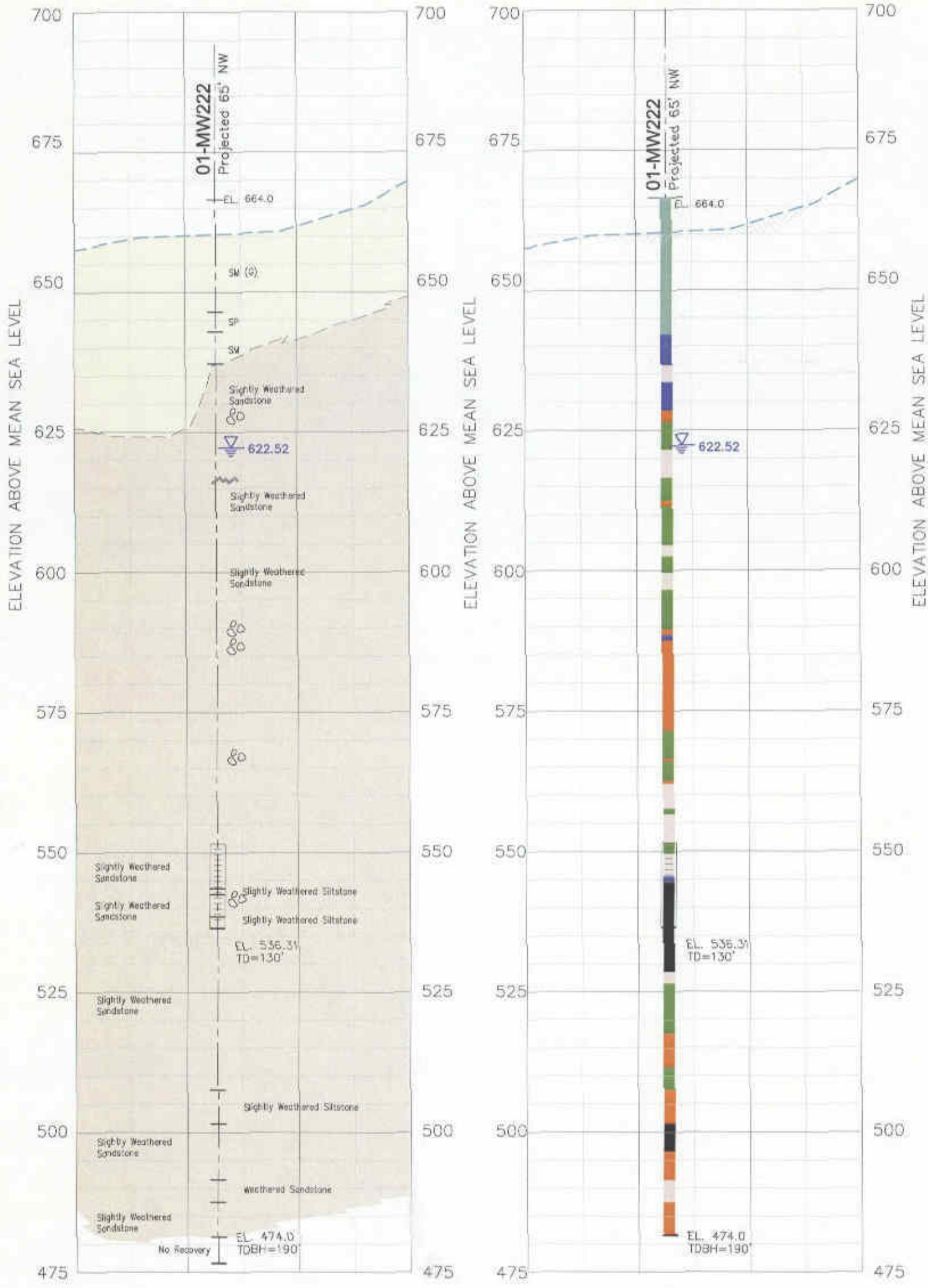
File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-6.dwg Time: Dec 20, 2006 - 3:57pm



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- FRACTURE
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

LEGEND:

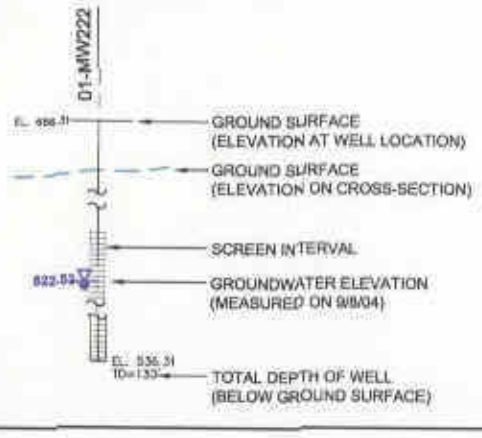
- ALLUVIUM
- FELDSPATHIC SANSTONE-A ("A" HORIZON, DECOMPOSITION ZONE, DRY, NON-REACTIVE WITH HCL)
- FELDSPATHIC SANSTONE-A ("B" HORIZON, ACCUMULATION ZONE, DRY, NON-REACTIVE WITH HCL)
- FELDSPATHIC SANSTONE-B-HCL ("B" HORIZON, DRY, REACTS WITH HCL)
- FELDSPATHIC SANSTONE-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSPATHIC SANSTONE-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)

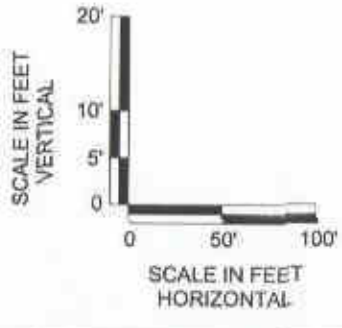
NOTES:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS

EOD	EXPLOSIVE ORDNANCE DISPOSAL
'	FEET
HCL	HYDROCHLORIC ACID
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
NW	NORTH WEST
SM	SILTY SAND
SM (G)	SILTY SAND WITH GRAVEL
SP	POORLY GRADED SAND
TDBH	TOTAL DEPTH OF BOREHOLE

WELL LEGEND:





Phase II Remedial Investigation — Final

01-MW222 INTERPRETIVE LOG

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	3-6

PAGE NO. 3-18

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Alluvium/Bedrock Contact Exposed in Western Reach of Borrego Canyon Wash. This illustrates the contact and illustrates an odd form of sandstone block cementation (possibly cementation along desiccation cracks). These cemented features clearly resist erosion better than the sandstone bedrock matrix, but they do not appear to be fractures.

These observations suggest the following:

- Water is being transported through the feldspathic sandstone primarily in zones of secondary porosity that do not react with HCl. It is not known with certainty what HCl-reactive mineral is missing, but this would appear to be the result of differential weathering, as bedding surfaces within the feldspathic sandstone have not been noted. Several references report that the Capistrano contains gypsum, which may be functioning as cement between the sandstone grains. Many workers report that the Capistrano and Niguel Formations are immature sandstones, having undergone only partial diagenesis and were therefore never fully cemented.
- As local recharge occurs, more of these non HCl-reactive zones may be activated, changing the local "aquifer" hydrodynamics.
- The flow regime in the sandstone bedrock appears to be quite complex, possibly not amenable to conventional methods of access.

The degree of weathering is thought likely to influence how groundwater moves within this matrix. As bedrock weathers in place it develops soil horizons, which over time can extend quite deep into the original fabric of the rock. Bedrock, which has undergone such deep weathering, is referred to as saprolite (Figure 3-7). Porosity and permeability of saprolites is commonly higher than less weathered bedrock, and in sedimentary rock matrices, the materials that formed the cement (commonly lime, gypsum, etc.) typically weather out first; however, this is not always the case as can be seen in the photograph above. The features shown in the photograph are found in the near

proximity of location 01-HPA5 where feldspathic sandstone bedrock, cropping out near to the inferred fault in the south of IRP Site 1, evinces fracture or rock fabric structures filled with cement that is more resistant to erosion than the rock matrix itself.

In general, the local groundwater gradient within the feldspathic sandstone tends to promote drainage of the ridge slopes surrounding IRP Site 1, and then along the western reach of Borrego Canyon Wash toward IRP Site 2. Comparison of Figures 3-4 and 3-5 provides evidence of the variation of this environment to absorb water. The period between September 2004 and March 2005 occasioned the second largest amount of precipitation ever recorded in the Los Angeles Basin (over 36 inches). Figure 3-4 shows the IRP Site 1 area after a prolonged period without precipitation with a gradient at equilibrium. Figure 3-5 shows the IRP Site 1 area in gradient dis-equilibrium after this historic amount of precipitation and this is interpreted to reflect the variable degree of recharge afforded by the partially cemented and differentially weathered feldspathic sandstone matrix.

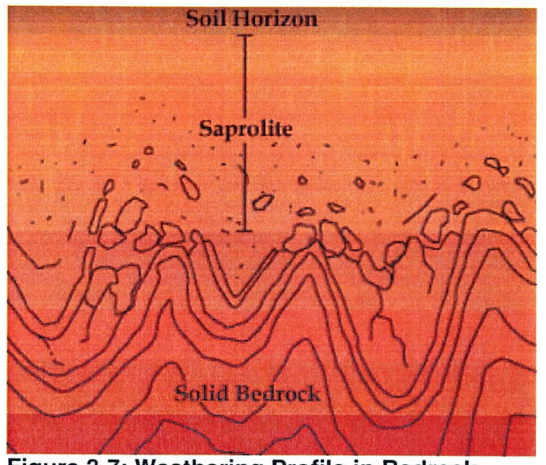

Figure 3-7: Weathering Profile in Bedrock

A long-term aquifer study conducted across IRP Site 2 found up to 8 separate hydraulic zones with the saturated bedrock of the Topanga Formation. These zones are believed to be distinct hydrogeologic entities, separated both vertically and horizontally, which respond poorly and with notable delays to precipitation events. The results of the long-term aquifer test at IRP Site 2 were a determining factor for the use of continuous coring during the Tier III-C investigation at IRP Site 1. The randomly variable secondary porosity observed in the cores at IRP Site 1 may be the mechanism for localized (or compartmentalized) hydrogeologic zones viewed on the scale of the aquifer test conducted at IRP Site 2.

The Tier III-C investigation found weathered bedrock to depths that ranged from 4 to 25 feet within the IRP Site 1 area. Most of these locations were around the periphery of the IRP Site 1 plume.

Information collected during the Tier III-C field investigation confirmed that saturated alluvium overlies the feldspathic sandstone bedrock south of IRP Site 1. Monitoring Well 01-PZ15, installed during the Tier III-B investigation, was screened entirely in alluvium and evinced perchlorate detections. Tier III-C Monitoring Wells 01-MW215, 01-MW213, 01-MW214 and 01-MW211 were placed upgradient and downgradient from Well 01-PZ15.

Examination of the core from Well 01-MW215 indicated that this well was actually installed in weathered bedrock. It was installed approximately 300 feet upgradient of 01-PZ15, and it also yielded perchlorate detections. Well 01-MW213, installed approximately 190 feet downgradient of Well 01-PZ15 was also found to have perchlorate detections.

These findings suggested that perchlorate was present in both saturated bedrock as well as saturated alluvium, which had been deposited over a paleochannel cut into the bedrock surface.

The Tier III-D investigation was designed to develop a better understanding of the paleochannel hydraulic environment. A total of 31 continuously cored borings were drilled across the western reach of Borrego Canyon Wash with Hydropunch™ groundwater samples collected soon after penetrating the aquifer surface. Each boring was completed to bedrock to define the geometry of the paleochannel with essentially 5 lines (Lines A through E from IRP Site 1 to near IRP Site 2). Bedrock, where encountered beneath the alluvium, was typically less weathered than that encountered within IRP Site 1. This is interpreted to have resulted from the fluvial erosion, which

probably cut, or removed, the softer weathered bedrock and continued to cut a classic "V" shaped channel into the resultant bedrock surface. The relatively narrow "V-cut" paleochannel retains a fairly consistent depth below the alluvial fill surface from the southernmost location near 01-HPE3 (91 feet bgs) to 01-HPA3 (86.5 feet bgs) over a distance of some 3,700 feet. The location of the V-cut channel and occurrence of the highest concentrations of perchlorate closely follow the western side of the western reach of Borrego Canyon Wash. This implies the historic tributary stream channel (paleochannel) had a westerly flow component directing flow along a relatively narrow section on the western margin of the western reach of Borrego Canyon Wash. Similarly, the primary occurrence of perchlorate after the confluence of the Borrego Canyon Wash with the unnamed tributary is along the western boundary of IRP Site 2 bedrock (Topanga Formation) and alluvial wash.

The coarse gravels and sands found at the bottom of the channel during the Tier III-D investigation attest to the cutting capacity of this drainage. As the final pulse of glaciation (the Wisconsin Stage) drew to a close approximately 15,000 years ago, sea levels worldwide rose nearly 300 feet for the last of four times, one time each for the four major glaciations. As the climate warmed, the Wisconsin Stage ice sheet, and locally alpine glaciers, melted. Many of the present day drainages were either deepened or initiated during this long, wet interval. Erosion in this wash gradually attenuated, probably due to lower rainfalls as the climate eventually stabilized to its present-day activity. Gradually lower stream velocities allowed for deposition, first of the coarser loads, and later the finer materials seen in the upper part of the wash stratigraphy.

Figure 2-4 presents locations of the Tier III-D Hydropunch™ and cross-section locations, and Figures 3-8 through 3-13 present cross-sections along lines A through E, south, down the length of the western reach of Borrego Canyon Wash between IRP Sites 1 and 2. As may be gleaned from these cross-sections, not only does the alluvium generally fine upward from the channel depths to the surface, but it also becomes progressively coarser from north to south such that at Line E (Figure 3-13), almost all of the material in the phreatic (saturated) zone is fine to coarse sands mixed with gravels. Average depth to groundwater during the Tier III-D program was approximately 37 feet bgs. The alluvial aquifer thickness along the channel axis is about 40-50 feet. During the Hydropunch™ program, coarse, heaving, unconsolidated sands were commonly encountered while trying to core the alluvium in the channel depths. This suggests clean saturated sands and gravels with relatively high groundwater flow velocities.

Due to the similarity in topography, stratigraphy, infiltration rate, surface runoff, and evapotranspiration in the general study area, the volume of groundwater flowing through the study area is likely proportional to the size of the upgradient watershed area. As discussed above, IRP Site 1 is a small isolated valley, and has an approximate surface drainage area of 0.14 square miles. Groundwater from IRP Site 1 converges and mixes with groundwater from the larger unnamed tributary (UT1) near the southern end of IRP Site 1. The unnamed tributary has a surface drainage area of approximately 0.45 square miles. From that location, groundwater flows southwest until it merges with groundwater from a second, larger unnamed tributary (UT2) and Borrego Canyon Wash, in the vicinity of IRP Site 2. The entire Borrego Canyon Wash upgradient from IRP Site 2, including IRP Site 1 and the unnamed tributary, has a surface drainage area of approximately 4.91 square miles. After the convergence of groundwater at IRP Site 2, groundwater flows into the Irvine Management Zone which includes numerous additional drainages areas coming off of the Santa Ana Mountains, which expand the additional watershed area even further.

Based on the approximate surface drainage areas described above, IRP Site 1 constitutes approximately 2.9 percent of the Borrego Canyon Wash surface drainage area to IRP Site 2. Therefore, it is reasonable to assume that IRP Site 1 contributes a similar amount of the total groundwater flow leaving Borrego Canyon Wash downgradient from IRP Site 2.

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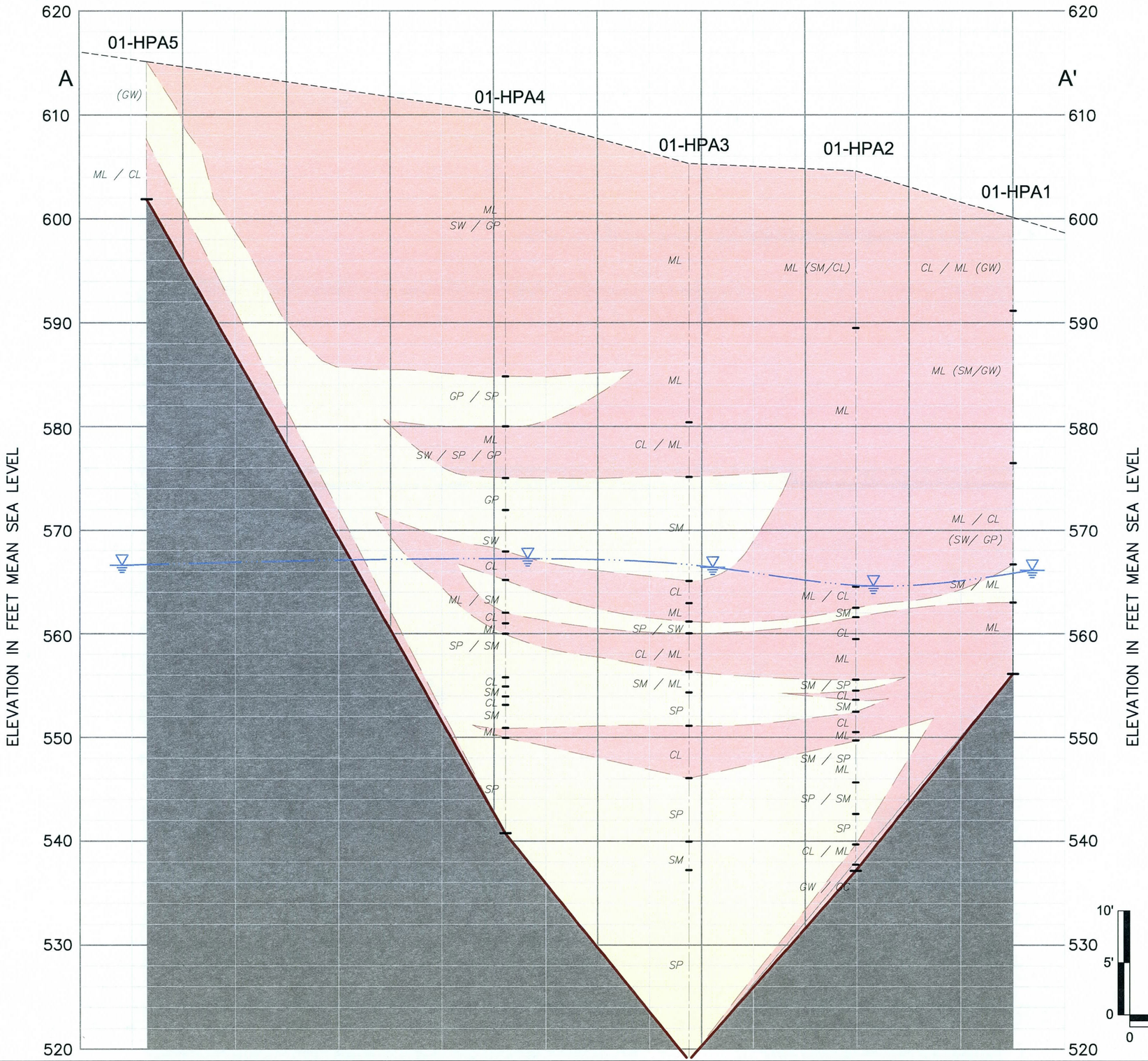

LEGEND:

01-HPA5 BOREHOLE DESIGNATION

EXISTING GROUND SURFACE

CONTACT

ELEVATION OF STATIC GROUNDWATER (HYDROPUNCH)

GEOLOGIC LEGEND:

COARSE TO FINE SANDS (CHANNELS)

SILTS AND CLAYS

WEATHERED BEDROCK

SAND/SILT CONTACT

ALLUVIUM / BEDROCK CONTACT

CL USCS CLAYS

ML USCS SILTS

SM USCS FINE SANDS, WELL GRADED

SP USCS COARSE, POORLY SORTED SANDS

GP USCS GRAVELS, POORLY SORTED

NOTES:

EOD EXPLOSIVE ORDNANCE DISPOSAL

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

USCS UNIFIED SOIL CLASSIFICATION SYSTEM

Phase II Remedial Investigation — Final

Cross-Section A-A'

IRP Site 1 - EOD Training Range

Date: 12-06

Former MCAS El Toro

Project No. 36097

EarthTech
A Tyco International Ltd. Company

Figure 3-8

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-8.dwg Time: Dec 19, 2006 - 10:43am

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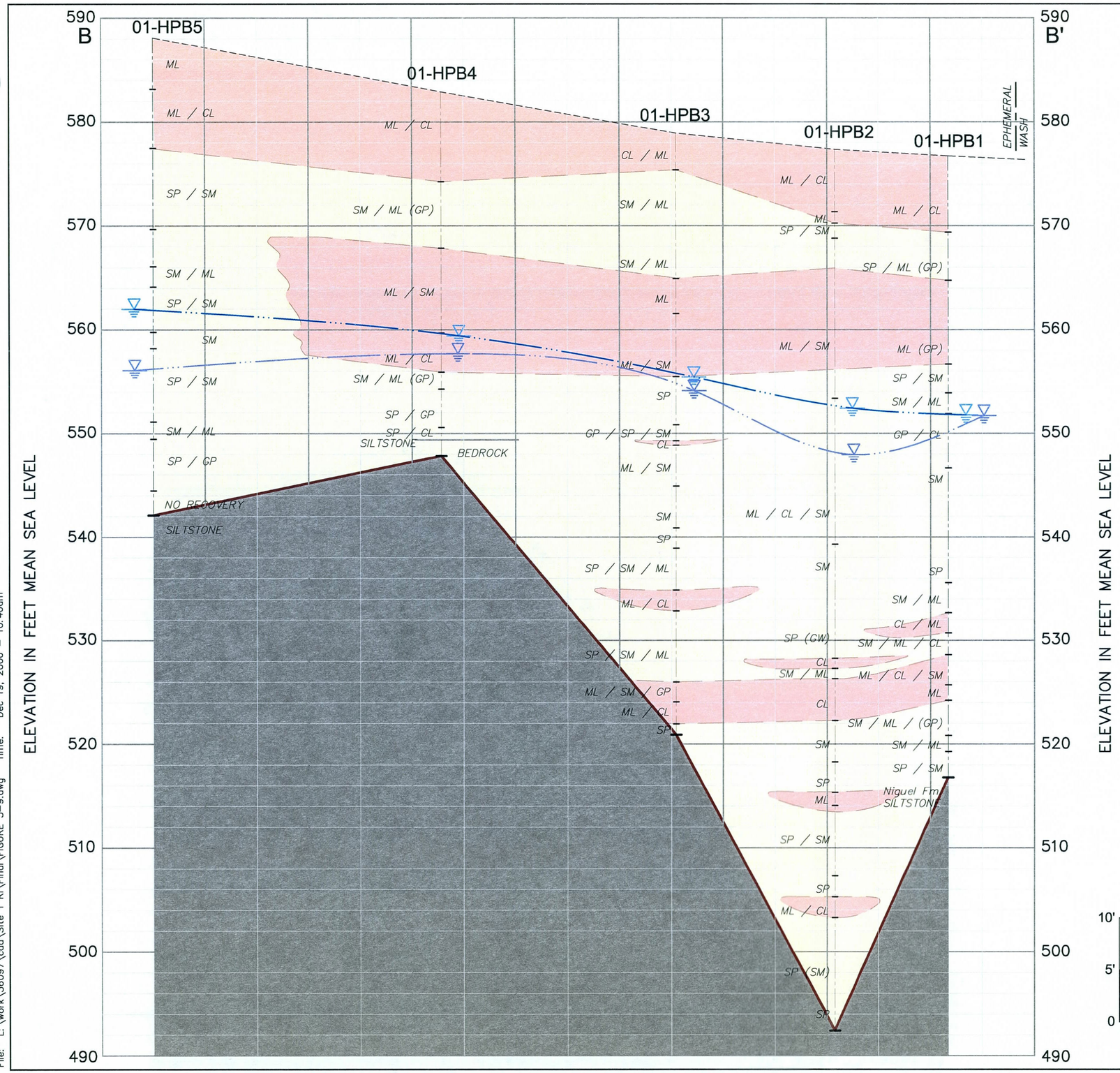

LEGEND:

01-HPB5 BOREHOLE DESIGNATION

EXISTING GROUND SURFACE

CONTACT

ELEVATION OF FIRST GROUNDWATER (HYDROPUNCH)

ELEVATION OF STATIC GROUNDWATER (HYDROPUNCH)

GEOLOGIC LEGEND:

COARSE TO FINE SANDS (CHANNELS)

SILTS AND CLAYS

WEATHERED BEDROCK

SAND/SILT CONTACT

ALLUVIUM / BEDROCK CONTACT

CL USCS CLAYS

ML USCS SILTS

SM USCS FINE SANDS, WELL GRADED

SP USCS COARSE, POORLY SORTED SANDS

GP USCS GRAVELS, POORLY SORTED

NOTES:

EOD EXPLOSIVE ORDNANCE DISPOSAL

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

USCS UNIFIED SOIL CLASSIFICATION SYSTEM

10' 5' 0 0 50' 100'

Phase II Remedial Investigation — Final

Cross-Section B-B'

IRP Site 1 - EOD Training Range

Date: 12-06

Former MCAS El Toro

Project No. 36097

EarthTech
A Tyco International Ltd. Company

Figure 3-9

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-9.dwg Time: Dec 19, 2006 - 10:46am

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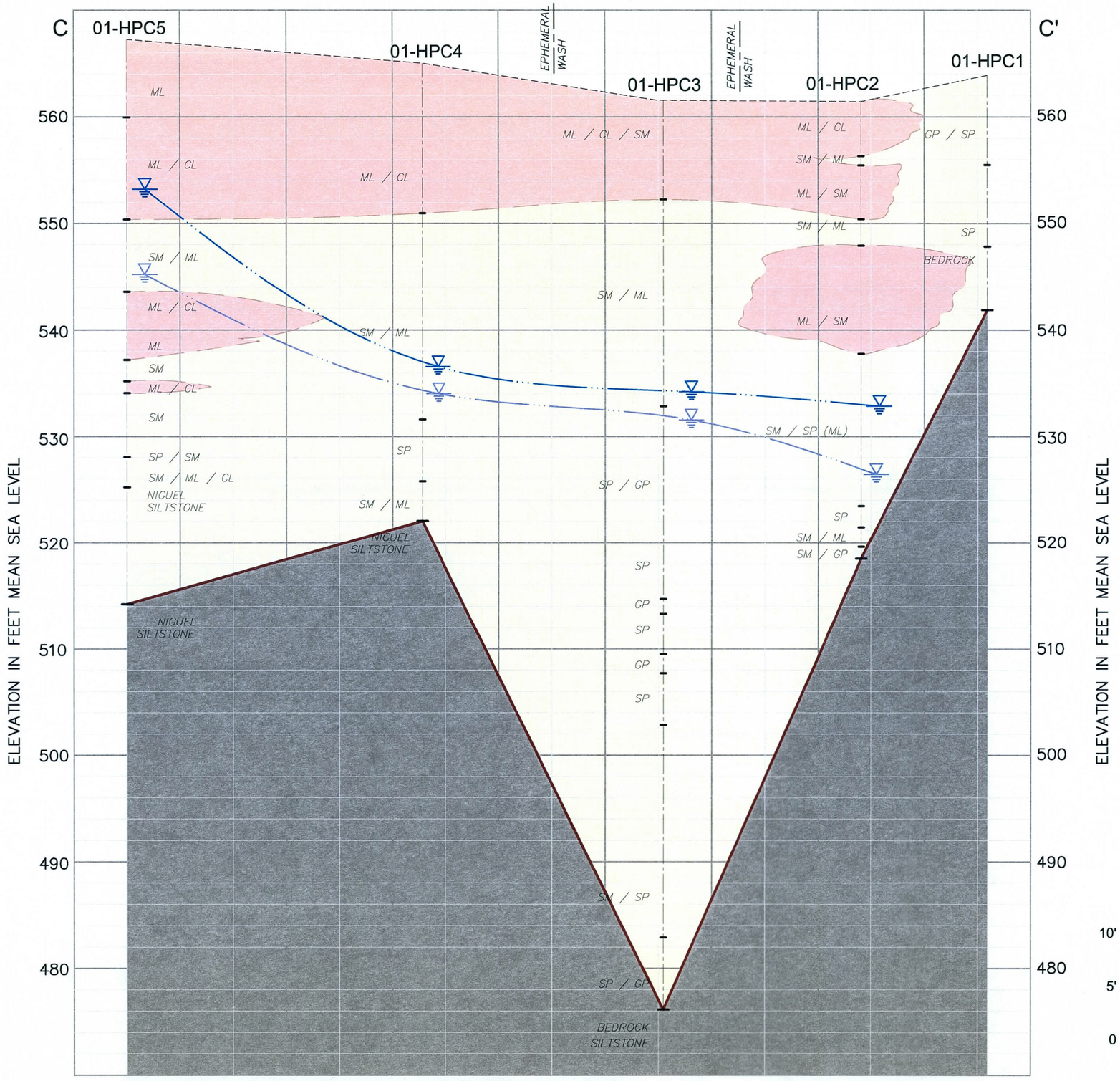

LEGEND:

01-HPC5 BOREHOLE DESIGNATION

EXISTING GROUND SURFACE

CONTACT

ELEVATION OF FIRST GROUNDWATER (HYDROPUNCH)

ELEVATION OF STATIC GROUNDWATER (HYDROPUNCH)

GEOLOGIC LEGEND:

- COARSE TO FINE SANDS (CHANNELS)
- SILTS AND CLAYS
- WEATHERED BEDROCK
- SAND/SILT CONTACT
- ALLUVIUM / BEDROCK CONTACT
- CL USCS CLAYS
- ML USCS SILTS
- SM USCS FINE SANDS, WELL GRADED
- SP USCS COARSE, POORLY SORTED SANDS
- GP USCS GRAVELS, POORLY SORTED

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
USCS	UNIFIED SOIL CLASSIFICATION SYSTEM

10' 5' 0 0 50' 100'

Phase II Remedial Investigation — Final

Cross-Section C-C'

IRP Site 1 - EOD Training Range

Date: 12-06 | Former MCAS El Toro | Figure 3-10

Project No. 36097

EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-10.dwg Time: Dec 19, 2006 - 10:50am

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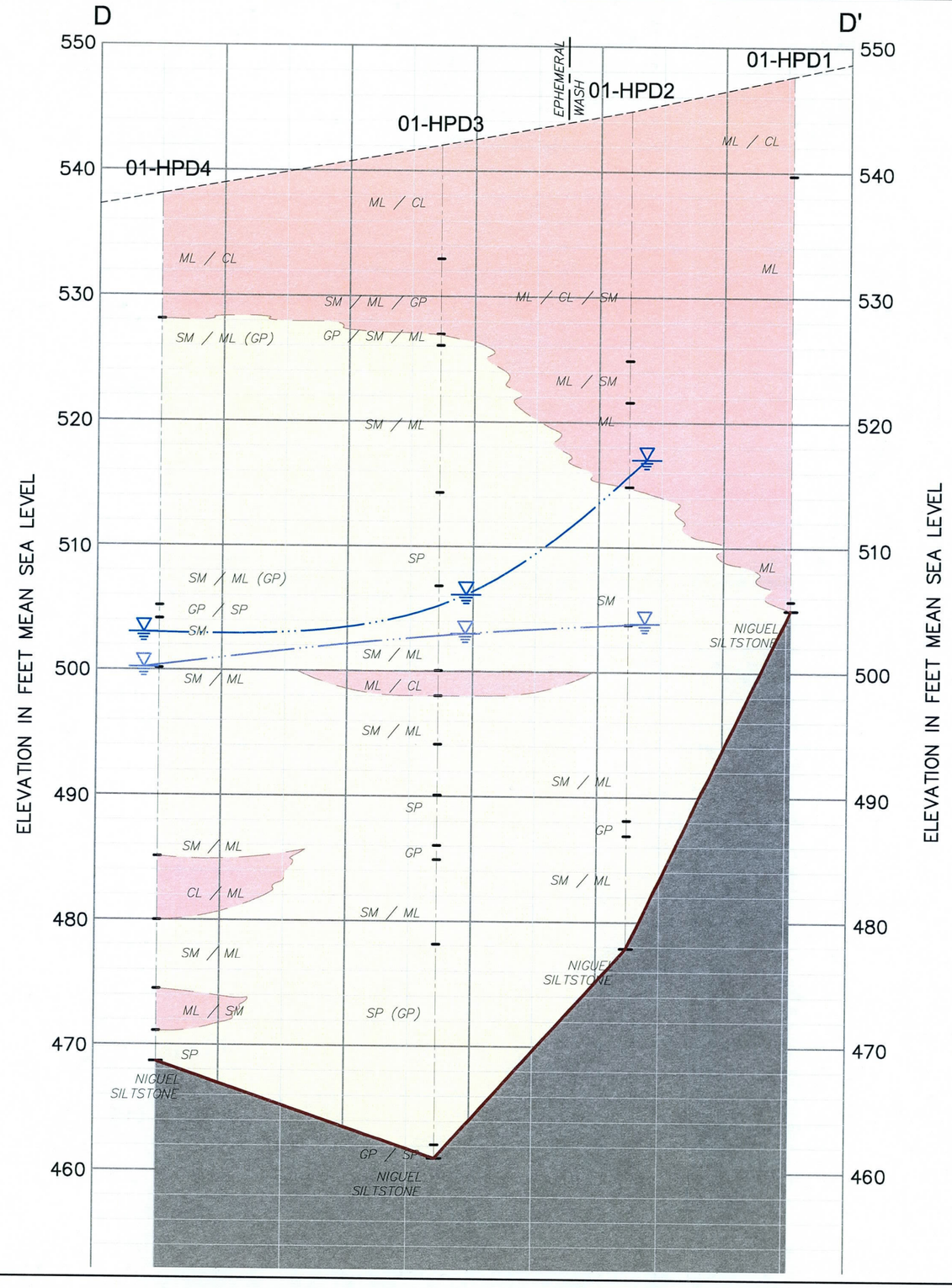

LEGEND:

01-HPD4 BOREHOLE DESIGNATION

EXISTING GROUND SURFACE

CONTACT

ELEVATION OF FIRST GROUNDWATER (HYDROPUNCH)

ELEVATION OF STATIC GROUNDWATER (HYDROPUNCH)

GEOLOGIC LEGEND:

COARSE TO FINE SANDS (CHANNELS)

SILTS AND CLAYS

WEATHERED BEDROCK

SAND/SILT CONTACT

ALLUVIUM / BEDROCK CONTACT

CL USCS CLAYS

ML USCS SILTS

SM USCS FINE SANDS, WELL GRADED

SP USCS COARSE, POORLY SORTED SANDS

GP USCS GRAVELS, POORLY SORTED

NOTES:

EOD EXPLOSIVE ORDNANCE DISPOSAL

IRP INSTALLATION RESTORATION PROGRAM

MCAS MARINE CORPS AIR STATION

USCS UNIFIED SOIL CLASSIFICATION SYSTEM

10' 5' 0 0 50' 100'

Phase II Remedial Investigation — Final

Cross-Section D-D'

IRP Site 1 - EOD Training Range

Date: 12-06

Former MCAS El Toro

Project No. 36097

EarthTech — A Tyco International Ltd. Company

Figure 3-11

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-11.dwg Time: Dec 19, 2006 – 11:00am

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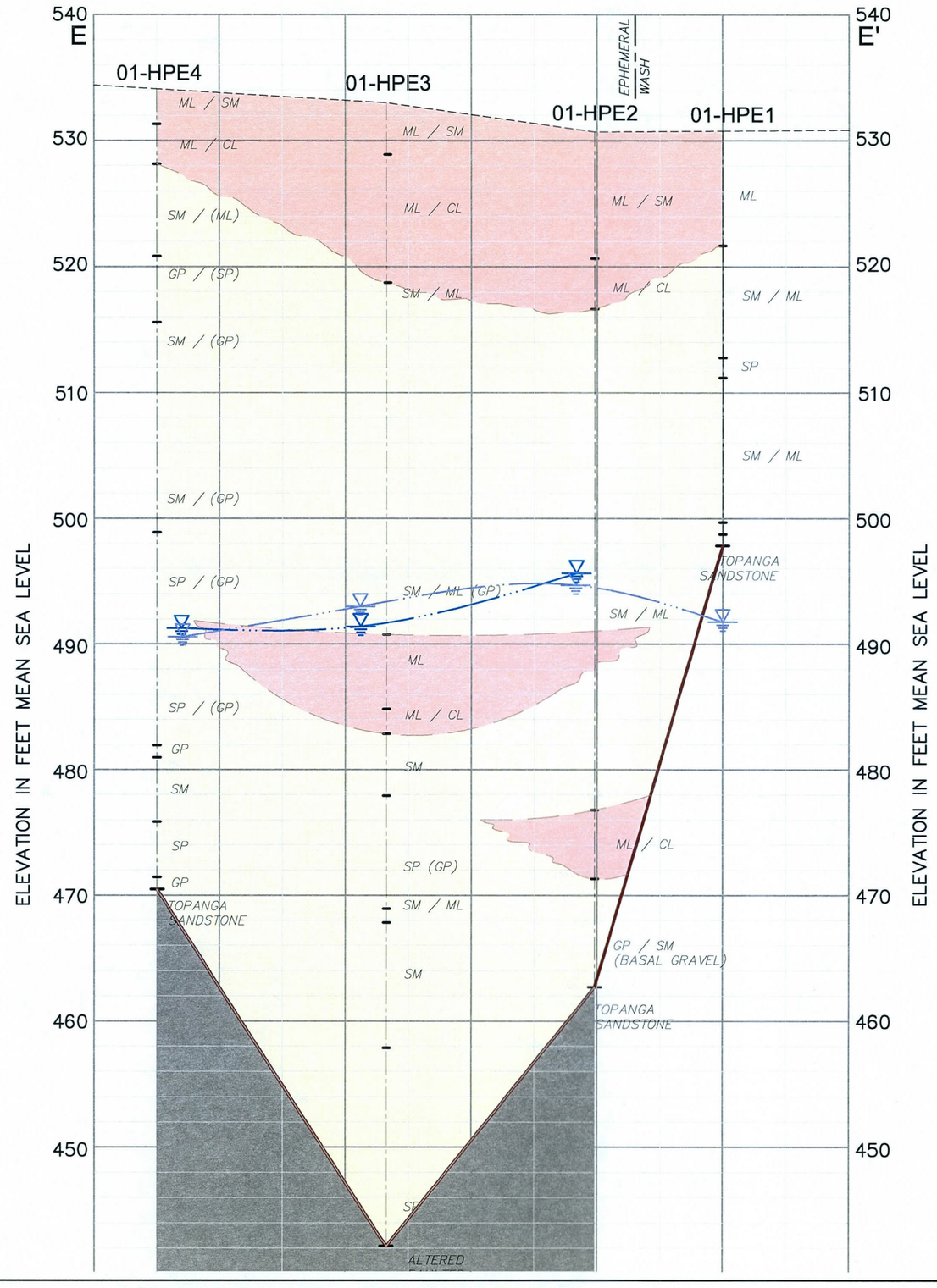

LEGEND:

01-HPE4	BOREHOLE DESIGNATION
	EXISTING GROUND SURFACE
	CONTACT
	ELEVATION OF FIRST GROUNDWATER (HYDROPUNCH)
	ELEVATION OF STATIC GROUNDWATER (HYDROPUNCH)

GEOLOGIC LEGEND:

	COARSE TO FINE SANDS (CHANNELS)
	SILTS AND CLAYS
	WEATHERED BEDROCK
	SAND/SILT CONTACT
	ALLUVIUM / BEDROCK CONTACT
CL	USCS CLAYS
ML	USCS SILTS
SM	USCS FINE SANDS, WELL GRADED
SP	USCS COARSE, POORLY SORTED SANDS
GP	USCS GRAVELS, POORLY SORTED

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
USCS	UNIFIED SOIL CLASSIFICATION SYSTEM

10' 5' 0 0 50' 100'

Phase II Remedial Investigation — Final

Cross-Section E-E'

IRP Site 1 - EOD Training Range

Date: 12-06 | Former MCAS El Toro | Figure 3-12

Project No. 36097 | EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 3-12.dwg Time: Dec 19, 2006 - 11:03am

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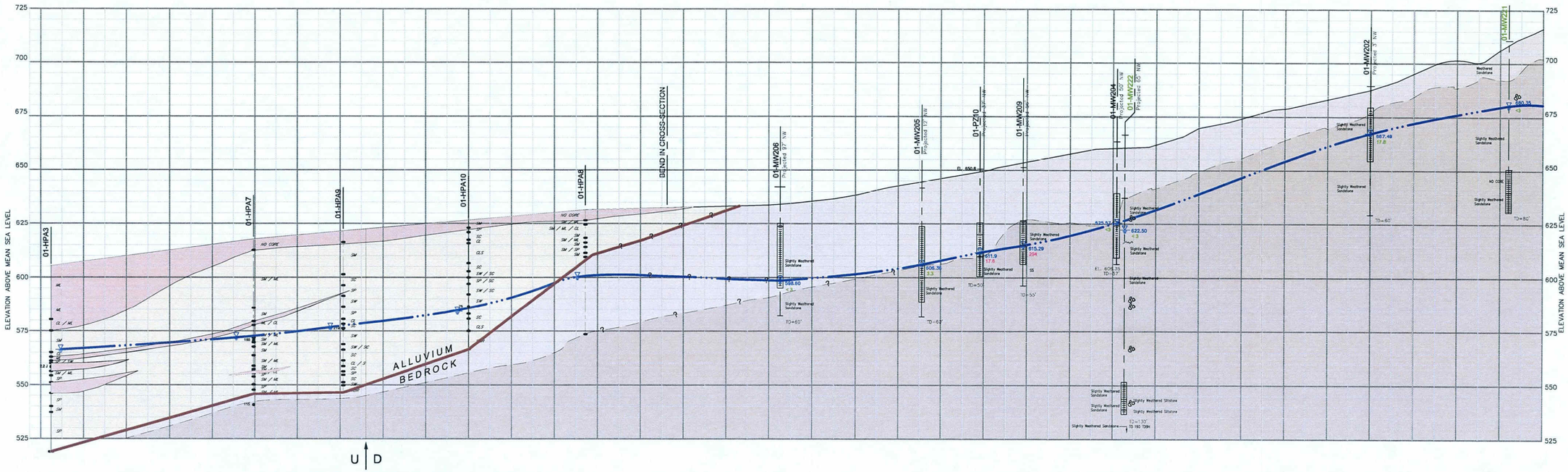


APPROXIMATE LOCATION OF UNNAMED FAULT #1
(MAPPED BY MORTON, 1999)

BOREHOLE LEGEND:

- 01-HPA7 — BOREHOLE DESIGNATION
- CONTACT
- ELEVATION OF FIRST GROUNDWATER (HYDROPUNCH) (SEE NOTE 1)
- 2.2 J — PERCHLORATE CONCENTRATION BELOW REPORTING LIMIT
- 185 — PERCHLORATE CONCENTRATION ABOVE REPORTING LIMIT

NOTE:

1. GROUNDWATER LEVELS COLLECTED FROM MONITORIN WELLS WERE GAUGED ON 3/9/05.
   GROUNDWATER LEVELS COLLECTED FROM BOREHOLES 01-HPA1, 01-HPA7, AND 01-HPA8 WERE GAUGED DURING BOREHOLE DRILLING IN FEBURARY 2005.

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

MONITORING WELL LEGEND:

- 01-MW218 Projected 3.5' S — GROUNDWATER MONITORING WELL (PROJECTED DISTANCE FROM CROSS-SECTION) GREEN INDICATES NEWLY INSTALLED WELL
- GROUND SURFACE (ELEVATION ON CROSS-SECTION)
- GEOLOGIC CONTACT
- SM — LITHOLOGY (SEE LEGEND AT RIGHT)
- CONTACT CORRELATION INTERPRETATION
- SCREEN INTERVAL
- 622.61 / 14.1 — GROUNDWATER ELEVATION (MEASURED ON 11/5/04, SEE NOTE 1)
- PERCHLORATE CONCENTRATION (MEASURED IN JULY-NOVEMBER 2004)
- TD=60' — TOTAL DEPTH OF WELL (BELOW GROUND SURFACE)

LITHOLOGIC LEGEND:

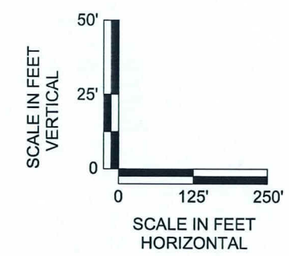
- SAND (INCLUDES SILTY AND CLAYEY SANDS)
- SILT AND OR CLAY
- ALLUVIUM / BEDROCK CONTACT
- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS), DECOMPOSED BEDROCK AND ALLUVIUM
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- FRACTURE
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

ML	CLAYEY SILT
SC	SANDY CLAY
SM	SILTY SAND
SM (G)	SILTY SAND WITH GRAVEL
SP	POORLY GRADED SAND
TD 190 TDBH	TOTAL DEPTH OF BOREHOLE
U	UPTHROWN
D	DOWNTHROWN

CROSS-SECTION L-L'



Phase II Remedial Investigation		Final
IRP Site 1 Cross-Section L-L' IRP Site 1 - EOD Training Range		
Date: 12-06	Former MCAS El Toro	Figure 3-13
Project No. 36097	EarthTech A Tyco International Ltd. Company	

File: L:\work\3\cad\Site 1 RI\Final\FIGURE 3-13.dwg Time: Dec 21, 2006 - 12:42pm

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An aquifer test has been conducted at IRP Site 1 to assess the hydraulic properties of the aquifer. The results of that aquifer test will be addressed in the Feasibility Study.

3.3 ECOLOGY

The habitat assessment was conducted at IRP Site 1 on 20 December 2000. The preliminary results were used to characterize habitat, and identify potentially impacted species, including any considered sensitive.

3.3.1 Vegetation

The dominant vegetation types at IRP Site 1 consist of non-native grassland coastal sage scrub (CSS), and toyon-sumac chapparral. Plants found on the site are listed in Table 3-2.

- **CSS.** CSS occurs in patches on the slopes in the northern part of the property. It is typically dominated by California sagebrush (*Artemisia californica*), California encelia (*Encelia californica*), and California buckwheat (*Eriogonum fasciculatum*). Other common elements of this habitat type are prickly pear (*Opuntia littoralis*), black sage (*Salvia mellifera*), and goldenbush (*Isocoma menziesii*). The structure and composition of this habitat also appears to be a function of how long since it was disturbed. In some locations such as the west-facing slope above the main valley, the valley contains more succulents (e.g., prickly pear) than the other stands of sage scrub. The number and cover of annual species observed were limited, however, partly because of the dense canopy in some stands and partly due to the timing of the survey. There are approximately 9.74 acres of sage scrub on IRP Site 1.
- **Toyon-sumac chapparral.** Toyon-sumac chaparral occurs primarily on the east-facing slopes above the main valley. Onsite, it is dominated by lemonadeberry. Subdominant elements of this vegetation type include toyon (*Heteromeles arbutifolia*) and laural sumac (*Malosma laurina*), and other CSS elements. It is a relatively tall (up to 8 feet) and dense vegetation type and does not appear to have been disturbed or burned in recent times. There are approximately 2.63 acres of chaparral on IRP Site 1.

There are also small areas of mulefat scrub, southern willow scrub, disturbed wetland, and ornamental plantings. Mulefat scrub is dominated by its namesake (*Baccharis salicifolia*) and occurs in two locations. One is in the vicinity of the Ephemeral Pond in the northern portion of the site. The other is along a flat graded section of a hillside, north of the main valley. This latter stand also supports an understory of exotic grasses. Mulefat scrub on IRP Site 1 ranges up to 8 feet tall and covers an area of approximately 0.03-acre.

Southern willow scrub stands consist of a few individuals of black willow (*Salix gooddingii*) up to 25 feet tall. There is approximately 0.01-acre of southern willow scrub on IRP Site 1.

Potential wetland occurs in the bottom of the Ephemeral Pond (perhaps a previous stockpond). It consists of a sparse cover of a variety of weedy and wetland species including mulefat, black willow, mustard, tocalote (*Centauria melitensis*), and soft chess (*Bromus hordeaceus*). There is approximately 0.29-acre of disturbed wetland on IRP Site 1.

The berm, which is partly responsible for the creation of the above basin, is planted with fan palms (*Washingtonia robusta*) and pines (*Pinus* sp.). These are mature specimens with an understory of CSS and annual grassland species. There is approximately 0.18-acre of ornamental plantings on IRP Site 1.

3.3.2 Fauna

A total of one reptile, one amphibian, 36 avian, and six mammalian species were documented on the site. The limited number of reptiles and amphibians reflects a single midwinter survey.

Sampling for vernal pool fairy shrimp on Former MCAS El Toro Conservation Area was conducted between February and March of 1998. The Conservation Area is bordered by the Former MCAS El Toro on the southwest, the foothill transportation corridor on the northeast, an arroyo, and nursery on the northwest, and an arroyo and an orange grove to the southeast.

No fairy shrimp cysts were detected in any of the dry sediment samples taken. Fairy shrimp were found in the Ephemeral Pond in the EOD during both sampling periods. These were identified as Riverside fairy shrimp (*Streptocephalus woottoni*). Sampling recovered two males and two females, both without cysts. This Ephemeral Pond is seasonal, and its dike has been breeched, although it is currently partially stabilized with sandbags. It is relatively shallow, not exceeding 1.5 meters at the deepest point. The Ephemeral Pond was clear and had a sparse aquatic invertebrate community.

The 2004-2005 wet season produced significantly more rainfall than in recent years. As a result of the increased rainfall, the Ephemeral Pond at IRP Site 1 filled with water to the lowest elevation of the breach. In January through March 2005, an additional wet season protocol survey for fairy shrimp (Riverside fairy shrimp, San Diego fairy shrimp [Branchinecta sandiegonensis], and vernal pool fairy shrimp [Branchinecta lynchi]) was conducted in order to verify the previous results (due to lack of rainfall, the Ephemeral Pond bottom had remained mostly dry between 1998 and 2005). Four site visits were made (21 January, 4 February, 18 February, and 4 March 2005). Fairy shrimp were not observed during the first visit on 21 January 2005. During the 4 February visit, shrimp were observed, but were too immature to identify the species. On 18 February, the fairy shrimp had increased in size and were identified as Riverside fairy shrimp based on their red cercopods. On 4 March, mature male and gravid female (brood pouches with cysts) Riverside fairy shrimp were observed. Thousands of fairy shrimp were observed during the last three visits, thus confirming the 1998 fairy shrimp sampling results.

Animals found at IRP Site 1 are listed in Table 3-3.

3.3.3 Sensitive Resources

Vegetation. CSS is considered a sensitive vegetation type by several resource agencies because it supports a number of State and Federally endangered, threatened, and rare vascular plants as well as several bird and reptile species that are Federally listed or are candidate species for Federal listing.

Wetland resources are also considered sensitive in semi-arid southern California due to their scarcity, their value to wildlife, and recent loss of this habitat from urbanization, agriculture, and flood control projects. The mulefat and southern willow scrubs and disturbed wetland are considered sensitive wetland habitats. Mulefat scrub is only considered sensitive where it occurs in a wetland landscape position (i.e., along drainages and not on level pads).

Potential Wetlands and Waters of the United States. The disturbed wetland and portions of the mulefat scrub and southern willow scrub may be subject to regulation under the Clean Water Act, as administered by the United States Army Corps of Engineers (USACE). Portions of the mulefat scrub and southern willow scrub may not be jurisdictional because they no longer occur in areas subject to wetland hydrology, and they were created in uplands.

Wildlife. Special status species include those listed by State and Federal agencies (CDFG 1994; USFWS 1989, 1990, 1992, 1993) as endangered, threatened, rare, or of special concern. They also include species listed by Everett (1979).

Previous dry and wet sampling conducted during 1996 and additional wet sampling conducted in 2005 in the Ephemeral Pond revealed the presence of the Riverside fairy shrimp (*Streptocephalus woottoni*), which is a Federally endangered species (KEA 1998). The presence of this species confers a high degree of sensitivity on this basin and its watershed.

During the generalized biological survey that was conducted during December 2000, the entire IRP Site 1 was covered by foot using meandering transects. Each habitat type was examined for sign (i.e., tracks and scat) and regular five-minute stops were made to look and listen for birds and other wildlife. All observed species, either listed or considered sensitive, were noted.

Four coastal California gnatcatchers (*Polioptila californica californica*), which are a Federally threatened species, were documented onsite. They consisted of one pair and two separate individuals of unknown gender.

Table 3-2: Flora Observed at IRP Site 1

Scientific Name	Common Name
*Amaranthus albus**	Tumbleweed
Malosma laurina	laurel sumac
Rhus integrifolia	Lemonadeberry
*Daucus carota**	Wild carrot
Ambrosia acanthicarpa	annual burweed
Artemisia californica	California sagebrush
Artemisia dracunculcus	Tarragon
Baccharis salicifolia	mule fat
Baccharis pilularis ssp. Consanguinea	coyote bush
Centaurea melitensis	Tocalote
*Conyza sp.**	Horseweed
*Cynara cardunculus**	Artichoke
Encelia californica	California encelia
Euthamia occidentalis	western goldenrod
Ericameria ericoides	Goldenbush
Hemizonia sp.	Tarplant
Heterotheca grandiflora	telegraph weed
Isocoma menziesii	Goldenbush
Lessingia filaginifolia var. *virgata*	sand-aster
Stephanomeria virgata	Virgate wreath-plant
Xanthium strumarium	Cocklebur
Cryptantha sp.	Cryptantha
Heliotorpium curassavicum	Helioitrope
*Brassica sp.**	Mustard
*Hirschfeldia incana**	perennial mustard
*Raphanus sativus**	Wild radish
Opuntia littoralis	prickly pear
Opuntia parryi	Cholla

Scientific Name	Common Name
Sambucus mexicana	Blue elderberry
*Atriplex semibaccata**	Australian saltbush
*Salsola tragus**	Russian thistle
Calystegia macrostegia	morning glory
*Convolvulus arvensis**	Bindweed
Marah macrocarpus	wild cucumber
Cuscuta sp., on *Eriogonum fasciculatum*	Dodder
Chamaesyce polycarpa	fairy mats
Eremocarpus setigerus	dove weed
*Ricinus communis**	castor bean
Lotus scoparius	Deerweed
Lupinus bicolor	miniature lupine
Lupinus succulentus	arroyo lupine
*Medicago polymorpha**	bur clover
*Melilotus alba**	white sweetclover
*Erodium botrys**	Filaree
*Erodium cicutarium**	red-stem filaree
*Erodium moshcatum**	green-stem filaree
*Marrubium vulgare**	Horehound
Salvia apiana	white sage
Salvia mellifera	black sage
Malacothamnus fasciculatus	bush mallow
Mirabilis californica	Wishbone bush
Eriogonum fasciculatum ssp. Fasciculatum	California buckwheat
*Polygonum aviculare**	yard knotweed
*Anagalus arvensis**	Pimpernel
Heteromeles arbutifolia	Toyon
Salix gooddingii	Godding's black willow
Mimulus aurantiacus	bush monkey-flower
*Nicotiana glauca**	tree tobacco
Solanum xantii	Nightshade
Calochortus sp.	mariposa lily
Yucca whipplei	Our Lord's Candle
*Avena barbata**	slender wild oat
*Bromus diandrus**	ripgut grass
*Bromus hordeaceus**	soft chess
Bromus madritensis ssp. *rubens**	foxtail chess
Elymus condesatus	giant rye
Nasella lepida	Needlegrass
Vulpia myuros var. *hirsute**	foxtail fescue

Note: * denotes exotic species
IRP = Installation Restoration Program

Three individual cactus wren (*Campylorhynchus brunneicapillus*) were documented in a cactus patch within CSS in the northwestern quadrant of the site. This bird is a Federally regionally sensitive species.

One non-vocalizing grasshopper sparrow (*Ammodramus savannarum*) was documented in non-native grassland in the north-central portion of the site.

Two southern California rufous-crowned sparrows (*Aimophila ruficeps canescens*) were documented in CSS in the north-central portion of the site (Federally regionally sensitive).

Evidence (scat or feces) of San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) was found in non-native grassland in the western portion of site between two patches of CSS.

PAGE NO. 3-40

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Table 3-3: Fauna Observed at IRP Site 1

Scientific Name	Common Name
Reptiles	
Sceloporus occidentalis	Western fence lizard
Amphibians	
Batrachoseps pacificus major	Garden slender salamander
Birds	
Cathartes aura	Turkey vulture
Buteo jamaicensis	Red-tailed hawk
*Buteo lineatus elagans**	Red-shouldered hawk
Accipiter cooperii	Cooper's hawk
Falco sparverius	American kestrel
Callipepla calfiornica	California quail
Zenaida macroura	Mourning dove
Otus kennicottii	Western screech owl
Calypte anna	Anna's hummingbird
Tyrannus vociferans	Cassin's kingbird
Sayornis nigricans	Black phoebe
Sayornis saya	Say's Phoebe
Corvus brachyrhynchos	Common crow
Aphelocoma coerulescens	Scrub jay
Corvus corax	Common raven
Psaltriparus minimus	Bushtit
Thryomanes bewickii	Bewick's wren
*Campylorhynchus brunneicapillus**	Cactus wren
*Polioptila californica californica**	Coastal California gnatcatcher
Chamaea fasciata	Wrentit
Mimus polyglottos	Northern mockingbird
Toxostoma redivivum	California thrasher
Dendroica coronata	Yellow-rumped Warbler
Pipilo crissalis	California towhee
Pipilo maculates	Spotted towhee
*Aimophila ruficeps canescens**	Southern California rufous-crowned sparrow
Ammodramus savannarum perpallidus	Grasshopper sparrow*
Melospiza melodia	Song sparrow
Ammodramus sandwichensis	Savannah Sparrow
Zonotrichia leucophrys	White-crowned sparrow
Chondestes grammacus	Lark sparrow
Sturnella neglecta	Western meadowlark
Agelaius phoeniceus	Red-winged blackbird
Euphagus cyanocephalus	Brewer's blackbird
Carpodacus mexicanus	House finch
Carduelus psaltria	Lesser goldfinch
Mammals	
Canis latrans	Coyote
Lynx rufus	Bobcat
Spermophilus beecheyi	California ground squirrel
Thomomys bottae	Botta's pocket gopher
Sylvilagus auduboni	Desert cottontail
*Lepus californicus bennettii**	San Diego black-tailed jackrabbit

Note: * denotes sensitive species
IRP = Installation Restoration Program

4. Nature and Extent of Contamination

As described previously, IRP Site 1 has been historically used for EOD training and detonation of munitions. Additionally, the initial assessment study conducted at Former MCAS El Toro noted that 2000 gallons of FS Smoke was burned in trenches located in the northern portion of the site (Brown and Caldwell 1986). It has been estimated that approximately 300,000 gallons of petroleum fuels were burned at IRP Site 1 from 1952 through 1993. Such activities have a potential to contaminate the soil with munitions and explosives of concern (MEC) items, explosives residues, perchlorate, fuel hydrocarbons, VOCs, SVOCs, and dioxins/furans. Potential contamination of groundwater is also expected due to the leaching of contaminants from the soil. Therefore, various investigations have been conducted at IRP Site 1, with each investigation targeted toward specific environmental media or contaminant, to adequately define the nature and extent of contamination at the site (Section 1.4). Based on their scopes, the investigations performed at IRP Site 1 can be divided into the following categories:

- Geophysical surveys
- MEC investigations
- Soil and groundwater sampling and analysis
- Surface water and sediment sampling and analysis
- Evaluation of contamination of groundwater with perchlorate
- Radiological investigations

The results of the previous investigations, along with the sampling and analysis conducted during the Phase II RI, were used to characterize the nature and extent of contamination at the site. This section is divided into five subsections for evaluation of environmental contamination at IRP Site 1:

1. Subsurface anomalies and MEC at IRP Site 1: This section describes the location and extent of subsurface anomalies identified based on the geophysical surveys performed at IRP Site 1. In addition, this section describes the types, locations, and depths of MEC identified at the site.
2. Soil contamination: This section summarizes the nature and extent of soil and sediment contamination at IRP Site 1 based on the results of soil and sediment sampling and analysis conducted during previous investigations and the Phase II RI. This also includes the results of surface radiological investigations for IRP Site 1.
3. Sediment contamination: This section summarizes the nature and extent of sediment contamination based on the results of sediment sampling conducted in the Ephemeral Pond in the northern part of IRP Site 1 during the Phase II RI.
4. Groundwater contamination: This section summarizes the nature and extent of groundwater contamination at IRP Site 1 based on the results of groundwater sampling and analysis conducted during previous investigations and the Phase II RI. This also includes the results of the radionuclide investigation for groundwater at IRP Site 1.
5. Surface Water Contamination: This section discusses the nature and extent of surface water contamination at IRP Site 1 based on the results of surface water sampling conducted in the Ephemeral Pond and western reach of Borrego Canyon Wash during the Phase II RI.

4.1 EXTENT OF SUBSURFACE ANOMALIES

Geophysical surveys have been conducted at IRP Site 1 to identify subsurface anomalies indicative of buried wastes or munitions. The methodology for these surveys has been described in Section 1.4.1. The geophysical anomalies identified during these surveys were used to define:

- The locations for MEC characterization sampling during intrusive MEC investigation as a part of the *Munitions and Explosives of Concern Range Evaluation* (Appendix C)
- Soil sampling locations during the *Verification of Perchlorate* study (Earth Tech 2001b)
- The locations of Tier II investigations conducted as a part of Phase II RI field activities.

The first geophysical survey (Phase I geophysical survey) at IRP Site 1 was performed in 1991 (JEG 1991). Several anomalies were observed at the site that were interpreted to be due to buried wastes. The GPR survey performed at the location of one of the stronger EM indications could not detect buried materials. This survey provided useful information on the location of historic operations (i.e., trenches, craters) and buried metallic objects (i.e., drums, vehicles). A large portion of the EOD Training Range was not investigated during this survey.

The Phase II geophysical survey was performed as part of the *Verification of Perchlorate* study (Earth Tech 2001b). Figure 1-4 provides the boundary of the survey grid and location of geophysical anomalies. The largest anomaly was detected at the northeast portion of the site. It was noted that various anomalies detected throughout the site appeared linear in alignment, suggesting locations of former trenches. This survey identified 73 anomalies in the Northern and Southern EOD Training Ranges for subsurface MEC sampling during the MEC Range evaluation (Earth Tech 2002).

The most recent geophysical survey was performed at IRP Site 1 as a part of the *Munitions and Explosives of Concern Range Evaluation* (Appendix C). This survey identified 26 anomalies in the Northern and Southern EOD Training Ranges, 95 locations in the Buffer Zone, and 89 anomalies in the Range Perimeter for intrusive investigations during MEC Range Evaluation.

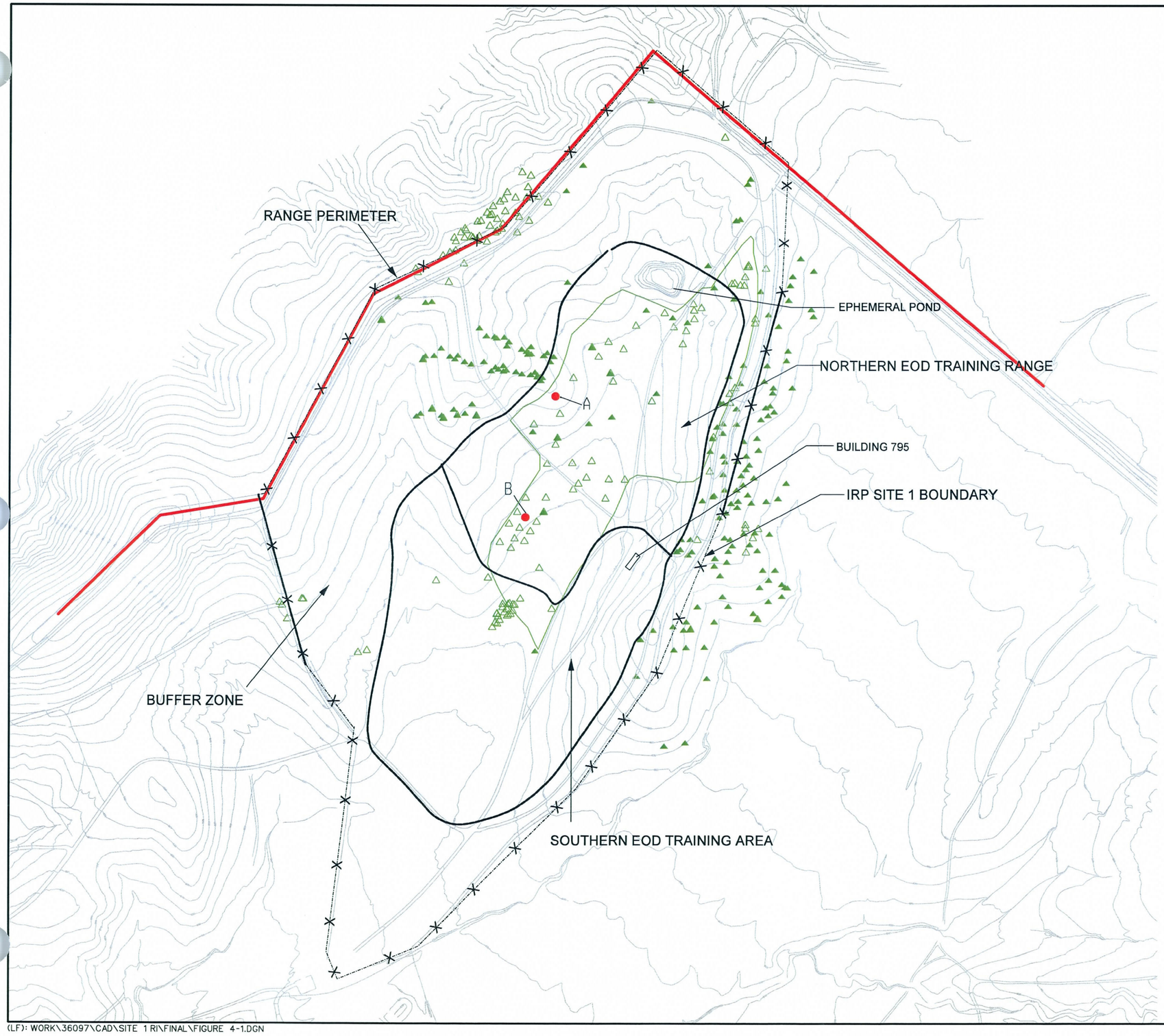
The geophysical survey of the 3.3-acre area in the southwestern portion of IRP Site 1 did not detect any significant subsurface anomalies greater than 5 millivolt (mV), thus indicating no buried MEC items.

4.2 NATURE AND EXTENT OF MUNITIONS AND EXPLOSIVES OF CONCERN

The evaluation of the nature and extent of MEC at IRP Site 1 was conducted as a part of the *Munitions and Explosives of Concern Range Evaluation* (Appendix C). The field activities constituting this investigation included surface surveys, geophysical surveys, and subsurface MEC sampling, and are described in Section 1.4.2. The summary of findings including characterization of the types of MEC and the location and depth of MEC at IRP Site 1, are presented in this section. A more thorough description of the field activities, findings, and conclusions is presented in Appendix C.

An Explosives Safety Submittal (ESS) was prepared for work at IRP Site 1. The ESS summarizes proposed work at the site and evaluates potential explosive hazards due to potential for residual MEC items. The ESS is included as Appendix D of this report.

Four safe-to-move MEC items and 776 MD scrap items (totaling approximately 5,000 pounds) were recovered during MEC field activities at IRP Site 1 (Table 4-1). No Unsafe-to-move MEC items were identified. While the MEC items were recovered only in the Northern EOD Training Range, the MD was recovered in all the four areas investigated. Figure 4-1 presents the location of all MEC and MD items recovered during the field investigation.



LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/IRP SITE 1 BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- MEC RECOVERED DURING FIELD INVESTIGATION
- SURFACE MD RECOVERED DURING FIELD INVESTIGATION
- SUBSURFACE MD RECOVERED DURING FIELD INVESTIGATION
- A — MEC: FLEX LINEAR-SHAPED CHARGE (DEPTH: SURFACE)
- B — MEC: 40MM CASINGS WITH PRIMER (2) AND 1/4-POUND OF SMOKELESS POWDER (DEPTH: 12 INCHES BELOW GROUND SURFACE)

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MD	MUNITIONS DEBRIS
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
MM	MILLIMETER

Note: Multiple MD items at one location are shown as one point.

NORTH

0 350 FEET

SCALE: 1"= 350'

Phase II Remedial Investigation — Final

MEC Investigation Results

IRP Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	4-1

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\FIGURE 4-1.DGN

PAGE NO. 4-4

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Table 4-1: Number of MEC and MD Scrap Recovered During MEC Field Investigation

Investigation Area	MEC	MD
Northern EOD Training Range	4*	409
Southern EOD Training Range	—	26
Buffer Zone	—	165
Range Perimeter	—	176
Total	4	776

Notes:
* 23 items were initially characterized as safe-to-move MEC; upon post-detonation inspection, 19 were concluded to contain no explosive compounds.
EOD = explosive ordnance disposal
MD = munitions debris
MEC = munitions and explosives of concern

Table 4-2 shows the depth distribution (minimum and maximum depth) of MEC and MD recovered during the MEC field investigation.

Table 4-2: Depth Distribution of MEC and MD

Investigation Area	Minimum Depth	Maximum Depth (inches bgs)
Northern EOD Training Range	Surface	96
Southern EOD Training Range	Surface	24
Buffer Zone	Surface	12
Range Perimeter	Surface	10

Notes:
bgs = below ground surface
EOD = explosive ordnance disposal
MD = munitions debris
MEC = munitions and explosives of concern

Table 4-3 and Table 4-4 summarize the type and depth of safe-to-move MEC recovered, and their characteristics.

Table 4-3: Type and Depth of MEC Recovered During MEC Field Investigation

Type of MEC *	Quantity	Depth Encountered (inches bgs)
Flex-linear-shaped charge	1	0
40mm cartridge primer	2	12
Smokeless powder	¼-pound	12

Notes:
* All MEC items were recovered from Northern EOD Training Range
bgs = below ground surface
EOD = explosive ordnance disposal
MEC = munitions and explosives of concern
mm = millimeter

Table 4-4: Characteristics of MEC at IRP Site 1

MEC Type	Hazard	Condition	Sensitivity
40 mm Cartridge Primer	Likely to cause minor injury	Functionable [a]	Sensitive [b]
Flex-liner-shaped charge	Likely to cause minor injury	Functionable [a]	Sensitive [b]
Smokeless Powder	Likely to cause minor injury	Functionable [a]	Sensitive [b]

Notes:
[a] Functionable items become hazardous when improperly handled
[b] Likely to detonate with moderate effort (dropping, striking, driving over, or exposing to extreme heat)
IRP = Installation Restoration Program
MEC = munitions and explosives of concern

mm = millimeter

4.3 NATURE AND EXTENT OF SOIL CONTAMINATION

Soil sampling was conducted at IRP Site 1 at various depths to delineate the nature and extent of contamination as a part of the *Verification of Perchlorate* study (Earth Tech 2001b), investigation of the 3.3-acre area located in the southern portion of the site in support of the Environmental Baseline Survey (EBS) (Earth Tech 2001c), and the Phase II RI sampling and analysis. The depth of soil covered by these investigations ranged from ground surface to approximately 35 feet bgs, and the lateral extent included the Northern and Southern EOD Training Ranges, and the 3.3-acre area located in the southern portion of IRP Site 1. The methods and procedures used for soil sampling are described in Sections 1.4.3 and 2.2.1. Results of the soil sampling are presented in Appendix E. Validation reports are presented in Appendix F. This section presents the nature and extent of soil contamination at IRP Site 1 based on the soil sampling results.

4.3.1 EBS Investigation

A total of 34 samples and four duplicate samples were collected from 17 locations during the investigation of the 3.3-acre area (Section 1.4.3.3). All these samples were analyzed for VOCs, SVOCs, petroleum hydrocarbons, explosives residues, metals, perchlorate, nitrate, and pH. Selected samples were also analyzed for dioxins/furans. Table 4-5 presents a summary of the detected analytes during this investigation. Table 4-6 presents the frequency of detection of the detected analytes and number of detections above the EPA Region 9 residential and industrial PRGs. Tables 4-7 and 4-8 present the minimum and maximum concentrations of the detected analytes.

4.3.1.1 VOLATILE ORGANIC COMPOUNDS

VOCs were not detected above the reporting limits in any of the samples analyzed during this investigation (Table E-2 [Appendix E]).

4.3.1.2 SEMIVOLATILE ORGANIC COMPOUNDS

SVOCs were detected in only two soil samples (see Tables 4-5, 4-6, and 4-7). One of the samples collected at 5 feet bgs, showed a low concentration (54 micrograms per kilogram [µg/kg]) of bis(2-ethylhexyl)phthalate (BEPH) and the other, taken at 1.5 feet bgs, showed a low concentration (110 µg/kg) of diethyl phthalate (Table 4-7). Neither concentration exceeded EPA Region 9 residential or industrial PRGs.

4.3.1.3 PETROLEUM HYDROCARBONS

Low concentrations of TPH as motor oils were detected in nine samples (Tables 4-5 and 4-6). The maximum concentration observed was 91 milligrams per kilogram (mg/kg) in a sample taken at 1.5 feet bgs (Table 4-7). TPH as diesel fuel were detected in three soil samples (Tables 4-5 and 4-6). The maximum concentration observed was 43 mg/kg in a sample collected at 1.5 feet bgs (Table 4-7).

Low concentrations, with a maximum of 0.2 mg/kg were measured for TPH-G in two samples (Tables 4-6 and 4-7).

The frequency and concentration of detection was higher for heavier hydrocarbons as compared to the lighter ones. This is most likely due to relatively higher volatility of the lighter hydrocarbons compared to the heavier ones.

Table 4-5: Summary of Detected Analytes - EBS Investigation

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP01 1.5 feet bgs LE001	DP01 5 feet bgs LE002	DP02 1.5 feet bgs LE003	DP02 5 feet bgs LE004	DP03 1.5 feet bgs LE005	DP03 5 feet bgs LE006	DP04 1.5 feet bgs LE007	DP04 5 feet bgs LE008	DP05 1.5 feet bgs LE009	DP05 1.5 feet bgs (dup) LE010	DP05 5 feet bgs LE011	DP06 1.5 feet bgs LE013	DP06 1.5 feet bgs (dup) LE014	DP06 5 feet bgs LE015	DP07 1.5 feet bgs LE016	DP07 1.5 feet bgs (dup) LE017	DP07 5 feet bgs LE018	DP08 1.5 feet bgs LE019	DP08 5 feet bgs LE020	DP09 1.5 feet bgs LE021	DP09 5 feet bgs LE022
SVOCs																									
2-ethylhexyl) Phthalate	34,700	123,000	-	µg/kg	570 U	590 U	560 U	560 U	580 U	530 U	570 U	570 U	660 U	590 U	560 U	590 U	560 U	580 U	560 U	560 U	560 U	560 U	560 U	590 U	550 U
hyl Phthalate	48,882,000	100,000,000	-	µg/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U	370 U	370 U	370 U	370 U	390 U	360 U
Hydrocarbons																									
Motor Oils	-	-	-	mg/kg	11 U	12 U	91	11 U	12 U	11 U	6 J	11 U	5 J	12 U	11 U	4 J	4 J	12 U	11 U	11 U	11 U	11 U	20	12 U	11 U
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	12 U	28	11 U	12 U	11 U	11 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	11 U	6 J	12 U	11 U
TPH as Gasoline	-	-	-	mg/kg	0.2 J	10 U	9.4 U	9.4 U	10 U	10 U	9.4 U	10 U	0.1 J	10 U	9.2 U	10 U	9.8 U	11 U	10 U	10 U	13 U	10 U	9.8 U	11 U	10 U
Explosives Residues																									
4-Amino-2,6-Dinitrotoluene	-	-	-	µg/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	540	220 U	240 U	220 U	230 U	220 U	230 U	220 U	220 U	230 U	240 U	220 U
2-Amino-4,6-Dinitrotoluene	-	-	-	µg/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	490	220 U	240 U	220 U	230 U	220 U	230 U	220 U	220 U	230 U	240 U	220 U
2,4,6-Trinitrotoluene	-	-	-	µg/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	740	220 U	240 U	220 U	230 U	220 U	230 U	220 U	220 U	230 U	240 U	220 U
RDX	4,420	15,670	-	µg/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	**7,380**	220 U	240 U	220 U	230 U	220 U	230 U	220 U	220 U	230 U	240 U	650
General Chemistry																									
Nitrate as N	-	-	-	mg/kg	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	3
pH	-	-	-	pH unit	8.18	8.77	7.73	8.39	7.61	6.92	7.94	8.45	8.11	8.36	8.43	8.16	8.08	8.49	8.68	8.49	8.66	8.36	8.58	8.57	8.61
Metals																									
Aluminum	76,000	100,000	14,800	mg/kg	7,380	8,440	5,780	6,780	8,110	3,560	3,960	6,460	1,200	8,980	8,620	6,300 J	5,140 J	8,710 J	4,930 J	4,640 J	5,400 J	5,650 J	6,330 J	9,020 J	4,110 J
Arsenic	0.39	1.59	6.86	mg/kg	***4***	***3.2***	***2.8***	***2.8***	***3.9***	1 UJ	1.4 UJ	***2.5***	1.9 UJ	***4.3***	***2.4***	4.3 UJ	3.1 UJ	***4.7***	3 UJ	3.6 UJ	3.5 UJ	4.5 UJ	3.8 UJ	***8.6***	2.8 UJ
Barium	5,375	66,578	173	mg/kg	100	96.2	92.7	99.4	91	59.6	63.3	77.9	86.9	115	80.4	87.9 J	80.9 J	118 J	83.5 J	85.7 J	92.1 J	89.6 J	97.8 J	106 J	75.8 J
Cadmium	37	451	2.35	mg/kg	2	2.1	1.4	2	1.9	1.6	1.1	1.5	0.63	1.9	1.1	1.1 J	1.1 J	2.2 J	0.95 J	1.2 J	1.1 J	1.5 J	1.4 J	3.7	0.78 J
Calcium	-	-	46,000	mg/kg	5,690	9,940	7,940	8,840	8,050	20,400	2,920	7,390	9,560	7,230	4,600	6,150	5,130	15,200	7,610	5,220	7,450	11,400	8,620	12,300	5,160
Chromium	211	448	26.9	mg/kg	11.3	13.5	8.5	9.8	11.9	7.2	5.8	8.8	9	14.1	8.5	9.4	7.6	12.3	7.2	7.8	8.1	9.1	9.2	22.2	6.5
Cobalt	903	1,921	6.98	mg/kg	5.2	4.8	3.5	4	4.9	2	2.4	4	3	4.4	3.6	3.6	3.5	5.3	3.5	3.9	3.4	4	4.3	6.6	2.7
Copper	3,129	40,877	10.5	mg/kg	7.7	5.9 J	4.7 J	4.7 J	5.6 J	2.1 J	3.1 J	3.4 J	4.1 J	6 J	4 J	5	4.6	7	4.4	5.7	3.9	5.6	4.8	13.7	3.7
Iron	23,463	100,000	18,400	mg/kg	10,400	11,400	8,270	9,050	10,800	4,760	5,470	8,880	7,830	12,100	8,450	8,980	7,900	13,300	8,420	8,730	9,650	10,100	10,000	14,500	7,470
Lead	150	750	15.1	mg/kg	2.8	1.9	2.1	1.8	2	1.2 UJ	5.1	1.7	7.7	2.2	2.5	3.3	4.3	1.6	1.6	4.6	1.4 J	1.6	1.3 J	2.1	1.4 J
Magnesium	-	-	8,370	mg/kg	4,710	5,710	5,090	5,630	6,170	8,340	2,310	4,530	3,190	5,200	3,500	4,040	3,400	6,830	4,580	3,730	4,210	6,550	4,600	6,060	3,240
Manganese	1,762	19,458	291	mg/kg	218 J	189 J	165 J	209 J	208 J	116 J	116 J	157 J	111 J	170 J	172 J	166 J	157 J	224 J	156 J	180 J	156 J	190 J	186 J	228 J	123 J
Mercury	23.5	307	0.22	mg/kg	0.078	0.066	0.065	0.053	0.07	0.043	0.061	0.046	0.12	0.1	0.048	0.075 J	0.1 J	0.063 J	0.061 J	0.06 J	0.063 J	0.071 J	0.071 J	0.066 J	0.056 J
Nickel	1,564	20,439	15.3	mg/kg	12.3	11.8	8	9.7	11	6.6	5.3	7.5	7.4	10.9	7.7	9.8	9.1	13.8	8.8	12.8	7.9	12.7	10.8	26.3	7.8
Potassium	-	-	4,890	mg/kg	2,100 J	2,100 J	1,620 J	1,830 J	2,290 J	956 J	1,020 J	1,640 J	1,170 J	2,070 J	1,600 J	1,590	1,490	2,480	1,540	1,650	1,750	1,860	1,750	2,350	1,080
Selenium	391	5,110	0.32	mg/kg	0.48	2.4 UJ	2.3 UJ	2.3 UJ	2.3 UJ	2.1 UJ	2.3 UJ	2.3 UJ	2.6 UJ	2.4 UJ	0.41 UJ	2.4 UJ	2.2 UJ	2.3 UJ	2.2 UJ	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	0.38 J	2.2 U
Vanadium	78	1,022	71.8	mg/kg	27.7	35	22.6	26.2	34.2	18.9	13.2	25.3	17.8	32.4	20.8	24.1	18.4	34.8	18.7	17.8	19.8	24.4	24.1	60.9	16.9
Zinc	23,463	100,000	77.9	mg/kg	36.1	34.3	25.9	29.7	34.6	18	21.7	25.1	28	33.2	27	29.2 J	27.2 J	40.1 J	25.5 J	32.1 J	25.7 J	32.1 J	31.2 J	48.9 J	22 J
Dioxins																									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.905	NA	NA	NA	NA	NA	0.179	2.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	18.5	NA	NA	NA	NA	NA	2.12	30.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.454	NA	NA	NA	NA	NA	0.107	0.816	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	2.3	NA	NA	NA	NA	NA	0.423	4.55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.169	NA	NA	NA	NA	NA	0.0668	0.0937 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.309	NA	NA	NA	NA	NA	0.0854	0.107 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0751	NA	NA	NA	NA	NA	0.0644	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.201	NA	NA	NA	NA	NA	0.0775	0.103 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.143	NA	NA	NA	NA	NA	0.0678	0.254	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.11	NA	NA	NA	NA	NA	0.057	0.125 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0711	NA	NA	NA	NA	NA	0.061	0.236	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0783	NA	NA	NA	NA	NA	0.0517	0.0566 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0506	NA	NA	NA	NA	NA	0.0483	0.135 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.106	NA	NA	NA	NA	NA	0.0521	0.114 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.139	NA	NA	NA	NA	NA	0.0556	0.0818 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0622	NA	NA	NA	NA	NA	0.0743	0.0838 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0759	NA	NA	NA	NA	NA	0.0884	0.114 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	NA	NA	1.23	NA	NA	NA	NA	NA	0.195	2.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	2.3	NA	NA	NA	NA	NA	0.761	8.51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.851	NA	NA	NA	NA	NA	0.163	0.778	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.363	NA	NA	NA	NA	NA	0.474855	0.749	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.49	NA	NA	NA	NA	NA	0.173	0.0818 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.413583	NA	NA	NA	NA	NA	0.399355	0.439832 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.06525	NA	NA	NA	NA	NA	0.074308	0.083767 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.299145	NA	NA	NA	NA	NA	0.278158	0.114489 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	-	-	0.34	-	-	-	-	-	0.23	0.28	-	-	-	-	-	-	-	-	-	-	-

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP10 1.5 feet bgs LE023	DP10 5 feet bgs LE024	DP11 1.5 feet bgs LE025	DP11 5 feet bgs LE026	DP12 1.5 feet bgs LE027	DP12 5 feet bgs LE028	DP12 5 feet bgs (dup) LE029	DP13 1.5 feet bgs LE030	DP13 5 feet bgs LE031	DP14 1.5 feet bgs LE032	DP14 5 feet bgs LE033	DP15 1.5 feet bgs LE034	DP15 5 feet bgs LE035	DP16 1.5 feet bgs LE036	DP16 5 feet bgs LE037	DP17 1.5 feet bgs LE038	DP17 5 feet bgs LE039
SVOCs																					
Bis(2-ethylhexyl) Phthalate	34,700	123,000	-	µg/kg	570 U	550 U	560 U	560 U	540 U	540 U	54 J	560 U	570 U	550 U	570 U	550 U	550 U	530 U	560 U	560 U	520 U
Diethyl Phthalate	48,882,000	100,000,000	-	µg/kg	370 U	360 U	110 J	370 U	360 U	360 U	370 U	370 U	380 U	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Hydrocarbons																					
Motor Oils	-	-	-	mg/kg	11 U	11 U	11 U	11 U	86	11 U	3 J	11 U	11 U	11 U	11 U	3 J	11 U	11 U	11 U	11 U	10 U
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	11 U	11 U	11 U	43	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	10 U
TPH as Gasoline	-	-	-	mg/kg	9.7 U	11 U	11 U	9.9 U	10 U	10 U	10 U	10 U	9.9 U	9.6 U	9.5 U	9.3 U	9.3 U	9.3 U	10 U	9.2 U	11 U
Explosives																					
4-Amino-2,6-Dinitrotoluene	-	-	-	µg/kg	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2-Amino-4,6-Dinitrotoluene	-	-	-	µg/kg	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2,4,6-Trinitrotoluene	-	-	-	µg/kg	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
RDX	4,470	15,670	-	µg/kg	230 U	220 U	650	220 U	2200	220 U	220 U	220 U	230 U	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
General Chemistry																					
Nitrate as N	-	-	-	mg/kg	28	7	3	4	3	3	3	2	2	2	2	3	2	2	2	2	3
pH	-	-	-	pH unit	7.47	8.54	8.45	8.45	8.19	8.75	8.69	8.68	8.62	8.97	8.74	8.38	8.46	8.51	8.62	8.45	8.43
Metals																					
Aluminum	76,000	100,000	14,800	mg/kg	7,080 J	2,730 J	6,240 J	6,510 J	3,490 J	3,890	3,960	5,450	8,360	4,330	4,770	4,570	6,110	5,090	4,610	5,610	2,980
Arsenic	0.39	1.59	6.86	mg/kg	3.9 UJ	2.4 UJ	3.6 UJ	3.7 UJ	2.8 UJ	2.6 UJ	3.3 UJ	3.9 UJ	4.5 UJ	3.2 UJ	3.9 UJ	3.7 UJ	4.1 UJ	2.9 UJ	3.3 UJ	3.1 UJ	2.8 UJ
Barium	5,375	66,578	173	mg/kg	110 J	100 J	95.4 J	105 J	67.8 J	68.9	120	84.3	109	91.4	84.8	70.9	93	90.8	71.5	86.6	61.6
Cadmium	37	451	2.35	mg/kg	1.5 J	0.29 J	3.7	1.6 J	0.5	1.1	1.3	1.5	2.1	1.8	2.2	1.4	2	1.6	1.7	1.7	1
Calcium	-	-	46,000	mg/kg	8,100	5,340	12,200	8,470	7,830	6,300	9,210	7,150	11,300	12,000	7,260	4,520	6,960	5,900	8,650	3,780	4,320
Chromium	211	448	26.9	mg/kg	11.2	4.5	10.2	10.8	5	6.4 J	6.5 J	8.3 J	10.8 J	8.6 J	8.1 J	7.5 J	9.6 J	8.3 J	8.1 J	10 J	5.4 J
Cobalt	903	1,921	6.98	mg/kg	4.5	2.5	3.4	3.8	2.6	2.5	3	3.6	5.3	3.3	3.9	3.1	3.8	3.4	3.3	4	2.4
Copper	3,129	40,877	10.5	mg/kg	6.1	1.8 UJ	4.7	4.9	3.3	3.8 UJ	4.2	5.2	6.9	6.3	6.2	4.6	6	4.6	4.7	6.5	3.5 UJ
Iron	23,463	100,000	18,400	mg/kg	10,600	4,220	8,510	9,170	6,390	6,480	7,240	8,590	13,900	7,750	9,150	7,140	10,100	7,770	7,870	8,210	5,440
Lead	150	750	15.1	mg/kg	1.9 J	0.89 J	1.5 J	1.5 J	1.2 J	1.3	1.7	1.7	1.8	1.1	1.7	3.4	1.3	1.8	1.3	2	1
Magnesium	-	-	8,370	mg/kg	5,290	2,600	3,980	4,720	4,270	3,170	4,860	3,890	6,430	4,330	3,890	2,860	4,290	3,480	4,060	2,690	2,170
Manganese	1,762	19,458	291	mg/kg	193 J	107 J	153 J	160 J	136 J	110 J	146 J	153 J	218 J	140 J	172 J	130 J	171 J	162 J	133 J	163 J	96.5 J
Mercury	23.5	307	0.22	mg/kg	0.06 J	0.053 J	0.058 J	0.07 J	0.069 J	0.05 J	0.051 J	0.084 J	0.1 J	0.22 U	0.1 J	0.034 J	0.22 U	0.21 U	0.24 J	0.057 J	0.11 J
Nickel	1,564	20,439	15.3	mg/kg	11.4	5.4	9.3	11	5.4	6.7 J	9 J	9.7 J	12.5 J	11.6 J	13.4 J	9.5 J	11.7 J	9.8 J	10.6 J	11.1 J	5.9 J
Potassium	-	-	4,890	mg/kg	2,000	619	1,490	1,460	1,100	979 J	1,220 J	1,490 J	2,510 J	1,370 J	1,500 J	1,230 J	1,670 J	1,340 J	1,260 J	1,330 J	739 J
Selenium	391	5,110	0.32	mg/kg	2.3 U	2.2 U	0.64	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.3 U	2.2 U	2.3 U	2.2 U	2.2 U	2.1 U	2.2 U	2.2 U	0.37
Vanadium	78	1,022	71.8	mg/kg	28.1	11.8	27.1	26.9	13.3	15.1	16.8	21.2	31	19.6	20.5	17.7	24.4	19.5	20.3	20.3	13
Zinc	23,463	100,000	77.9	mg/kg	35.1 J	12.4 J	28.1 J	29.2 J	18.5 J	19.3	21.7	26.1	38.3	23	27.8	23.4	28.8	22.6	22.5	28.5	14.5
Dioxins																					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.595	NA	0.0889 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	4.6	NA	1.54 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.138 UJ	NA	0.101	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.556 UJ	NA	0.396 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0477 UJ	NA	0.0721 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0472 UJ	NA	0.0422 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0415 U	NA	0.0638 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0472	NA	0.044	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0438 U	NA	0.0671 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0368 U	NA	0.0491 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0393 U	NA	0.0603 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0346	NA	0.0403	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0337 U	NA	0.0436 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0335 U	NA	0.0447 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0409 UJ	NA	0.0367 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	NA	NA	0.0464 U	NA	0.0493 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	0.0556 U	NA	0.0585 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.305 UJ	NA	0.064917 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.946 UJ	NA	0.64 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.253	NA	0.044	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.313179 U	NA	0.42178 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.153 UJ	NA	0.077 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.299015 U	NA	0.379602 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	NA	NA	0.046426 U	NA	0.04933 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	0.250228 U	NA	0.306249 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	-	-	0.08	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Concentrations in **BOLD** indicate detected values above the EPA Region 9 residential PRGs

Concentrations in ***BOLD ITALICS*** indicate detected values above EPA Region 9 industrial PRGs

'-' = value not available

ug/kg = micrograms per kilogram

bgs = below ground surface

EPA = United States Environmental Protection Agency

J = the level stated is an estimated value

MCAS = Marine Corps Air Station

mg/kg = milligrams per kilogram

N = nitrogen

NA = the sample was not analyzed for the particular analyte

ng/kg = nanograms per kilogram

pH = negative logarithm of hydrogen ion concentration

PRG = preliminary remediation goal

RDX = cyclotrimethylenetrinitramine

SVOCs = semivolatile organic compounds

TPH = total petroleum hydrocarbons

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value.

WHO-TEQ = World Health Organization toxicity equivalent

2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 4-6: Frequency of Detection of the COPCs and Metals and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – EBS Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRGs	Detections Above Industrial PRGs	Detections Above Background (metals only)
Bis(2-ethylhexyl) Phthalate	34	1	2.9	0	0	-
Diethyl Phthalate	34	1	2.9	0	0	-
TPH as Motor Oils	34	9	26.5	-[b]	-[b]	-
TPH as Diesel Fuel	34	3	8.8	-[b]	-[b]	-
TPH as Gasoline	34	2	5.9	-[b]	-[b]	-
4-Amino-2,6-Dinitrotoluene	34	1	2.9	-[b]	-[b]	-
2-Amino-4,6-Dinitrotoluene	34	1	2.9	-[b]	-[b]	-
2,4,6-Trinitrotoluene	34	1	2.9	-[b]	-[b]	-
RDX	34	4	11.8	1	0	-
Nitrate	34	34	100	-[b]	-[b]	-
Metals						
Aluminum	34	34	100	0	0	0
Arsenic	34	10	29.4	10	10	1
Barium	34	34	100	0	0	0
Cadmium	34	34	100	0	0	2
Calcium	34	34	100	-[b]	-[b]	0
Chromium	34	34	100	0	0	0
Cobalt	34	34	100	0	0	0
Copper	34	31	91.2	0	0	1
Iron	34	34	100	0	0	0
Lead	34	33	97.1	0	0	0
Magnesium	34	34	100	-[b]	-[b]	0
Manganese	34	34	100	0	0	0
Mercury	34	31	91.2	0	0	1
Nickel	34	34	100	0	0	1
Potassium	34	34	100	-[b]	-[b]	0
Selenium	34	4	11.8	0	0	4
Vanadium	34	34	100	0	0	0
Zinc	34	34	100	0	0	0

Notes:
% = percent
COPCs = chemicals of potential concern
EBS = Environmental Baseline Survey
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RDX = cyclotrimethylenetrinitramine
TPH = total petroleum hydrocarbons
[a] Number of samples analyzed for the specified analyte, excluding four duplicates.
[b] No PRGs, therefore, no comparison was made.

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Table 4-7: Minimum and Maximum Concentrations of Detected Analytes – EBS Investigation

Analyte	PRG (µg/kg)		Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and Depth of Maximum Concentration
	Residential	Industrial				
SVOCs (µg/kg)						
Bis(2-ethylhexyl) Phthalate	34,700	123,000	54 J	DP12 (dup), 5 feet bgs	54 J	DP12 (dup), 5 feet bgs
Diethyl Phthalate	48,882,000	100,000,000	110 J	DP11, 1.5 bgs	110 J	DP11, 1.5 bgs
Hydrocarbons (mg/kg)						
TPH as Motor Oils	-	-	3 J	DP12 (dup), 5 feet bgs; DP15, 1.5 feet bgs	91	DP02, 1.5 feet bgs
TPH as Diesel Fuel	-	-	6 J	DP08, 5 feet bgs	43	DP12, 1.5 feet bgs
TPH as Gasoline	-	-	0.1 J	DP05, 1.5 feet bgs	0.2 J	DP01, 1.5 feet bgs
Explosives Residues (µg/kg)						
4-Amino-2,6-Dinitrotoluene	-	-	540	DP05, 1.5 feet bgs (dup)	540	DP05, 1.5 feet bgs (dup)
2-Amino-4,6-Dinitrotoluene	-	-	490	DP05, 1.5 feet bgs (dup)	490	DP05, 1.5 feet bgs (dup)
2,4,6-Trinitrotoluene	-	-	740	DP05, 1.5 feet bgs (dup)	740	DP05, 1.5 feet bgs (dup)
RDX	4,420	15,670	650	DP09, 5 feet bgs; and DP11, 1.5 feet bgs	7,380	DP05, 1.5 feet bgs (dup)
Nitrate (mg/kg)						
Nitrate	-	-	2	DP07, 5 feet bgs; DP08, 1.5 feet bgs; DP08, 5 feet bgs; DP09, 1.5 feet bgs; DP13, 1.5 feet bgs; DP13, 5 feet bgs; DP14, 1.5 feet bgs; DP14, 5 feet bgs; DP15, 5 feet bgs; DP16, 1.5 feet bgs; DP16, 5 feet bgs; DP17, 1.5 feet bgs	28	DP10, 1.5 feet bgs

Notes:
- = PRG not available
µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
EBS = Environmental Baseline Survey
J = the concentration shown is an estimated value
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons

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Table 4-8: Minimum and Maximum Concentrations of Detected Metals – EBS Investigation

Analyte	PRG (mg/kg)		MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration (mg/kg)	Location and Depth of Minimum Concentration	Maximum Concentration (mg/kg)	Location and Depth of Maximum Concentration
	Residential	Industrial					
Aluminum	76,000	100,000	14,800	2730 J	DP10, 5 feet bgs	8980	DP05, 1.5 feet bgs
Arsenic	0.39	1.6	6.86	2.4	DP05, 5 feet bgs	***8.6***	DP09, 1.5 feet bgs
Barium	5,375	66,578	173	59.6	DP03, 5 feet bgs	120	DP12, 5 feet bgs (dup)
Cadmium	37	451	2.35	0.29 J	DP10, 5 feet bgs	3.7	DP09, 1.5 feet bgs; and DP11, 1.5 feet bgs
Calcium	-	-	46,000	2920	DP04, 1.5 feet bgs	20400	DP03, 5 feet bgs
Chromium	211	448	26.9	4.5	DP10, 5 feet bgs	22.2	DP09, 1.5 feet bgs
Cobalt	903	1,921	6.98	2	DP03, 5 feet bgs	6.6	DP09, 1.5 feet bgs
Copper	3,129	40,877	10.5	2.1 J	DP03, 5 feet bgs	13.7	DP09, 1.5 feet bgs
Iron	23,463	100,000	18,400	4220	DP10, 5 feet bgs	14500	DP09, 1.5 feet bgs
Lead	150	750	15.1	0.89 J	DP10, 5 feet bgs	7.7	DP05, 1.5 feet bgs
Magnesium	-	-	8,370	2170	DP17, 5 feet bgs	8340	DP03, 5 feet bgs
Manganese	1,762	19,458	291	96.5 J	DP17, 5 feet bgs	228 J	DP09, 1.5 feet bgs
Mercury	23.5	307	0.22	0.034 J	DP15, 1.5 feet bgs	0.24 J	DP16, 5 feet bgs
Nickel	1,564	20,439	15.3	5.3	DP04, 1.5 feet bgs	26.3	DP09, 1.5 feet bgs
Potassium	-	-	4,890	619	DP10, 5 feet bgs	2510 J	DP13, 5 feet bgs
Selenium	391	5,110	0.32	0.37	DP17, 5 feet bgs	0.64	DP11, 1.5 feet bgs
Vanadium	78	1,022	71.8	11.8	DP10, 5 feet bgs	60.9	DP09, 1.5 feet bgs
Zinc	23,463	100,000	77.9	12.4 J	DP10, 5 feet bgs	48.9 J	DP09, 1.5 feet bgs

Notes:
Concentrations in ***BOLD ITALICS*** indicate values above the EPA Region 9 Industrial PRGs
- = PRG not available
bgs = below ground surface
dup = duplicate sample
EBS = Environmental Baseline Survey
J = the concentration shown is an estimated value
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal

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4.3.1.4 EXPLOSIVES RESIDUES

The explosives residues detected in the soil samples from the 3.3-acre area were 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2,4,6-trinitrotoluene, and cyclotrimethylenetrinitramine (RDX) (Table 4-5). 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and 2,4,6-trinitrotoluene were each detected in one soil sample while RDX was detected in four soil samples (Table 4-6). All the explosive compounds and maximum concentration of RDX (7,380 µg/kg) were detected in a sample collected from 1.5 feet bgs at location DP-05 (Table 4-7). Among the detected explosive compounds, only RDX exceeded its EPA Region 9 residential PRG in one soil sample. None of the detected concentrations of explosive compounds exceeded industrial PRGs.

4.3.1.5 GENERAL CHEMISTRY

Perchlorate was not detected in any of the samples above the reporting limits. The reporting limits ranged from 21 µg/kg to 26 µg/kg (Table E-2 [Appendix E]).

Nitrate was detected in all samples analyzed at concentrations ranging from 2 mg/kg to 28 mg/kg (Tables 4-5, 4-6, and 4-7).

The range of pH measured in the soil samples was 6.92 to 8.97 suggesting a neutral to alkaline nature for the soil (Table 4-5).

4.3.1.6 METALS

The concentrations of most of the metals in soil samples were below background values, except for arsenic (one sample), cadmium (two samples), copper (one sample), mercury (one sample), nickel (one sample), and selenium (four samples) (Tables 4-5 and 4-6). None of the metals exceeded their EPA Region 9 residential or industrial PRGs except arsenic. Arsenic exceeded its residential and industrial PRGs in 10 soil samples. However, only one of these 10 samples collected at 1.5 feet bgs at location DP-09, had arsenic concentration greater than its established background of 6.86 mg/kg (Table 4-8).

4.3.1.7 DIOXINS/FURANS

A total of five samples (LE003, LE009, LE010, LE025, and LE027) were submitted for dioxin and furan analysis based on the detection of TPH as diesel and TPH as motor oils (Table 4-5). The World Health Organization (WHO) toxicity equivalency factors (TEFs) were used to calculate the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalent quotient (TEQ) concentration for each sample (WHO 1997) (Table 4-5). The 2,3,7,8-TCDD TEQ concentrations were below the EPA Region 9 residential PRGs for all the samples.

4.3.1.8 SUMMARY OF THE RESULTS

Only RDX exceeded its EPA Region 9 residential PRG in one soil sample during the soil investigation of the 3.3-acre area located in the southern portion of IRP Site 1. Among the metals arsenic exceeded its residential and industrial PRGs in the samples collected throughout the area. However, only one of these detections exceeded the established background concentration for arsenic at Former MCAS El Toro.

4.3.2 Northern and Southern EOD Training Ranges Investigation

The soil at the Northern and Southern EOD Training Ranges were investigated during the Verification of Perchlorate Study, and Tier I, Tier II, Tier III-A, and Tier III-C of the Phase II RI. The following sections present the nature and extent of contamination at the Northern and Southern EOD Training Ranges.

4.3.2.1 VOLATILE ORGANIC COMPOUNDS

Verification of Perchlorate Study

During this Study, 28 soil samples and one duplicate were collected from depths of approximately 1.5 feet to 4.5 feet bgs, and analyzed for VOCs (Table 4-9). Acetone, a common laboratory contaminant, was the only VOC detected in four of the 29 samples (Tables 4-9 and 4-10). The concentrations of acetone detected ranged from 12 µg/kg to 24 µg/kg and were well below its EPA Region 9 residential and industrial PRG (Table 4-11).

Phase II RI Tier I Soil Sampling

As described previously, Tier I soil sampling involved collection of 77 soil samples and eight duplicates from 39 locations in both the Northern and Southern EOD Training Ranges. The VOCs detected in the soil samples included 2-butanone, 2-hexanone, 4-methyl-2-pentanone, and toluene (Tables 4-12, 4-13, and 4-14). 2-Butanone was detected at two locations, at concentrations of 6 µg/kg and 9 µg/kg (Table 4-12). 2-Hexanone was detected in seven samples with concentrations ranging from 20 µg/kg to 50 µg/kg (Tables 4-13 and 4-14). 4-methyl-2-pentanone was detected at 2 µg/kg in one sample taken from 1.5 feet bgs (Tables 4-13 and 4-14). Toluene was detected in 17 samples at concentrations ranging from 0.3 µg/kg to 0.7 µg/kg (Tables 4-13 and 4-14). The maximum concentrations of the detected compounds were well below the EPA Region 9 residential and industrial PRGs (Table 4-14).

Phase II RI Tier II Soil Sampling

The Phase II Tier II soil investigation involved trenching and potholing lengthwise across the selected geophysical anomalies identified during the previously conducted geophysical surveys. A total of 33 soil samples and four duplicates were collected for analysis of VOCs during the Tier II sampling. The VOCs detected in the soil samples included acetone, benzene, chloroform, ethylbenzene, PCE, toluene, and xylenes (Tables 4-15, 4-16, and 4-17). The most frequently detected VOC was chloroform (detected in 11 samples), and the least frequently detected VOCs were acetone and PCE (each detected in one sample). Table 4-17 presents the minimum and maximum concentrations of the detected VOCs along with their locations. Acetone and PCE were each detected only once at concentrations of 8,700 µg/kg and 2 µg/kg, respectively. The range of concentrations for benzene, chloroform, ethylbenzene, toluene, and xylenes were 36 µg/kg to 610 µg/kg, 0.5 µg/kg to 0.9 µg/kg, 240 µg/kg to 14,000 µg/kg, 0.5 µg/kg to 41,000 µg/kg, and 1,500 µg/kg to 98,000 µg/kg, respectively.

None of the detected VOCs exceeded their respective EPA Region 9 residential or industrial PRGs.

Phase II RI Tier III-A Soil Sampling

The Tier III-A soil investigation involved drilling one borehole at the Tier II sampling location (Trench 34) that resulted in detections of petroleum hydrocarbons, VOCs, and metals at 6 feet and 10 feet bgs. Seven soil samples and one duplicate sample were collected from 5 feet bgs to 35 feet bgs for analysis of VOCs. Three VOCs were detected, including ethylbenzene, toluene, and xylenes (Table 4-18). Ethylbenzene and xylenes were detected in four samples and toluene was detected in two samples (Table 4-19). Table 4-20 presents the minimum and maximum concentrations of the detected VOCs along with their locations. The maximum concentrations of detected VOCs were below the EPA Region 9 residential and industrial PRGs.

Table 4-9: Summary of Detected Analytes - Perchlorate Investigation

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	MW202 10 feet bgs LD-021	MW202 20 feet bgs LD-022	MW203 10 feet bgs LD-029	MW204 10 feet bgs LD-042	MW204 35 feet bgs LD-047	MW205 10 feet bgs LD-050	MW205 30 feet bgs LD-054	MW206 5 feet bgs LD-060	MW206 15 feet bgs LD-062	MW207 5 feet bgs LD-073	MW207 15 feet bgs LD-075	HA01 1.5 feet bgs LD-110	HA01 4 feet bgs LD-111	HA02 1.5 feet bgs LD-112	HA02 4 feet bgs LD-113	HA03 1.5 feet bgs LD-114	HA03 4 feet bgs LD-115	HA04 1.5 feet bgs LD-116	HA04 3.5 feet bgs LD-117	HA05 1.5 feet bgs LD-120	HA05 4.5 feet bgs LD-121	HA06 1.5 feet bgs LD-122	HA06 4.5 feet bgs LD-123
VOCs																											
tone	14,126,570	54,321,000	-	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110 U	110 U	17 J	15 J	120 U	120 U	110 U	100 U	110 U	110 R	110 R	110 R
SVOCs																											
nyl Phthalate	48,882,000	100,000,000	-	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	540 U	NA	NA	NA	NA	NA	220 J	NA	NA	NA	550 U
Di-n-butyl Phthalate	-	-	-	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	540 U	NA	NA	NA	NA	NA	530 U	NA	NA	NA	550 U
Hexachlorobenzene	304	1,080	-	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	530 U	540 U	NA	NA	NA	NA	NA	530 U	NA	NA	NA	550 U
Hydrocarbons																											
TPH as Diesel Fuel	-	-	-	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 J	11 U	6 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	1 J	11 U
TPH as Gasoline	-	-	-	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 J	0.1 J	0.1 J	11 U	11 U	11 U	11 U	11 U	11 U	14 U	10 U	11 U
General Chemistry																											
Perchlorate	7,820	102,200	-	µg/kg	23 U	22 U	22 U	22 U	24 U	21 U	23 U	23 U	25 U	23 U	24 U	21 U	22 U	21 U	22 U	21 U	22 U	21 U	21 U	22 U	22 U	22 U	22 U
Nitrate as N	-	-	-	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	970	220 U	NA	NA	NA	NA	NA	2700	NA	NA	NA	220 U
pH	-	-	-	pH unit	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.37	8.67	7.04	7.28	6.97	8.61	7.02	7.13	8.64	8.76	8.12	8.97
Metals																											
Aluminum	76,000	100,000	14,800	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5770	3580	NA	NA	NA	NA	NA	6,760	NA	NA	NA	4,500
Antimony	31	410	3.06	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 UJ	5.4 U	NA	NA	NA	NA	NA	5.3 U	NA	NA	NA	0.21 UJ
Arsenic	0.39	1.59	6.86	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.71**	0.45 UJ	NA	NA	NA	NA	NA	**1.1**	NA	NA	NA	0.34 UJ
Barium	5,375	66,578	173	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.5	30.1	NA	NA	NA	NA	NA	37.2	NA	NA	NA	30.1
Beryllium	154	1,941	0.669	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19	0.36	NA	NA	NA	NA	NA	0.2	NA	NA	NA	0.26
Cadmium	37	451	2.35	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15 UJ	0.02 UJ	NA	NA	NA	NA	NA	5.2	NA	NA	NA	0.054 UJ
Calcium	-	-	46,000	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,090	2,900	NA	NA	NA	NA	NA	2,490	NA	NA	NA	12,800
Chromium	211	448	26.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.1	1.8	NA	NA	NA	NA	NA	4.1	NA	NA	NA	4
Cobalt	903	1,921	6.98	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3	0.67	NA	NA	NA	NA	NA	1.5	NA	NA	NA	0.93
Copper	3,129	40,877	10.5	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9	0.36 UJ	NA	NA	NA	NA	NA	7	NA	NA	NA	3.1
Iron	23,463	100,000	18,400	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,260	2,190	NA	NA	NA	NA	NA	4460	NA	NA	NA	4,730
Lead	150	800	15.1	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.5	0.68	NA	NA	NA	NA	NA	9.8	NA	NA	NA	1.3
Magnesium	-	-	8,370	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,100	1,030	NA	NA	NA	NA	NA	1290	NA	NA	NA	1,140
Manganese	1,762	19,458	291	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	42.7	25.6	NA	NA	NA	NA	NA	84	NA	NA	NA	45.4
Mercury	23.5	307	0.22	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.53	0.22 U	NA	NA	NA	NA	NA	0.074 J	NA	NA	NA	0.22 U
Nickel	1,564	20,439	15.3	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8	0.84	NA	NA	NA	NA	NA	96	NA	NA	NA	2.1
Potassium	-	-	4,890	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	433	430	NA	NA	NA	NA	NA	769	NA	NA	NA	614
Selenium	391	5,110	0.32	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 UJ	0.79 UJ	NA	NA	NA	NA	NA	1.5	NA	NA	NA	1.8
Sodium	-	-	405	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33.4 UJ	35.8 UJ	NA	NA	NA	NA	NA	110 U	NA	NA	NA	90.4
Vanadium	78	1,022	71.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.9	4.1	NA	NA	NA	NA	NA	6.7	NA	NA	NA	5.6
Zinc	23,463	100,000	77.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.9	5.7	NA	NA	NA	NA	NA	772	NA	NA	NA	10.6
Dioxins																											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 5 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.36 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 41 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	-	-	-	-	-	-	-	-	-	-	-	0.67	-	-	-	-	-	-	-	-	-	-	-

Analyte	PRGs Residential	PRGs Industrial	MCAS Ei Toro Background (0.95 Quantile)	Units	HA07 1.5 feet bgs LD-125	HA07 4 feet bgs LD-126	HA08 1.5 feet bgs LD-127	HA08 3.5 feet bgs LD-128	HA09 1.5 feet bgs LD-129	HA09 1.5 feet bgs (dup) LD-130	HA09 4 feet bgs LD-131	HA10 1.5 feet bgs LD-132	HA10 4.5 feet bgs LD-133	HA11 1.5 feet bgs LD-134	HA11 3 feet bgs LD-135	HA12 1.5 feet bgs LD-136	HA12 3.5 feet bgs LD-137	HA13 1.5 feet bgs LD-138	HA13 4 feet bgs LD-139	HA14 1.5 feet bgs LD-141	HA14 4 feet bgs LD-142	SS01 Surface LD-143	SS02 Surface LD-144	SS03 Surface LD-145
VOCs																								
Acetone	14,126,570	54,321,000	-	µg/kg	110 U	110 U	120 U	24 J	110 U	120 U	120 UJ	12 J	110 UJ	120 UJ	110 UJ	120 UJ	110 UJ	120 UJ	120 UJ	110 UJ	110 UJ	NA	NA	NA
SVOCs																								
Diethyl Phthalate	48,882,000	100,000,000	-	µg/kg	72 J	NA	NA	530 U	530 U	530 U	250 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl Phthalate	-	-	-	µg/kg	530 U	NA	NA	530 U	71 J	530 U	971	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	304	1,080	-	µg/kg	530 U	NA	NA	530 U	530 U	530 U	220 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons																								
TPH as Diesel Fuel	-	-	-	mg/kg	4 J	11 U	11 U	11 U	4 J	6 J	7 J	11 U	11 U	11 U	11 U	13	11 U	11 U	1 J	11 U	2 J	12	2 J	27
TPH as Gasoline	-	-	-	mg/kg	0.1 J	13 U	12 U	11 U	9.9 U	11 U	9.9 U	11 U	11 U	10 U	10 U	9.8 U	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
General Chemistry																								
Perchlorate	7,820	102,200	-	µg/kg	21 U	29	110	210	21 U	21 U	22 U	21 U	21 U	21 U	22 U	21 U	22 U	21 U	21 U	21 U	22 U	20 U	320	20 U
Nitrate as N	-	-	-	µg/kg	246	NA	NA	450	2,600	2,000	2,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	-	-	-	pH unit	6.78	6.94	6.77	6.75	7.06	7.28	7.94	6.95	7.01	6.88	7.2	7.15	7.32	6.72	8.88	6.62	6.54	5.89	6.46	6.32
Metals																								
Aluminum	76,000	100,000	14,800	mg/kg	6,440	NA	NA	7,290	5,790	5,480	5,410	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	31	410	3.06	mg/kg	5.3 U	NA	NA	5.3 U	0.57 UJ	1.1 UJ	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.39	1.59	6.86	mg/kg	**0.83**	NA	NA	**0.85**	**0.7**	**0.94**	**0.94**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	5,375	66,578	173	mg/kg	36.6	NA	NA	32.2	54.1	53.5	46.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	154	1,941	0.669	mg/kg	0.19	NA	NA	0.23	0.16	0.17	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	37	451	2.35	mg/kg	0.26	NA	NA	0.045 UJ	0.85	1.4	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	-	-	46,000	mg/kg	2,400	NA	NA	2,430	2,690	2,660	2,570	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	211	448	26.9	mg/kg	3.4	NA	NA	4.2	3.5	4.6	5.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	903	1,921	6.98	mg/kg	1.3	NA	NA	1.4	1.1	1.1	0.97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	3,129	40,877	10.5	mg/kg	30.4	NA	NA	1.9	56.7	107	234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	23,463	100,000	18,400	mg/kg	3,590	NA	NA	3,820	3,290	3,120	3,150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	150	800	15.1	mg/kg	13.6	NA	NA	2	44	133	67	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	-	-	8,370	mg/kg	1,200	NA	NA	1,350	1,140	993	1,050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1,762	19,458	291	mg/kg	64.1	NA	NA	69	61.4	67.2	47.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	23.5	307	0.22	mg/kg	0.083 J	NA	NA	0.21 UJ	3.6	10.6	2.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1,564	20,439	15.3	mg/kg	1.6	NA	NA	1.9	2.1	2.4	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	-	-	4,890	mg/kg	564	NA	NA	475	715	638	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	391	5,110	0.32	mg/kg	1.4	NA	NA	1.1 UJ	0.88 UJ	0.69 UJ	0.74 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	-	-	405	mg/kg	11.9 UJ	NA	NA	28.2 UJ	36.9 UJ	66.5	149	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	78	1,022	71.8	mg/kg	5.9	NA	NA	5.5	5.5	5.4	5.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	23,463	100,000	77.9	mg/kg	50.2	NA	NA	8.6	123	177	481	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins																								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	11.1	32.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5 U	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	297	426	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8 U	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	6.2	16.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	14	34.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8 U	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.7 U	0.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.76 J	3.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.7 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.3 U	1.4 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.4 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	2.4 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.4 U	0.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.3 U	1.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.4 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	0.4 U	0.71 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	18.6	36.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 U	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	38	119	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8 U	NA	NA	NA	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	9.5	12.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	4.1	10.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	0.75	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	0.4 U	1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	-	-	-	-	1.07	2.22	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-

Notes:

Concentrations in **BOLD** indicate values above the EPA Region 9 residential PRGs

Concentrations in ***BOLD ITALICS*** indicate values above EPA Region 9 industrial PRGs

'-' = value not available

ug/kg = micrograms per kilogram

bgs = below ground surface

EPA = United States Environmental Protection Agency

J = the level stated is an estimated value

MCAS = Marine Corps Air Station

mg/kg = milligrams per kilogram

N = nitrogen

NA = the sample was not analyzed for the particular analyte

ng/kg = nanograms per kilogram

pH = negative logarithm of hydrogen ion concentration

PRG = preliminary remediation goal

R = rejected data

SVOCs = semivolatile organic compounds

TPH = total petroleum hydrocarbons

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

VOCs = volatile organic compounds

2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 4-10: Frequency of Detection for COPCs and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – Perchlorate Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRGs[c]	Detections Above Industrial PRGs[c]
Acetone	29	4	13.8	0	0
Diethyl Phthalate	8	3	37.5	0	0
Di-n-butyl Phthalate	8	2	25	0	0
Hexachlorobenzene	8	1	12.5	0	0
TPH as Diesel Fuel	31	12	38.7	-[b]	-[b]
TPH as Gasoline	31	4	12.9	-[b]	-[b]
Perchlorate	42	4	9.5	0	0
Nitrate	8	6	75	-[b]	-[b]

Notes:
[a] Number of samples analyzed for the specified analyte excluding duplicates.
[b] No PRG; therefore, no comparison was made.
[c] Comparison was made to EPA Region 9 PRGs.
% = percent
COPCs = chemicals of potential concern
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
TPH = total petroleum hydrocarbons

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Table 4-11: Minimum and Maximum Concentrations of Detected Analytes – Perchlorate Investigation

Analyte	PRG (µg/kg)		Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and Depth of Maximum Concentration
	Residential	Industrial				
VOCs (µg/kg)						
Acetone	1,412,570	54,321,000	12 J	HA10, 1.5 feet bgs	24 J	HA08, 3.5 feet bgs
SVOCs (µg/kg)						
Diethyl Phthalate	48,882,000	100,000,000	72 J	HA07, 1.5 feet bgs	250 J	HA09, 4 feet bgs
Di-n-butyl Phthalate	-	-	71 J	HA09, 1.5 feet bgs	971	HA09, 4 feet bgs
Hexachlorobenzene	304	1,080	220 J	HA09, 4 feet bgs	220 J	HA09, 4 feet bgs
Hydrocarbons (mg/kg)						
TPH as Diesel Fuel	-	-	1 J	HA06, 1.5 feet bgs; and HA13, 4 feet bgs	27	SS03, surface soil
TPH as Gasoline	-	-	0.1 J	HA01, 4 feet bgs; HA02, 1.5 feet bgs; HA07, 1.5 feet bgs	0.2 J	HA01, 1.5 feet bgs
Perchlorate and Nitrate (mg/kg)						
Perchlorate	7,820	102,200	29	HA07, 4 feet bgs	320	SS02, surface soil
Nitrate	-	-	246	HA07, 1.5 feet bgs	2,700	HA04, 3.5 feet bgs; and HA09, 4 feet bgs

Notes:

- = No PRGs available
µg/kg = micrograms per kilogram
bgs = below ground surface
J = the concentration shown is an estimated value
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compunds

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Table 4-12: Summary of Detected Analytes - RI Tier I Investigation

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP18 1 to 1.5 ft bgs LE060	DP18 5 feet bgs LE061	DP19 1 to 1.5 ft bgs LE062	DP19 5 feet bgs LE063	DP20 1 to 1.5 ft bgs LE064	DP20 5 feet bgs LE065	DP20 5 feet bgs (dup) LE066	DP21 1 to 1.5 ft bgs LE067	DP21 5 feet bgs LE068	DP24 1 to 1.5 ft bgs LE069	DP24 5 feet bgs LE070	DP25 1 to 1.5 ft bgs LE071	DP25 5 feet bgs LE072	DP22 1 to 1.5 ft bgs LE073	DP22 5 feet bgs LE074	DP23 1 to 1.5 ft bgs LE075	DP23 5 feet bgs LE076	DP32 1 to 1.5 ft bgs LE079	DP32 5 feet bgs LE080	DP30 1 to 1.5 ft bgs LE081	DP30 5 feet bgs LE082
VOCs																									
anone	22,311,200	113,264,400	-	µg/kg	110 UJ	190 UJ	140 UJ	100 UJ	110 UJ	130 UJ	140 UJ	98 UJ	180 UJ	140 UJ	160 UJ	150 UJ	140 UJ	180 UJ	95 UJ	92 U	100 U	130 U	190 U	180 U	150 U
anone	-	-	-	µg/kg	56 U	93 U	71 U	51 U	56 U	65 U	72 U	49 U	89 U	70 U	78 U	75 U	68 U	88 U	47 U	46 U	50 U	63 U	96 U	90 U	76 U
ethyl-2-Pentanone	-	-	-	µg/kg	56 U	93 U	71 U	51 U	56 U	65 U	72 U	49 U	89 U	2 J	78 U	75 U	68 U	88 U	47 U	46 U	50 U	63 U	96 U	90 U	76 U
Toluene	520,000	520,000	-	µg/kg	5.6 U	9.3 U	7.1 U	5.1 U	0.7 J	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U	5 U	6.3 U	9.6 U	9 U	7.6 U
SVOCs																									
Phenol	18,330,930	100,000,000	-	µg/kg	868	100 J	83 J	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	94 J	580 U	540 U	550 U	530 U	540 U
Hydrocarbons																									
Motor Oils	-	-	-	mg/kg	5 J	11 U	17 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	16 J	12 U	11 U	11 U	24	11 U
TPH as Diesel Fuel	-	-	-	mg/kg	12 U	11 U	3 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	7 J	11 U
TPH as Gasoline	-	-	-	mg/kg	11 U	20 U	13 U	15 U	12 U	13 U	9.6 U	21 U	15 U	14 U	17 U	9.9 U	11 U	16 U	11 U	11 U	16 U	19 U	21 U	0.1 J	14 U
General Chemistry																									
Perchlorate	7,820	102,200	-	µg/kg	24 UJ	22 UJ	21 UJ	23 UJ	21 UJ	22 UJ	22 U	21 U	21 U	23 U	22 U	43	22 U	21 U	22 U	21 U	23 UJ	22 U	22 U	21 U	22 U
Nitrate as N	-	-	-	mg/kg	2 J	2.9 J	3.6 J	2.7 J	3.3 J	0.54 J	0.59 J	1.7 J	1 J	0.59 J	0.6 J	2.1 J	1.6 J	2.1 J	0.74 J	2.6 J	0.77 J	0.72 J	0.55 J	0.36 J	0.69 J
pH	-	-	-	pH unit	7.78	7.28	6.76	7.26	5.01	7.02	8.77	8.52	7.6	7.43	8.02	8.64	9.26	8.74	8.63	8.39	9.28	8.11	8.78	7.98	8.1
Metals																									
Aluminum	76,000	100,000	14,800	mg/kg	4,040	4,600	5,130	2,210	4,920	3,180	2,130	3,490	5,710	4,860	4,510	3,440	3,720	5,110	2,460	6,640	11,000	6,880	5,330	7,750	1,430
Antimony	31	410	3.06	mg/kg	3.6 U	3.4 U	3.2 U	3.4 U	3.2 U	3.3 U	3.3 U	3.2 U	3.2 U	3.4 U	3.3 U	3.2 U	3.3 U	3.2 U	3.3 U	3.2 U	3.5 U	3.2 U	0.24 UJ	0.34 UJ	3.2 U
Arsenic	0.39	1.59	6.86	mg/kg	0.54 UJ	0.35 UJ	0.49 UJ	0.35 UJ	0.29 UJ	0.28 UJ	0.31 UJ	0.43 UJ	0.43 UJ	**0.63**	**0.61**	0.36 UJ	0.41 UJ	**0.68**	0.38 UJ	**0.78**	**2.7**	**0.67**	**0.77**	**0.82**	0.25
Barium	5,375	66,578	173	mg/kg	24.4	29.8	29	21.3	22.8	21.9	22.2	30	34.8	49.1	38.2	32.3	24.3	30.4	25.4	58.6	129	44.6	23.3	44.9	25.5
Beryllium	154	1,941	0.669	mg/kg	0.16	0.18	0.22	0.17	0.2	0.26	0.2	0.17	0.17	0.27	0.28	0.17	0.25	0.23	0.17	0.41	1.1	0.32	0.21	0.36	0.15
Cadmium	37	451	2.35	mg/kg	0.24 UJ	0.22 UJ	0.21 UJ	0.013 J	0.21 UJ	0.22 UJ	0.06 J	0.019 J	0.21 UJ	0.0073 J	0.22 UJ	0.016 J	0.22 UJ	0.028 J	0.22 UJ	0.21 UJ	0.044 J	0.1	0.017 UJ	0.12	0.019 UJ
Calcium	-	-	46,000	mg/kg	1,890	2,050	3,250	3,920	2,190	4,280	9,880	1,970	2,120	3,370	2,900	3,970	4,830	8,290	2,440	5,890	10,900	2,580	3,450	3,650	2,930
Chromium	211	448	26.9	mg/kg	2.7	3.3	2.8	1.4	2.3	1.5	0.99	2.4	3	3.8	3.4	2	2.6	3.3	1.2	4	11.3	3.7	3.2	4.3	0.91
Cobalt	903	1,921	6.98	mg/kg	1.1	0.86	0.91	0.62	0.61	0.68	0.66	1.1	1.3	1.8	1.1	0.67	0.53	1.1	0.47	1.8	3.6	1.5	0.66	1.3	0.47
Copper	3,129	40,877	10.5	mg/kg	2.2	1.2	1.5	0.47	0.81	0.42	0.34	2.5	1.5	2.4	1.3	0.58	0.49	2	0.26 UJ	1.8	3.7	2.3 J	0.76 J	3.7 J	0.38 UJ
Iron	23,463	100,000	18,400	mg/kg	2,790	2,750	2,820	1,780	2,180	2,150	1,680	2,570	3,270	3,770	3,310	2,300	2,200	3,090	1,510	4,380	11,600	3,960	2,690	3,990	1,080
Lead	150	800	15.1	mg/kg	4.8	1.7	4.6	0.86	2.2	1	1.3	3.4	1.8	1.8	1.8	1.2	0.94	4.3	0.69	2.1	3.6	1.8 J	1.8 J	8.8 J	0.92 J
Magnesium	-	-	8,370	mg/kg	932	1,030	1,150	802	675	949	729	1,000	1,220	1,450	1,210	1,030	839	1,140	727	1,570	4,360	1,330	1,130	1,470	513
Manganese	1,762	19,458	291	mg/kg	46	37.4	32.7	16.9	19.8	25.8	60.1	55.4	51.9	82.1	30.2	23	18.2	53.2	13.6	64.2	209	102	14.8	54.4	16.1
Mercury	23.5	307	0.22	mg/kg	0.025 J	0.016 J	0.031 J	0.014 J	0.018 J	0.02 J	0.023 J	0.034 J	0.021 J	0.025 J	0.014 J	0.023 J	0.013 J	0.021 J	0.015 J	0.029 J	0.024 J	0.031 J	0.024 UJ	0.066 J	0.021 UJ
Nickel	1,564	20,439	15.3	mg/kg	1.4	1.5	1.2	0.53	0.75	0.53	1.1	1.4	1.5	1.9	1.5	0.73	0.65	1.6	0.4	1.8	4.4	1.9	1.2	2.4	0.45
Potassium	-	-	4,890	mg/kg	367 J	367 J	467 J	526 J	272 J	618 J	393 J	754 J	588 J	650 J	317 J	569 J	558 J	560 J	245 J	506 J	2,830 J	571 J	111 J	560 J	221 J
Selenium	391	5,110	0.32	mg/kg	0.18 UJ	0.34 U	0.32 U	0.16 UJ	0.32 U	0.16 UJ	0.11 UJ	0.16 UJ	0.32 U	0.21 UJ	0.33 U	0.32 U	0.33 U	0.2 UJ	0.33 U	0.32 U	0.35 U	0.32 U	0.33 U	0.32 U	0.32 U
Sodium	-	-	405	mg/kg	15.4 J	110 U	110 U	110 U	110 U	6.6 J	110 U	297 J	110 U	110 U	74.4 J	17.4 J	95.8 J	110 U	7.3 J	110 U	185 J	52 UJ	181	51.3 UJ	25.9 UJ
Thallium	5.16	67	0.42	mg/kg	0.48 UJ	0.45 UJ	0.43 UJ	0.46 UJ	0.43 UJ	0.45 UJ	0.43 UJ	0.43 UJ	0.42 UJ	0.46 UJ	0.44 UJ	0.43 UJ	0.44 UJ	0.43 UJ	0.43 UJ	0.43 UJ	0.46 UJ	0.077 UJ	0.44 U	0.43 U	0.43 U
Vanadium	78	1,022	71.8	mg/kg	5.4	5.3	5.8	4.1	3.9	4.5	3.7	4.8	5.2	7	6.1	5.3	4.9	5.7	3.8	9.4	29.6	6.3	7.3	7.3	2.6
Zinc	23,463	100,000	77.9	mg/kg	8.5 J	5.9 J	9 J	5.9 J	6.7 J	6.4 J	5 J	7.4 J	7.8 J	9.8 J	7.2 J	6.8 J	6.5 J	10 J	3.9 J	11.3 J	37.9 J	9.9	4.2	15.4	3.1

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP33 1 to 1.5 ft bgs LE083	DP33 5 feet bgs LE084	DP29 1 to 1.5 ft bgs LE085	DP29 5 feet bgs LE091	DP27 1 to 1.5 ft bgs LE092	DP27 5 feet bgs LE093	DP27 5 feet bgs (dup) LE094	DP26 1 to 1.5 ft bgs LE095	DP26 5 feet bgs LE096	DP28 1 to 1.5 ft bgs LE097	DP28 5 feet bgs LE098	DP28 5 feet bgs (dup) LE099	DP36 1 to 1.5 ft bgs LE100	DP36 5 feet bgs LE101	DP37 1 to 1.5 ft bgs LE102	DP37 5 feet bgs LE103	DP38 1 to 1.5 ft bgs LE104	DP38 5 feet bgs LE105	DP38 5 feet bgs (dup) LE106	DP39 1 to 1.5 ft bgs LE107	DP39 5 feet bgs LE108
VOCs																									
2-Butanone	22,311,200	113,264,400	-	µg/kg	170 U	200 U	9 J	140 U	170 U	160 U	91 U	160 U	170 U	200 U	140 U	97 U	190 U	230 U	220 U	200 U	200 U	110 U	100 U	150 U	89 U
2-Hexanone	-	-	-	µg/kg	84 U	100 U	86 U	70 U	84 U	36 J	20 J	36 J	38 U	43 J	70 U	21 J	94 U	50 J	110 U	100 U	44 J	25 J	22 J	73 U	45 U
4-Methyl-2-Pentanone	-	-	-	µg/kg	84 U	100 U	86 U	70 U	84 U	82 U	45 U	82 U	87 U	98 U	70 U	49 U	94 U	120 U	110 U	100 U	100 U	57 U	50 U	73 U	45 U
Toluene	520,000	520,000	-	µg/kg	8.4 U	10 U	8.6 U	7 U	8.4 U	0.6 J	0.4 J	0.5 J	8.7 U	0.6 J	0.5 J	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	0.3 J
SVOCs																									
Phenol	18,330,930	100,000,000	-	µg/kg	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U
Hydrocarbons																									
Motor Oils	-	-	-	mg/kg	7 J	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	10 U	11 U
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	10 U	11 U
TPH as Gasoline	-	-	-	mg/kg	16 U	13 U	16 U	16 U	14 U	14 U	12 U	15 U	15 U	16 U	16 U	11 U	19 U	21 U	19 U	18 U	21 U	11 U	14 U	17 U	11 U
General Chemistry																									
Perchlorate	7,820	102,200	-	µg/kg	33	22 U	21 U	21 U	660	910	22 U	21 U	21 U	23 U	22 U	22 U	21 U	23 U	22 U	23 U	22 U	21 U	22 U	21 UJ	22 UJ
Nitrate as N	-	-	-	mg/kg	10.9 J	2.9	1.2	1.4 J	1.1 J	0.66 J	0.79 J	1.9	0.5 J	1.1 J	1.5 J	0.61 J	0.32 J	0.88 J	5.1	0.49 J	1.5	0.63 J	0.45 J	7	2.5
pH	-	-	-	pH unit	8.05	8.25	7.77	7.71	7.78	8.28	8.28	7.57	7.83	7.93	9.64	9.55	8.14	8.19	9.05	9.48	9.09	9.14	9.55	8.28	7.96
Metals																									
Aluminum	76,000	100,000	14,800	mg/kg	4,140	8,930	4,250	4,790	8,290	2,790	1,740	4,470	3,870	7,400	3,260	4,790	9,860	6,120	5,750	2,260	3,280	2,330	1,990	2,570	4,950
Antimony	31	410	3.06	mg/kg	3.2 U	3.2 U	3.1 U	3.2 U	3.3 U	3.3 U	3.3 U	3.2 U	3.2 UJ	3.4 UJ	3.3 UJ	3.3 UJ	3.2 UJ	3.5 UJ	3.3 UJ	3.5 UJ	3.4 UJ	3.2 UJ	3.3 UJ	0.098 UJ	3.3 UJ
Arsenic	0.39	1.59	6.86	mg/kg	**0.59**	**0.77**	**0.55**	**0.69**	**0.55**	**0.44**	0.3	0.36	**0.46**	**0.41**	0.2	0.31	**0.51**	0.3	**0.54**	**0.96**	**0.7**	0.24	0.25	0.3	**0.41**
Barium	5,375	66,578	173	mg/kg	30.6	40	49.4	36.2	29	31.4	29.5	23.5	47.3	48.2	29.6	52	43.4	31.9	37.9	34.1	44.7	31.6	36.5	38.6	41.3
Beryllium	154	1,941	0.669	mg/kg	0.29	0.3	0.16	0.17	0.26	0.32	0.11	0.34	0.34 J	0.99 J	0.26 J	0.19 J	0.38 J	0.23 J	0.29 J	0.23 J	0.19 J	0.15 J	0.14 J	0.11 J	0.19 J
Cadmium	37	451	2.35	mg/kg	0.11	0.04 UJ	0.15	0.091	0.0067 UJ	0.0089 UJ	0.22 U	0.21 U	0.31	0.057 UJ	0.04 UJ	0.03 UJ	0.066 UJ	0.056 UJ	0.097 UJ	0.11 UJ	0.056 UJ	0.012 UJ	0.017 UJ	0.28	0.057 UJ
Calcium	-	-	46,000	mg/kg	3,310	3,460	1,890	1,820	2,360	3,030	2,870	3,370	3,390	5,830	5,000	6,100	4,350	3,170	13,300	71,000	29,500	4,120	3,380	2,090	2,600
Chromium	211	448	26.9	mg/kg	2.5	4.5	3	4.5	3.4	1.8	1.4	1.9	3.3	4.7	2.1	3.6	5.6	4	3.1	1.2	2.4	2.6	1.3	2.1	4.6
Cobalt	903	1,921	6.98	mg/kg	0.81	1.2	1.5	2	0.98	0.57	0.55	0.86	1.3	1.5	0.73	1.7	1.8	1.3	1.1	0.68	0.8	0.51	0.72	0.87	1.7
Copper	3,129	40,877	10.5	mg/kg	1 J	0.97 J	2.5 J	3.3 J	0.71 J	0.27 UJ	0.35 UJ	0.48 UJ	0.64 UJ	1	0.51 UJ	1.2	2.2	1.6	1.4	0.48 UJ	0.9 UJ	0.72 UJ	0.43 UJ	11.8	2.2
Iron	23,463	100,000	18,400	mg/kg	2,380	3,900	3,260	3,360	3,350	2,050	1,490	2,080	2,380	5,130	2,430	4,910	5,210	3,460	3,380	1,520	2,460	2,010	1,740	2,030	3,760
Lead	150	800	15.1	mg/kg	4.2 J	3.5 J	1.7 J	4.3 J	1.6 J	0.59 J	0.71 J	1.1 J	2.8 J	1.8 J	0.9 J	1.1 J	2.1 J	1.5 J	2.3 J	0.89 J	0.98 J	0.75 J	0.59 J	15.1 J	2 J
Magnesium	-	-	8,370	mg/kg	997	1,570	1,050	1,100	1,310	889	789	1,040	861 J	2,310 J	1,090 J	2,090 J	2,040 J	1,300 J	1,580 J	759 J	909 J	638 J	681 J	654 J	1,340 J
Manganese	1,762	19,458	291	mg/kg	42.5	34.1	94.1	80.3	30.9	14.6	12.9	21.5	711	72.8	23.3	46.3	83.8	53.5	68.1	164	27.8	15.5	21.2	44	82.8
Mercury	23.5	307	0.22	mg/kg	0.045 J	0.04 J	0.034 J	0.095 J	0.031 J	0.024 UJ	0.02 UJ	0.028 J	0.015 UJ	0.013 UJ	0.0095 UJ	0.0072 UJ	0.016 UJ	0.028 J	0.023 UJ	0.02 UJ	0.02 UJ	0.014 UJ	0.021 UJ	1.5	0.026 J
Nickel	1,564	20,439	15.3	mg/kg	0.89	1.7	1.7	2.8	1.1	0.46	0.52	0.59	2.2 J	1.6 J	0.73 J	1.2 J	2.4 J	1.9 J	1.5 J	1.1 J	1 J	1 J	0.58 J	1.3 J	2.5 J
Potassium	-	-	4,890	mg/kg	415 J	397 J	714 J	570 J	289 J	303 J	286 J	199 J	332 J	562 J	812 J	1,550 J	863 J	520 J	748 J	501 J	421 J	475 J	543 J	508 J	726 J
Selenium	391	5,110	0.32	mg/kg	0.32 U	0.32 U	0.16	0.32 U	0.33 U	0.33 U	0.33 U	0.32 U	0.57	0.34 U	0.33 U	0.33 U	0.32 U	0.35 U	0.33 U	0.45 UJ	0.34 U	0.32 U	0.33 U	0.13 UJ	0.33 U
Sodium	-	-	405	mg/kg	38.4 UJ	52.4 UJ	100 U	110 U	51.5 UJ	39.8 UJ	10.6 UJ	12 UJ	34.4 J	16.2	90.4	110 U	23.5	120 U	110 U	7.2	110 U	110 U	110 UJ	100 UJ	110 UJ
Thallium	5.16	67	0.42	mg/kg	0.42 U	0.43 U	0.42 U	0.43 U	0.44 U	0.45 U	0.44 U	0.43 U	0.43 UJ	0.46 U	0.44 U	0.45 U	0.43 U	0.47 U	0.44 U	0.093 UJ	0.45 U	0.43 U	0.43 U	0.42 U	0.44 U
Vanadium	78	1,022	71.8	mg/kg	5	7.9	5.6	6.5	6.1	4.3	3.9	5.5	7.5	9.9	4.7	10.1	8.9	6.7	6.5	4.3	5.7	4.3	4.2	4.2	7.2
Zinc	23,463	100,000	77.9	mg/kg	9.3	9.2	8.9	10.9	6.5	5.4	4.2	5.3	5.2 J	13.4 J	7.9 J	16.4 J	12.2 J	8.1 J	9.4 J	4.8 J	6.7 J	5.4 J	5.4 J	22.7 J	8.5 J

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP40 1 to 1.5 ft bgs LE109	DP40 5 feet bgs LE110	DP34 1 to 1.5 ft bgs LE113	DP34 5 feet bgs LE114	DP34 5 feet bgs (dup) LE115	DP42 1 to 1.5 ft bgs LE116	DP42 5 feet bgs LE117	DP43 1 to 1.5 ft bgs LE118	DP43 5 feet bgs LE119	DP44 1 to 1.5 ft bgs LE120	DP44 5 feet bgs LE121	DP48 1 to 1.5 ft bgs LE122	DP48 5 feet bgs LE123	DP47 1 to 1.5 ft bgs LE124	DP47 5 feet bgs LE125	DP47 5 feet bgs (dup) LE126	DP46 1 to 1.5 ft bgs LE127	DP46 5 feet bgs LE128	DP50 1 to 1.5 ft bgs LE129	DP50 3.5 feet bgs LE130	DP51 1 to 1.5 ft bgs LE131
VOCs																									
tanone	22,311,200	113,264,400	-	µg/kg	200 U	160 U	190 UJ	170 UJ	95 UJ	150 UJ	160 UJ	170 UJ	160 UJ	170 UJ	160 UJ	200 UJ	120 UJ	120 UJ	200 UJ	140 UJ	170 UJ	160 UJ	160 UJ	150 UJ	160 UJ
xanone	-	-	-	µg/kg	99 U	82 U	94 U	83 U	48 U	75 U	79 U	87 U	82 U	84 U	80 U	98 U	59 U	100 U	100 U	70 U	83 U	80 U	80 U	74 U	80 U
Methyl-2-Pentanone	-	-	-	µg/kg	99 U	82 U	94 U	83 U	48 U	75 U	79 U	87 U	82 U	84 U	80 U	98 U	59 U	100 U	100 U	70 U	83 U	80 U	80 U	74 U	80 U
Toluene	520,000	520,000	-	µg/kg	0.7 J	8.2 U	9.4 U	8.3 U	0.3 J	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	0.5 J	0.7 J	8 U	8 U	0.5 J	0.7 J
SVOCs																									
Phenol	18,330,930	100,000,000	-	µg/kg	550 U	120 J	580 U	540 U	550 U	540 U	540 U	530 U	550 U	520 U	520 U	540 U	590 J	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Hydrocarbons																									
Motor Oils	-	-	-	mg/kg	11 U	11 U	12 U	11 U	11 U	6 J	11 U	11 U	11 U	10 U	10 U	11 U	13 U	11 U	11 U	11 U	6 J	11 U	6 J	11 U	10 U
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	10 U	3 J	11 U	13 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	10 U
TPH as Gasoline	-	-	-	mg/kg	16 U	16 U	19 U	16 U	9.1 U	15 U	16 U	15 U	9.5 U	16 U	15 U	16 U	24 U	16 U	21 U	12 U	16 U	17 U	14 U	20 U	16 U
General Chemistry																									
Perchlorate	7,820	102,200	-	ug/kg	22 UJ	23 UJ	23 UJ	22 UJ	22 UJ	22 UJ	22 UJ	21 UJ	22 UJ	21 UJ	21 UJ	22 UJ	26 UJ	21 UJ	22 U	22 U	22 U	21 U	22 U	21 U	21 U
Nitrate as N	-	-	-	mg/kg	1.7	0.6 J	1.5 J	0.86 J	0.54 J	1.2 J	1.6 J	1.1 J	0.59 J	1.3 J	0.77 J	0.98 J	0.58 J	0.97 J	0.64 J	0.72 J	1.1 J	0.63 J	0.77 J	0.68 J	1 J
pH	-	-	-	pH unit	9.12	9.34	9.21	8.85	8.73	8.45	8.35	8.49	8.1	7.7	7.78	7.82	7.69	7.8	8.02	7.76	7.29	6.9	6.78	7.01	6.48
Metals																									
Aluminum	76,000	100,000	14,800	mg/kg	4,250	3,060	12,800	3080	3090	1,1500	8,360	7,020	7,870	6,550	4,630	6,740	9,090	4,790	9,850	10,400	7,370	9,530	5,530	9,580	4,520
Antimony	31	410	3.06	mg/kg	3.3 UJ	3.4 UJ	0.11 UJ	3.3 UJ	3.3 UJ	0.11 UJ	0.16 UJ	3.2 UJ	3.3 UJ	3.1 UJ	0.15 UJ	0.13 UJ	0.14 UJ	0.19 UJ	0.14 UJ	0.16 UJ	3.2 U	0.2 UJ	0.11 UJ	3.2 U	3.1 U
Arsenic	0.06	0.25	6.86	mg/kg	0.38	0.27	**0.94**	0.23	0.25	**0.63**	**0.65**	**0.39**	**0.65**	**0.39**	0.3	**0.52**	**0.57**	0.33	**0.77**	**0.82**	**0.47**	**0.54**	**0.87**	**1.6**	0.28
Barium	5,375	66,578	173	mg/kg	29.5	25.3	41.1	21.2	23.5	45.8	35.8	41.6	42.2	39.3	28.8	44.2	51.9	32.6	56.4	52.5	50	57.2	39.1	59.3	32.1
Beryllium	154	1,941	0.669	mg/kg	0.31 J	0.3 J	0.45	0.45	0.46	0.35	0.15	0.28	0.36	0.22	0.18	0.31	0.44	0.16	0.4	0.4	0.3	0.32	0.067	0.29	0.16
Cadmium	37	451	2.35	mg/kg	0.11 UJ	0.017 UJ	0.069 UJ	0.22 U	0.22 U	0.029 UJ	0.22 U	0.069 UJ	0.051 UJ	0.085 UJ	0.06 UJ	0.097 UJ	0.049 UJ	0.081 UJ	0.085 UJ	0.043 UJ	0.087 UJ	0.084 UJ	0.032 UJ	0.21 U	0.16
Calcium	-	-	46,000	mg/kg	11,400	3,700	4,760	3,360	3,460	2,890	1,720	3,460	3,780	2,550	2,190	3,150	3,780	2,180	3,760	3,760	3,620	2,940	1,360	1,830	1,860
Chromium	211	448	26.9	mg/kg	2.7	1.6	5.2	2	2	6.4	5.3	3.9	4.5	3.5	3	4	5.2	2.8	5.5	5.5	4.2	6.3	5.4	6.2	2.9
Cobalt	903	1,921	6.98	mg/kg	0.96	0.76	1.7	0.45	0.49	2	1.4	1.4	1.8	1.4	1.3	1.9	2.1	1.1	3.5	2	1.7	3	2.7	1.3	1.1
Copper	3,129	40,877	10.5	mg/kg	1.5	0.49 UJ	1.5	0.27 UJ	0.28 UJ	1.8	0.98 UJ	1.9	1.8	2	1.6	1.8	1.6	1.6	2 J	2 J	2.2 J	2.8 J	2.2 J	1.4 J	1.5 J
Iron	23,463	100,000	18,400	mg/kg	2,790	1,940	5,310	1,650	1,750	5,950	5,590	3,950	4,610	3,660	3,000	4,390	5,480	2,840	5,310	5,440	4,050	5,960	4,700	6,660	2,860
Lead	150	800	15.1	mg/kg	4.3 J	1.1 J	2.8	0.8	0.94	3.1	2.1	1.7	2	1.7	1.5	1.8	2.1	1.5	3.1	2.6	2	2.8	2.1	2.1	1.4
Magnesium	-	-	8,370	mg/kg	1,100 J	899 J	2,190 J	956 J	971 J	2,000 J	1,860 J	1,690 J	2,120 J	1,450 J	1,230 J	1,770 J	2,340 J	1,140 J	2,170 J	2,240 J	1,760 J	2,010 J	1,420 J	1,970 J	1,080 J
Manganese	1,762	19,458	291	mg/kg	56.7	22.8	68.4	13.4	13.6	71.5	31.9	77.4	76.1	81	61.6	88.9	80.1	75.4	208 J	74.8 J	94.9 J	226 J	82.2 J	21.2 J	68.9 J
Mercury	23.5	307	0.22	mg/kg	0.023 UJ	0.048 J	0.025 J	0.0062 J	0.0074 J	0.049 J	0.04 J	0.024 J	0.0087 J	0.039 J	0.011 J	0.032 J	0.031 J	0.039 J	0.025 J	0.036 J	0.0062 J	0.0077 J	0.02 J	0.027 J	0.039 J
Nickel	1,564	20,439	15.3	mg/kg	1.3 J	0.68 J	2.1	0.45 UJ	0.48 UJ	2.5	1.7	2	2.5	1.8	1.8	1.9	2.3	1.4	4	2.5	2.3	4.5	2.5	5.3	1.5
Potassium	-	-	4,890	mg/kg	563 J	260 J	413 J	286 J	275 J	818 J	609 J	743 J	686 J	927 J	713 J	1,060 J	839 J	656 J	704 J	713 J	815 J	1,110 J	623 J	403 J	702 J
Selenium	391	5,110	0.32	mg/kg	0.33 U	0.34 U	0.35 U	0.33 U	0.33 U	0.32 U	0.32 U	0.32 U	0.33 U	0.31 U	0.31 U	0.32 U	0.39 U	0.32 U	0.33 U	0.33 U	0.32 U	0.32 U	0.32 U	0.32 U	0.31 U
Sodium	-	-	405	mg/kg	110 UJ	110 UJ	73.8	43.3	60	36.9	110 UJ	22.3 J	38.7	100 UJ	100 UJ	110 UJ	55.3	110 U	126	113	33.1	28.1	13.4	357	15.7
Thallium	5.16	67	0.42	mg/kg	0.44 U	0.45 U	0.46 U	0.44 U	0.44 U	0.43 U	0.43 U	0.43 U	0.44 U	0.41 U	0.42 U	0.43 U	0.097 UJ	0.43 U	0.1	0.44 U	0.43 U	0.43 U	0.43 U	0.43 U	0.41 U
Vanadium	78	1,022	71.8	mg/kg	5.6	4.6	8.6	3.5	3.9	11.7	14.6	5.2	7	5.6	5.1	6.8	8	5.1	8.2	8.7	6.8	10.4	10.8	13.1	4.8
Zinc	23,463	100,000	77.9	mg/kg	8.9 J	5 J	11.7 J	4.6 J	4.7 J	13.1 J	10.1 J	10.8 J	11.7 J	10.3 J	8.1 J	11.9 J	14.1 J	8.2 J	11.7 J	12 J	11.1 J	13.9 J	9.9 J	7.8 J	8.5 J

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	DP51 5 feet bgs LE132	DP52 1 to 1.5 ft bgs LE133	DP52 5 feet bgs LE134	DP56 1 to 1.5 ft bgs LE135	DP56 5 feet bgs LE136	DP55 1 to 1.5 ft bgs LE137	DP55 5 feet bgs LE138	DP54 1.5 feet bgs LE139	DP53 1 to 1.5 ft bgs LE142	DP53 5 feet bgs LE143	DP49 1 to 1.5 ft bgs LE144	DP49 5 feet bgs LE145	DP49 5 feet bgs (dup) LE146	DP45 1 to 1.5 ft bgs LE147	DP45 5 feet bgs LE148	DP41 1 to 1.5 ft bgs LE149	DP41 5 feet bgs LE150	DP35 1 to 1.5 ft bgs LE151	DP35 5 feet bgs LE152	DP35 5 feet bgs (dup) LE153	DP31 1 to 1.5 ft bgs LE154	DP31 5 feet bgs LE155
VOCs																										
2-Butanone	22,311,200	113,264,400	-	ug/kg	150 UJ	120 UJ	150 UJ	160 UJ	130 UJ	120 UJ	120 UJ	150 UJ	150 UJ	150 UJ	6 J	130 UJ	160 UJ	150 UJ	160 UJ	170 UJ	150 UJ	130 UJ	120 UJ	140 UJ	140 UJ	130 UJ
2-Hexanone	-	-	-	ug/kg	75 U	62 U	76 U	80 U	63 U	61 U	58 U	76 U	73 U	73 U	76 U	63 U	80 U	75 U	81 U	84 U	76 U	66 U	62 U	71 U	71 U	66 U
4-Methyl-2-Pentanone	-	-	-	ug/kg	75 U	62 U	76 U	80 U	63 U	61 U	58 U	76 U	73 U	73 U	76 U	63 U	80 U	75 U	81 U	84 U	76 U	66 U	62 U	71 U	71 U	66 U
Toluene	520,000	520,000	-	ug/kg	0.5 J	6.2 U	7.6 U	8 U	0.5 J	0.5 J	0.5 J	0.6 J	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
SVOCs																										
Phenol	18,330,930	100,000,000	-	ug/kg	1200	260 J	550 U	520 U	540 U	510 U	560 U	530 U	130 J	390 J	610 U	560 U	380 J	620 U	220 J	570 U	570 U	170 J	170 J	550 U	280 J	540 U
Hydrocarbons																										
Motor Oils	-	-	-	mg/kg	11 U	11	9 J	9 J	11 U	10 U	11 U	11 U	10 U	11 U	5 J	11 U	11 U	12 U	11 U	11 U	11 U	5 J	11 U	11 U	19	11 U
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	10 U	11 U	10 U	11 U	10 U	11 U	11 U	10 U	11 U	6 J	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	3 J	11 U
TPH as Gasoline	-	-	-	mg/kg	17 U	14 U	14 U	19 U	14 U	14 U	14 U	15 U	14 U	15 U	17 U	9.9 U	15 U	12 U	14 U	15 U	16 U	16 U	12 U	12 U	18 U	13 U
General Chemistry																										
Perchlorate	7,820	102,200	-	ug/kg	23 U	20 U	22 U	21 U	22 U	21 U	22 U	21 U	21 U	22 U	24 U	22 U	22 U	25 U	22 U	23 U	23 U	22 U	22 U	22 U	21 U	22 U
Nitrate as N	-	-	-	mg/kg	0.6 J	0.79 J	0.52 J	1 J	0.75 J	2 J	3.4 J	0.64 J	0.8	0.74	3.2	0.96	1.2	1.6	0.87	2	1.3	2.5	1.1	1.7	5	0.57
pH	-	-	-	pH unit	6.42	8.18	8.38	8.45	8.38	8.52	7.75	8.22	7.19	7.49	8.19	9.09	8.91	7.04	7.47	8.73	9.38	8.47	8.74	9.28	7.83	9.08
Metals																										
Aluminum	76,000	100,000	14,800	mg/kg	7,740	6,950	10,800	3,460	8,990	2,940	904	2,970	4,110	7,070	6,240	5,190	5,660	7,900	10,400	6,250	5,100	4,390	5,630	4,200	4,460	2,690
Antimony	31	410	3.06	mg/kg	0.12 UJ	0.18 UJ	0.17 UJ	0.21 UJ	3.2 U	0.15 UJ	3.4 U	3.2 U	0.095 UJ	3.4 U	3.6 U	3.4 U	3.3 U	3.7 U	3.3 U	3.4 U	3.4 U	3.3 U	3.3 U	3.3 U	3.2 U	3.2 U
Arsenic	0.06	0.25	6.86	mg/kg	0.36	***2.2***	***4***	***1.9***	***4.6***	0.7	0.15	***1.8***	0.5 UJ	**0.68**	**0.72**	0.17 UJ	0.18 UJ	**0.61**	**0.71**	**1**	0.58 UJ	**0.92**	**0.64**	0.35 UJ	**0.95**	0.32 UJ
Barium	5,375	66,578	173	mg/kg	39.3	85.1	106	61.4	108	31.2	30.8	62.5	33.7	47.3	51.1	33.4	35.5	44.2	43.6	44.2	28.2	42.3	41	33.1	32.8	29.3
Beryllium	154	1,941	0.669	mg/kg	0.25	0.09	0.019 UJ	0.022 UJ	0.02 UJ	0.047	0.22 U	0.12	0.051	0.22	0.34	0.14	0.19	0.38	0.44	0.28	0.27	0.3	0.2	0.3	0.25	0.19
Cadmium	37	451	2.35	mg/kg	0.031 UJ	1.3	2.4	1.3	2.2	0.12 UJ	0.099 UJ	0.38	0.21 UJ	0.22 UJ	0.038 J	0.22 UJ	0.22 UJ	0.036 J	0.22 UJ	0.046 J	0.0079 J	0.22 UJ	0.22 UJ	0.22 UJ	0.072 J	0.22 UJ
Calcium	-	-	46,000	mg/kg	2,620	4,050	10,900	4,870	9,750	2,440	677	2,190	2,210 J	3,750 J	10,500 J	4,350 J	4,720 J	4,580 J	4,600 J	30,000 J	4,890 J	34,600 J	13,900 J	4,140 J	14,500 J	4,090 J
Chromium	211	448	26.9	mg/kg	4.7	8.5	16.2	6	11.7	3.5	0.77	6.2	3.1	7.7	4.8	3	3.6	4.8	5.5	4.2	3.3	3	4.1	2.7	2.4	1.7
Cobalt	903	1,921	6.98	mg/kg	1.1	2.4	4.7	2	4.5	1.4	0.23	0.32	1.6	1.9	2.2	1.2	1.2	1.9	2	1.5	0.77	1.2	1.4	0.97	0.9	0.42
Copper	3,129	40,877	10.5	mg/kg	1.8 J	4.7 J	8.4 J	3.3 J	7.2 J	1.2 J	0.28 UJ	1.4 J	1.2	1.8	2.2	0.55	0.56	2.1	1.4	1.2	0.62	0.97	0.87	0.57	2.9	0.41
Iron	23,463	100,000	18,400	mg/kg	4,090	7,830	13,500	5,380	13,400	2,540	697	3,000	3,480	5,210	5,100	3,510	3,900	5,290	5,950	4,570	3,220	3,100	4,480	3,400	2,650	1,610
Lead	150	800	15.1	mg/kg	1.8	2.9	2.7	1	2.5	1.4	0.28	0.91	1.7	1.9	2.7	0.84	0.9	6.5	2.2	3	1.2	2.1	1.8	1.3	6	0.63
Magnesium	-	-	8,370	mg/kg	1,640 J	2,890 J	6,230 J	2,510 J	5,710 J	914 J	239 J	1,060 J	1,320 J	1,920 J	2,120 J	1,490 J	1,650 J	1,970 J	2,130 J	1,820 J	1,300 J	1,300 J	1,800 J	1,460 J	972 J	596 J
Manganese	1,762	19,458	291	mg/kg	32.4 J	99.8 J	239 J	108 J	205 J	42.7 J	17 J	15.4 J	43.9 J	56.9 J	90.7 J	28.6 J	32.7 J	77 J	58.6 J	52 J	24.5 J	45 J	52.7 J	46.5 J	51 J	19.9 J
Mercury	23.5	307	0.22	mg/kg	0.022 J	0.039 J	0.018 J	0.033 J	0.037 J	0.03 J	0.049 J	0.071 J	0.0063 UJ	0.01 UJ	0.22	0.018 UJ	0.022 UJ	0.045 J	0.035 J	0.039 J	0.018 UJ	0.028 UJ	0.017 UJ	0.018 UJ	0.089	0.018 UJ
Nickel	1,564	20,439	15.3	mg/kg	1.9	7	17.3	6.6	11.9	2.3	0.42 UJ	3.6	1.2 J	3 J	2.4 J	1.1 J	1.2 J	2.1 J	2.1 J	1.9 J	1 J	1.3 J	1.5 J	1 J	1.1 J	0.57 J
Potassium	-	-	4,890	mg/kg	530 J	1,580 J	2,470 J	1,110 J	2,730 J	353 J	125 J	252 J	529 J	715 J	835 J	804 J	945 J	755 J	414 J	970 J	824 J	549 J	1,330 J	964 J	465 J	286 J
Selenium	391	5,110	0.32	mg/kg	0.34 U	0.31 U	0.7	0.31 U	0.32 U	0.31 U	0.34 U	0.32 U	0.31 U	0.34 U	0.36 U	0.34 U	0.33 U	0.37 U	0.33 U	0.12 UJ	0.34 U	0.17 UJ	0.33 U	0.33 U	0.1 UJ	0.32 U
Sodium	-	-	405	mg/kg	29.1	18.7	110 U	100 U	110 U	100 U	110 U	248	100 U	110 UJ	120 UJ	110 UJ	110 UJ	120 UJ	20.1 J	110 UJ	171	110 UJ	6.6 J	44.1 J	13.7 J	19.5 J
Thallium	5.16	67	0.42	mg/kg	0.46 U	0.41 U	0.44 U	0.42 U	0.43 U	0.41 U	0.45 U	0.43 U	0.42 U	0.45 U	0.48 U	0.45 U	0.44 U	0.5 U	0.44 U	0.45 U	0.46 U	0.44 U	0.44 UJ	0.44 UJ	0.42 UJ	0.43 UJ
Vanadium	78	1,022	71.8	mg/kg	7.6	19.2	38.9	14.4	30.8	8.3	1.8	8.3	9	12.5	10.8	7.5	8.4	9.5	10.5	10	7.8	8.4	9.9	8.1	5.5	3.8
Zinc	23,463	100,000	77.9	mg/kg	9.7 J	22.4 J	39.5 J	16.8 J	38.6 J	6.3 J	1.9 J	7 J	8.4 J	12.3 J	14.3 J	10.3 J	11.4 J	14.2 J	11.8 J	13.4 J	8.9 J	8.5 J	13.2 J	10 J	10.3 J	3.8 J

Notes:

Concentrations in **BOLD** indicate detected values above the EPA Region 9 residential PRGs

Concentrations in ***BOLD ITALICS*** indicate detected values above EPA Region 9 industrial PRGs

'-' = value not available

ug/kg = micrograms per kilogram

bgs = below ground surface

EPA = United States Environmental Protection Agency

J = the level stated is an estimated value

MCAS = Marine Corps Air Station

mg/kg = milligrams per kilogram

N = nitrogen

pH = negative logarithm of hydrogen ion concentration

PRG = preliminary remediation goal

RI = remedial investigation

SVOCs = semivolatile organic compounds

TPH = total petroleum hydrocarbons

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

VOCs = volatile organic compounds

Table 4-13: Frequency of Detection of the COPCs and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – RI Tier I Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[c]	Detections Above Industrial PRG[c]
2-Butanone	77	2	2.5	0	0
2-Hexanone	77	6	7.8	0	0
4-Methyl-2-Pentanone	77	1	1.3	0	0
Toluene	77	17	22.1	0	0
Phenol	77	15	19.5	0	0
TPH as Motor Oils	77	14	18.2	-[b]	-[b]
TPH as Diesel Fuel	77	5	6.5	-[b]	-[b]
TPH as Gasoline	77	1	1.3	-[b]	-[b]
Perchlorate	77	4	5.2	0	0
Nitrate	77	77	100	-[b]	-[b]

Notes:
[a] Number of samples analyzed for the specified analyte excluding 8 duplicates.
[b] No PRG; therefore, no comparison was made.
[c] Comparison was made to EPA Region 9 PRGs.
% = percent
COPCs = chemicals of potential concern
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation
TPH = total petroleum hydrocarbons

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Table 4-14: Minimum and Maximum Concentrations of Detected Analytes – RI Tier I Sampling

Analyte	PRGs (µg/kg)		Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and Depth of Maximum Concentration
	Residential	Industrial				
VOCS (µg/kg)						
2-Butanone	22,311,200	113,264,400	6 J	DP49, 1.5 feet bgs	9 J	DP29, 1.5 feet bgs
2-Hexanone	-	-	20 J	DP27 (dup), 5 feet bgs	50 J	DP36, 5 bgs
4-Methyl-2-Pentanone	-	-	2 J	DP24, 1.5 feet bgs	2 J	DP24, 1.5 feet bgs
Toluene	520,000	520,000	0.3 J	DP39, 5 feet bgs; and DP34 (dup), 5 feet bgs	0.7 J	DP20, 1.5 feet bgs; DP40, 1.5 feet bgs; DP46, 1.5 feet bgs; and DP51, 1.5 feet bgs
SVOCs (µg/kg)						
Phenol	18,330,930	100,000,000	83 J	DP19, 1.5 feet bgs	1200	DP51, 5 feet bgs
Hydrocarbons (mg/kg)						
TPH as Motor Oils	-	-	5 J	DP18, 1.5 feet bgs; DP49, 1.5 feet bgs; and DP35, 1.5 feet bgs	24	DP30, 1.5 feet bgs
TPH as Diesel Fuel	-	-	3 J	DP19, 1.5 feet bgs; DP44, 5 feet bgs; and DP31, 1.5 feet bgs	7 J	DP30, 1.5 feet bgs
TPH as Gasoline	-	-	0.1 J	DP30, 1.5 feet bgs	0.1 J	DP30, 1.5 feet bgs
Perchlorate and Nitrate (µg/kg)						
Perchlorate	7,820	102,200	33	DP33, 1.5 feet bgs	910	DP27, 5 feet bgs
Nitrate	-	-	320 J	DP36, 1.5 feet bgs	10,900 J	DP33, 1.5 feet bgs

Notes:

- = No PRGs available
µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
J = the concentration is an estimated value
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

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Table 4-15: Summary of Detected Analytes - RI Tier II Investigation

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	LE158 2 feet bgs Trench 54	LE160 2 feet bgs Trench 51	LE161 2 feet bgs Trench 6	LE162 1 foot bgs Trench 15	LE163 1.5 feet bgs Trench 14	LE165 1 foot bgs Trench 27	LE166 1.5 feet bgs Trench 13	LE167 1.5 feet bgs Trench 23	LE169 3 feet bgs Trench 20	LE170 5 feet bgs Trench 29A	LE171 3 feet bgs Trench 29A	LE172 0.5 feet bgs Trench 5	LE173 0.5 feet bgs (dup) Trench 5	LE174 2 feet bgs Trench 17	LE176 3 feet bgs Trench 23	LE177 3 feet Trench 33	LE178 5 feet bgs Trench 32	LE179 1.5 feet bgs Trench 32	LE181 2 feet bgs Trench 34	LE182 6 feet bgs Trench 34	LE183 10 feet bgs Trench 34	LE184 10 feet bgs (dup) Trench 34	LE185 8 feet bgs Trench 31
VOCs																											
Acetone	14,126,570	54,321,000	-	µg/kg	94 UJ	90 UJ	99 UJ	100 UJ	120 UJ	89 UJ	120 UJ	88 UJ	93 UJ	130 UJ	120,000 UJ	130 UJ	140 UJ	120 UJ	150 UJ	180 UJ	95 UJ	100 UJ	120,000 UJ	8,700 J	13,000 UJ	11,000 UJ	150 UJ
Benzene	643	1410	-	µg/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	610 J	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	430 J	36 J	640 U	560 U	7.6 U
Chloroform	941	2,000	-	µg/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	0.6 J	6.1 U	0.5 J	0.7 J	0.7 J	6,00 U	0.7 J	7.2 U	0.7 J	0.9 J	0.9 J	4.8 U	0.6 J	6,100 U	560 UJ	640 UJ	560 UJ	7.6 U
Ethylbenzene	395,000	395,000	-	µg/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6,000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	14,000	530 J	470 J	240 J	7.6 U
Tetrachloroethene (PCE)	484	1,309	-	µg/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6,000 U	6.6 U	7.2 U	5.9 U	7.7 U	2 J	4.8 U	5 U	6,100 U	560 U	640 U	560 U	7.6 U
Toluene	520,000	520,000	-	µg/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	0.5 J	4.6 U	6.5 U	6,000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	0.6 J	5 U	41,000	600 J	140 J	73 J	7.6 U
Xylenes, Total	271,000	420,000	-	µg/kg	14 U	14 U	15 U	16 U	17 U	13 U	18 U	13 U	14 U	20 U	18,000 U	20 U	22 U	18 U	23 U	27 U	14 U	15 U	98,000	5,400 J	3,000 J	1,500 J	23 U
SVOCs																											
2,4-Dinitrotoluene	120,000	12,000,000	-	µg/kg	220 U	220 U	210 U	3100	220 U	210 U	210 U	7,000	220 U	650	240 U	220 U	220 U	120 J	240 U	240 U	210 U	220 U	240 U	230 U	250 U	220 U	220 U
2-Methylnaphthalene	-	-	-	µg/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120,000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	270,000	18,000	36,000	22,000	550 U
Bis(2-ethylhexyl) Phthalate	34,700	123,000	-	µg/kg	550 U	540 U	520 U	420 J	550 UJ	530 U	520 U	420 J	110 J	560 UJ	120,000 UJ	550 UJ	550 UJ	650 UJ	590 UJ	590 UJ	530 UJ	540 UJ	120,000 UJ	2,300 UJ	2,500 UJ	2,200 UJ	550 UJ
Di-n-butyl Phthalate	-	-	-	µg/kg	550 U	540 U	520 U	113,000	27,800	530 U	69 J	307,000	30,300	200 J	120,000 U	550 U	71 J	15,300	590 U	590 U	530 U	540 U	120,000 U	2,300 U	2,500 U	2,200 U	550 U
Naphthalene	1,700	4,200	-	µg/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120,000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	***128,000***	***9,900***	***16,000***	***10,000***	550 U
n-nitrosodiphenylamine	99,300	352,000	-	µg/kg	550 U	540 U	520 U	12,300	3,500	530 U	520 U	66,700	4,000	560 U	120,000 U	550 U	550 U	1300	590 U	590 U	530 U	540 U	120,000 U	2,300 U	2,500 U	2,200 U	550 U
Hydrocarbons																											
Motor Oils	-	-	-	mg/kg	11 U	11 U	5 J	8 J	5 J	6 J	4 J	20	8 J	19	NA	20	9 J	7 J	41	67	11 U	9 J	2400 U	230 U	250 U	560 U	7 J
TPH as Diesel Fuel	-	-	-	mg/kg	11 U	11 U	10 U	130	23	11 U	10 U	387	110	150	NA	11 U	11 U	15	110	324	11 U	11 U	37,000	3,700	4,600	4,900	10 J
TPH as Gasoline	-	-	-	mg/kg	14 U	9.2 U	10 U	9.9 U	10 U	11 U	9.2 U	11 U	9.5 U	19 U	NA	15 UJ	12 U	12 U	21 U	22 U	9.5 U	14 U	1,600 J	250 J	220 J	170 J	11 U
Explosives Residues																											
1,3-Dinitrobenzene	6,100	62,000	-	µg/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	630	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U	230 U	250 U	220 U	220 U
General Chemistry																											
Perchlorate	7,820	102,200	-	µg/kg	22 U	22 U	21 U	21 U	22 U	21 U	21 U	21 U	22 U	22 U	24 UJ	22 U	22 U	26 U	24 UJ	94 J	21 UJ	48 J	300 J	1,600	25 U	130	22
Nitrate as N	-	-	-	mg/kg	3.6	2.1	3.4	3.9	1	0.9	1.9	1.3	2	1.8		0.74	0.78	1.5	1.8	52.7	0.67	0.87	0.99	0.52	0.68	0.49	0.78
pH	-	-	-	pH unit	7.43	6.79	6.26	6.91	7.43	7.31	6.88	7.25	7.46	7.78	5.36	8.33	8.39	7.01	8.02	8.03	8.34	6.77	9.92	9.57	9.57	8.83	8.18
Metals																											
Aluminum	76,000	100,000	14,800	mg/kg	5,460	6,820	2,560	4,720	7,150	3,370	3,140	5,070	7,700	5,270	6,750	8,060	5,720	8,520	88,300	***190,000***	5,820	5,510	11,100	3,610	5,400	4,580	19,800
Antimony	31	410	3.06	mg/kg	0.24 UJ	0.78 UJ	0.32 UJ	0.23 UJ	0.28 UJ	3.2 U	0.22 UJ	0.26 UJ	0.55 UJ	0.93 UJ	0.81 UJ	0.41 UJ	0.27 UJ	0.68 UJ	18.8	**103**	0.85 UJ	0.44 UJ	0.27 UJ	0.13 UJ	0.33 UJ	3.4 U	4.2
Arsenic	0.39	1.59	8.86	mg/kg	**0.75**	**0.97**	0.34	**0.52**	**0.74**	0.38	0.33	**0.57**	**0.58**	0.19	0.22 J	**0.61**	0.38	**0.61**	35 U	***12.4***	**0.65**	**0.42**	0.35 UJ	**0.94**	**0.71**	**0.54**	***2.8***
Barium	5,375	66,578	173	mg/kg	45.9	75.5	52.8	30.5	39.1	27.7	29.9	38.2	40.2	23.8	36.9	57.6	115	45.9	245	537	36.2	35.9	170	40.6	43.6	39	804
Beryllium	154	1,941	0.669	mg/kg	0.32	0.25	0.093	0.26	0.3	0.38	0.13	0.19	0.29	0.14	0.2	0.32	0.24	0.29	24 U	0.17	0.33	0.33	0.19	0.24	0.25	0.28	0.23
Cadmium	37	451	2.35	mg/kg	0.77 J	31.7 J	0.23 J	0.18 J	0.096 J	2 J	0.32 J	4 J	0.14	0.07	0.043	0.18	0.47	6.8	**156**	2.7	9.1	0.12	0.33	0.076	0.1	0.038 UJ	1.9
Calcium	-	-	46,000	mg/kg	3,330	3,090	1,540	3,870	3,660	2,850	1,660	2,470	2,970	1,600	2,960	19,800	22,700	3,170	2,930	2,680	3,130	3,400	2,650	1,870	2,580	2,930	5,180
Chromium	211	448	26.9	mg/kg	4	7.3	4.8	2.7	4	1.7	2.2	2.9	4.3	4	9.1	4.8	4.3	4.6	171	18.6	10.5	4.2	3.1	2.9	3.7	3.1	15.7
Cobalt	903	1,921	6.98	mg/kg	1.6	1.7	1	1.1	1.5	0.73	1.1	1.1	1.8	1.5	1.9	1.7	1.5	1.9	59 U	2	1.8	1.9	1.3	1.5	1.5	1.5	1.5
Copper	3,129	40,877	10.5	mg/kg	2.7	11.3	9.6	4.6	21.8	13.3	15.7	20.4	11.3	67.6	4.2	5.7	54.3	375	409	**16,700**	9	7	16.8	2.8	5.3	2.6	818
Iron	23,463	100,000	18,400	mg/kg	3,780	8,890	5,100	2,730	4,190	1,900	2,430	3,100	4,400	19,900	17,200	4,890	3,730	4,940	8,450	6,410	5,330	8,490	3,580	2,880	3,290	3,330	14,000
Lead	150	800	15.1	mg/kg	6.4	44	12.7	29.4	6.5	4	13	42.4	32.8	89.8	27.4	4.7	13	22.8	115	***1,580***	**392**	15.3	18.7	8.1	23.9	4.7	**299**
Magnesium	-	-	8,370	mg/kg	1,680	1,410	630	1,120	1,530	895	762	1,130	1,620	980	1,460	2,050	1,490	1,720	2,000	2,670	1,320	1,390	1,740	1,180	1,350	1,420	1,220
Manganese	1,762	19,458	291	mg/kg	60.4 J	80.6 UJ	62.1	43.8	48.4	28.4 J	49.6 J	35.5 J	79.3	70.4	83.7	75.1	53.7	86.8	123	143	67.4	58.8	70.5	54.6	50.9	57	127
Mercury	23.5	307	0.22	mg/kg	0.031	0.069	1.1	0.031	0.044	0.034	1.5	0.048	0.18	0.054	0.061	0.046	0.065	0.13	0.059	0.1	0.012	0.016	0.88	0.06	0.39	0.062	0.081
Nickel	1,564	20,439	15.3	mg/kg	2	3.3	2	1.2	1.8	0.67	1.6	1.3	1.9	6.1	2.3	5.8	36.2	2.7	112	33	2.2	1.3	1.4	2.4	1.8	1.7	25.3
Potassium	-	-	4,890	mg/kg	450	485	460	416	486	254	525	416	612	518	626	826	730	721	1,300	1,150	655	810	7,940	1,490	1,040	607	742
Selenium	391	5,110	0.32	mg/kg	0.11 UJ	0.33 U	0.31 U	0.32 U	0.33 U	0.32 U	0.31 U	0.32 U	0.32 U	0.34 U	0.36 U	0.33 U	0.33 U	0.39 U	35 U	4.7	0.32 U	0.33 U	0.37 U	0.34 U	0.38 U	0.34 U	0.21
Silver	391	5,110	0.539	mg/kg	0.55 UJ	0.54 U	0.52 UJ	0.54 UJ	0.55 UJ	0.53 UJ	0.52 UJ	0.54 UJ	0.54 U	0.56 U	0.6 U	0.55 U	0.55 U	0.65 U	5.8	1.9	0.53 U	0.54 U	0.61 U	0.56 U	0.64 U	0.56 U	1.1
Sodium	-	-	405	mg/kg	22.9 UJ	147	100 UJ	110 UJ	87.8	52.5	100 UJ	110 UJ	110 U	322	256	16.2 UJ	110 U	130 U	3010	120 U	119 UJ	73.4 UJ	8,760	1,840	973	427	110 U
Thallium	5.16	67	0.42	mg/kg	0.44 U	0.43 U	0.41 U	0.43 U	0.44 U	0.43 U	0.42 U	0.43 U	0.43 U	0.45 U	0.48 U	0.44 U	0.44 U	0.52 U	47 U	**15.2**	0.42 U	0.43 U	0.49 U	0.45 U	0.51 U	0.45 U	0.44 U
Vanadium	78	1,022	71.8	mg/kg	7.5	7.7	3.6	6	9.1	4.7	3.9	6.3	8.2	5.2	6.1	9.8	8	8.7	8.3	11.9	5.7	6.2	4	5.4	6.2	6.8	5.8
Zinc	23,463	100,000	77.9	mg/kg	41.8	328	32.6	69.1	163	211	48.6	548	354	54.5	14	104	354	1530	**29,100**	2,060	23.7	34.7	98.2	12.5	33.7	11.8	1,250
Dioxins																											
1,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6 J	3.2 J	NA	4.15 J	21.1	NA	NA	2.37 J	0.525 U	0.5 U	0.471 J	NA
1,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.4	24	NA	90.5	568	NA	NA	98.3	4.27 UJ	5.37 UJ	3.08 UJ	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.19	2.18 J	NA	5.09	29.1	NA	NA	2.33 J	0.262 U	0.154 UJ	0.169 UJ	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.66	2.61 J	NA	19.9	96.2	NA	NA	14.4 J	0.676 UJ	0.963 UJ	0.604 UJ	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.528 J	0.183 J	NA	0.522 J	2.39 J	NA	NA	0.183 J	0.262 U	0.25 U	0.274 U	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.03 J	0.375 J	NA	1.53 J	9.91	NA	NA	0.481 J	0.262 U	0.25 U	0.274 U	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.434 J	0.269 U	NA	1.01 J	4.87	NA	NA	2.31 J	0.398 U	0.25 U	0.274 U	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.04 J	0.437 J	NA	1.47 J	8.22	NA	NA	0.365 J	0.262 U	0.25 U	0.274 U	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.548 J	0.248 J	NA	1.92 J	9.4	NA	NA	1.63 J	0.32 U	0.152 J	0.274 U	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.481	0.149 J	NA	0.496 J	2.88 J	NA	NA	0.24 J	0.262 U	0.25 U	0.274 U	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.501 J	0.161 J	NA	1.78 J	8.53	NA	NA	1.81 J	0.335 U	0.146 J	0.274 U	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.24 J	0.267 J	NA	0.925 J	7.7	NA	NA	0.261 J	0.262 U	0.25 U	0.274 U	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.449 J	0.269 U	NA	0.904 J	5.69	NA	NA	1.19 J	0.262 U	0.25 U	0.274 U	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.11 J	0.556 J	NA	2.11 J	13.5	NA	NA	0.411 J	0.262 U	0.25 U	0.274 U	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.83 J	0.487 J	NA	1.85 J	13.7	NA	NA	0.462 J	0.262 U	0.25 U	0.274 U	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.04	0.624	NA	1.34	11.5	NA	NA	0.536 J	0.233 U	0.166 J	0.212 J	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.424 U	0.364 U	NA	0.394 J	2.51	NA	NA	0.277 U	0.242 U	0.248 U	0.216 U	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.8	3.45	NA	8.8	47.3	NA	NA	7.21	0.262417 U	0.250248 U	0.267 UJ	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13	8.23	NA	39.9	176	NA	NA	61.5	0.876 UJ	2.53	1.34 UJ	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.6	4.18	NA	16.8	97.5	NA	NA	7.96	0.262417 U	0.250248 U	0.273768 U	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.68	1.34	NA	23.3	102	NA	NA	45.6	0.34807 U	1.19	0.479641 U	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29.2	5.54	NA	21.4	148	NA	NA	4.06	0.262417 U	0.250248 U	0.273768 U	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.18	0.902	NA	10.9	54.4	NA	NA	20.3	0.344291 U	0.148	0.273768 U	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	39	7.58	NA	28.8	249	NA	NA	3.78	0.137087 U	0.166	0.156595 U	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6	0.364097 U	NA	7.25	43.4	NA	NA	11.7	0.242053 U	0.247646 U	0.332902 U	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	-	-	-	-	-	-	-	-	-	-	-	2.69	0.89	-	3.7	***23.65***	-	-	2.53	0.45	0.43	0.44	-

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	LE187 2 feet bgs Trench 48	LE188 3 feet bgs Trench 59	LE189 3 feet bgs Trench 57	LE190 4 feet bgs Trench 52	LE191 6.5 feet bgs Trench 50	LE192 6.5 feet bgs (dup) Trench 50	LE194 3 feet bgs Trench 34N	LE195 6 feet bgs Trench 34E	LE196 8 feet bgs Trench 34S	LE197 8 feet bgs Trench 34W	LE199 4 feet bgs Trench 66	LE200 2.5 feet bgs Trench 63	LE201 2 feet bgs Trench 65	LE202 2 feet bgs (dup) Trench 65
VOCs																		
Acetone	14,126,570	54,321,000	-	µg/kg	120 UJ	150 UJ	130 UJ	150 UJ	110 UJ	99 UJ	97 UJ	110 UJ	92 UJ	87 UJ	160 UJ	98 UJ	95 UJ	95 UJ
Benzene	643	1410	-	µg/kg	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Chloroform	941	2,000	-	µg/kg	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	0.6 U	5.4 U	0.6 U	4.3 U	0.8 J	0.6 J	4.8 U	4.8 U
Ethylbenzene	395,000	395,000	-	µg/kg	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Tetrachloroethene (PCE)	484	1,309	-	µg/kg	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Toluene	520,000	520,000	-	µg/kg	6.1 U	7.6 U	0.7 J	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	1 J	4.9 U	4.8 U	4.8 U
Xylenes, Total	271,000	420,000	-	µg/kg	18 U	23 U	20 U	22 U	16 U	15 U	15 U	16 U	14 U	13 U	25 U	15 U	14 U	14 U
SVOCs																		
2,4-Dinitrotoluene	120,000	12,000,000	-	µg/kg	1,600	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	-	-	-	µg/kg	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate	34,700	123,000	-	µg/kg	73 J	640 UJ	120 J	530 UJ	660 UJ	560 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl Phthalate	-	-	-	µg/kg	41,700	110 J	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	56,000	188,000	-	µg/kg	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodiphenylamine	99,300	352,000	-	µg/kg	5,300	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons																		
Motor Oils	-	-	-	mg/kg	39	18	69	15	9 J	11 J	6 J	10 J	6 J	6 J	35	14	8 J	21
TPH as Diesel Fuel	-	-	-	mg/kg	73	13 U	20	11 U	13 U	11 U	11 U	12 U	11 U	11 U	4 J	11 U	11 U	11 U
TPH as Gasoline	-	-	-	mg/kg	13 U	12 U	10 U	10 U	12 U	12 U	9.3 U	11 U	11 U	9.1 U	10 U	8.9 U	9.1 U	9.5 U
Explosives Residues																		
1,3-Dinitrobenzene	6,100	62,000	-	µg/kg	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
General Chemistry																		
Perchlorate	7,820	102,200	-	µg/kg	27 UJ	26 UJ	22 UJ	21 UJ	26 UJ	22 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate as N	-	-	-	mg/kg	0.66	0.64	2.6	5.5	8.7	6.3								
pH	-	-	-	pH unit	7.15	6.97	7.15	7.88	4.7	4.06	8.88	7.58	8.23	8.45	NA	NA	NA	NA
Metals																		
Aluminum	76,000	100,000	14,800	mg/kg	4310	2,560	4,810	4,960	4,590	3,660	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	31	410	3.06	mg/kg	0.28 UJ	11.1	1	0.26 UJ	0.14 UJ	0.15 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.39	1.59	6.86	mg/kg	0.4 UJ	**1.2**	***0.68***	***0.67***	***0.59***	***0.83***	NA	NA	NA	NA	NA	NA	NA	NA
Barium	5,375	66,578	173	mg/kg	36.7	39.3	60.1	44.8	39.9	29	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	154	1,941	0.669	mg/kg	0.4	0.67	0.48	0.3	0.13 UJ	0.11 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	37	451	2.35	mg/kg	0.26	2.7	16.3	0.14	0.052 UJ	0.092	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	-	-	46,000	mg/kg	14,700	2,140	3,330	3,600	2,390	2,580	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	211	448	26.9	mg/kg	2.5	**4**	6.2	3.4	2.4	2.5	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	903	1,921	6.98	mg/kg	0.93	1	1.5	1.6	0.81	0.79	NA	NA	NA	NA	NA	NA	NA	NA
Copper	3,129	40,877	10.5	mg/kg	55.2	442	30.5	3.7	3	9	NA	NA	NA	NA	NA	NA	NA	NA
Iron	23,463	100,000	18,400	mg/kg	2,620	9,760	8,050	4,010	2,820	2,790	NA	NA	NA	NA	NA	NA	NA	NA
Lead	150	800	15.1	mg/kg	14.6	147	56.1	10.1	8.5	11.1	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	-	-	8,370	mg/kg	1,080	702	1,130	1,330	754	710	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1,762	19,458	291	mg/kg	60	58.1	67	66.6	24.3	27.1	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	23.5	307	0.22	mg/kg	0.026	0.058	0.057	0.02 UJ	0.034	0.021 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1,564	20,439	15.3	mg/kg	1.1	2.7	2.8	2	0.8	0.99	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	-	-	4,890	mg/kg	477	354	423	607	392	455	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	391	5,110	0.32	mg/kg	.041 U	0.38 U	0.33 U	0.32 U	0.4 U	0.34 U	NA	NA	NA	NA	NA	NA	NA	NA
Silver	391	5,110	0.539	mg/kg	0.68 U	0.64 U	0.54 U	0.53 U	0.66 U	0.58 U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	-	-	405	mg/kg	76.7 UJ	130 U	195	27.7 UJ	34.2 UJ	34 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	5.16	67	0.42	mg/kg	0.55 U	0.11 UJ	0.43 U	0.42 U	0.53 U	0.45 U	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	78	1,022	71.8	mg/kg	5.1	3.1	5.2	7.2	5.4	4.8	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	23,463	100,000	77.9	mg/kg	471	1300	200	15.6	12.4	12.4	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins																		
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	-	-	-	ng/kg	45.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	-	-	-	ng/kg	1740	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	-	-	-	ng/kg	8.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	-	-	-	ng/kg	244	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	-	-	-	ng/kg	2.11 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	0.636 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	7.78	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	0.529 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	40.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	-	-	-	ng/kg	0.514 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	-	-	-	ng/kg	26.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	0.231 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	-	-	-	ng/kg	6.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	-	-	-	ng/kg	1.72 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	-	-	-	ng/kg	0.414 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	-	-	-	ng/kg	0.259 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	-	-	-	ng/kg	0.955	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	-	-	-	ng/kg	37.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	-	-	-	ng/kg	448	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	-	-	-	ng/kg	12.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	-	-	-	ng/kg	313	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	-	-	-	ng/kg	4.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	-	-	-	ng/kg	55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	-	-	-	ng/kg	2.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	-	-	-	ng/kg	11.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal	3.9	20	-	ng/kg	**18.1**	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Concentrations in **BOLD** indicate detected values above the EPA Region 9 residential PRGs

Concentrations in ***BOLD ITALICS*** indicate detected values above EPA Region 9 industrial PRGs

'-' = value not available

ug/kg = micrograms per kilogram

bgs = below ground surface

EPA = United States Environmental Protection Agency

J = the level stated is an estimated value

MCAS = Marine Corps Air Station

mg/kg = milligrams per kilogram

N = nitrogen

NA = the sample was not analyzed for the particular analyte

ng/kg = nanograms per kilogram

PCE = tetrachloroethene

pH = negative logarithm of hydrogen ion concentration

PRG = preliminary remediation goal

R = rejected data

SVOCs = semivolatile organic compounds

TPH = total petroleum hydrocarbons

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

VOCs = volatile organic compounds

2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 4-16: Frequency of Detection of the COPCs and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – RI Tier II Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[c]	Detections Above Industrial PRG[c]
Acetone	33	1	3	0	0
Benzene	33	3	9.1	0	0
Chloroform	33	11	33.3	0	0
Ethylbenzene	33	3	9.1	0	0
Tetrachloroethene	33	1	3	0	0
Toluene	33	8	24.2	0	0
Xylenes, Total	33	3	9.1	0	0
2,4-Dintrotoluene	26	4	15.4	0	0
2-Methylnaphthalene	26	3	11.5	-[b]	-[b]
Bis(2-ethylhexyl) Phthalate	26	5	19.2	0	0
Di-n-butyl Phthalate	26	10	38.5	-[b]	-[b]
Naphthalene	26	3	11.5	3	3
n-Nitrosodiphenylamine	26	6	23.1	0	0
TPH as Motor Oils	32	26	81.2	-[b]	-[b]
TPH as Diesel Fuel	32	15	46.9	-[b]	-[b]
TPH as Gasoline	32	3	9.4	-[b]	-[b]
1,3-Dinitrobenzene	26	1	3.8	0	0
Perchlorate	26	6	23.1	0	0
1,3-Dinitrobenzene	26	1	3.8	0	0
Nitrate	26	26	100	-[b]	-[b]

Notes:
[a] Number of samples analyzed for the specified analyte, excluding duplicates if any.
[b] No PRG; therefore, no comparison was made.
[c] Comparison was made to EPA Region 9 PRGs, except for naphthalene for which California Modified PRG was used for comparison purposes since it is significantly more protective than EPA Region 9 PRG
% = percent
COPCs = chemicals of potential concern
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation
TPH = total petroleum hydrocarbons

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Table 4-17: Minimum and Maximum Concentrations of Detected Analytes – RI Tier II Investigation

Analyte	PRG (µg/kg)		Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and Depth of Maximum Concentration
	Residential	Industrial				
VOCs (µg/kg)						
Acetone	14,126,570	54,321,000	8700 J	Trench 34, LE182, 6 feet bgs	8700 J	Trench 34, LE182, 6 feet bgs
Benzene	643	1410	36 J	Trench 34, LE182, 6 feet bgs	610 J	Trench 29A, LE171, 3 feet bgs
Chloroform	941	2,000	0.5 J	Trench 23, LE167, 1.5 feet bgs	0.9 J	Trench 28, LE176, 3 feet bgs; and Trench 33, LE177, 3 feet bgs
Ethylbenzene	395,000	395,000	240 J	Trench 34, LE184 (dup), 10 feet bgs	14000	Trench 34, LE181, 2 feet bgs
Tetrachloroethene	484	1309	2 J	Trench 33, LE177, 3 feet bgs	2 J	Trench 33, LE177, 3 feet bgs
Toluene	520,000	520,000	0.5 J	Trench 23, LE167, 1.5 feet bgs	41000	Trench 34, LE181, 2 feet bgs
Xylenes, Total	271,000	420,000	1500 J	Trench 34, LE184 (dup), 10 feet bgs	98000	Trench 34, LE181, 2 feet bgs
SVOCs (µg/kg)						
2,4-Dintrotoluene	120,000	12,000,000	120 J	Trench 17, LE174, 2 feet bgs	7000	Trench 23, LE167, 1.5 feet bgs
2-Methylnaphthalene	-	-	18000	Trench 34, LE 182, 6 feet bgs	270000	Trench 34, LE 181, 2 feet bgs
Bis(2-ethylhexyl) Phthalate	34,700	123,000	73 J	Trench 48, LE187, 2 feet bgs	420 J	Trench 15, LE162, 1 feet bgs; and Trench 23, LE167, 1.5 feet bgs
Di-n-butyl Phthalate	-	-	69 J	Trench 13, LE166, 1.5 feet bgs	307000	Trench 23, LE167, 1.5 feet bgs
Naphthalene	1,700	4,200	***9900***	Trench 34, LE182, 6 feet bgs	***128000***	Trench 34, LE181, 2 feet bgs
n-nitrosodiphenylamine	99,300	352,000	1300	Trench 174, 2 feet bgs	66700	Trench 23, LE167, 1.5 feet bgs
Hydrocarbons (mg/kg)						
TPH as Motor Oils	-	-	4 J	Trench 13, LE166, 1.5 feet bgs	69	Trench 57, LE 189, 3 feet bgs
TPH as Diesel Fuel	-	-	4 J	Trench 66, LE199, 4 feet bgs	37000	Trench 34, LE181, 2 feet bgs
TPH as Gasoline	-	-	170 J	Trench 34, LE184 (dup), 10 feet bgs	1600 J	Trench 34, LE181, 2 feet bgs
Explosives Residues (µg/kg)						
1,3-Dinitrobenzene	6,100	62,000	630	Trench 29A, LE171, 3 feet bgs	630	Trench 29A, LE171, 3 feet bgs
Perchlorate and Nitrate (mg/kg)						
Perchlorate	7,820	102,200	22	Trench 31, LE185, 8 feet bgs	1600	Trench 34, LE182, 6 feet bgs
Nitrate	-	-	490	Trench 34, LE 184 (dup), 10 feet bgs	52,700	Trench 33, LE 177, 3 feet bgs

Notes:
Concentrations in ***BOLD ITALICS*** indicate values above the California Modified Industrial PRG
- = PRG not available
µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
J = the concentration is an estimated value
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons

VOCs = volatile organic compounds

Table 4-18: Summary of Detected Analytes - RI Tier III-A Investigation

Analyte	PRGs Residential	PRGs Industrial	MCAS El Toro Background (0.95 Quantile)	Units	B-1 5 feet bgs LE207	B-1 10 feet bgs LE208	B-1 15 feet bgs LE209	B-1 15 feet bgs (dup) LE210	B-1 20 feet bgs LE211	B-1 25 feet bgs LE212	B-1 30 feet bgs LE213	B-1 35 feet bgs LE214
VOCs												
Ethylbenzene	395,000	395,000	-	µg/kg	650 J	1,000 J	240 J	330 J	2,600 J	6.6 U	5.5 U	5.1 U
Toluene	520,000	520,000	-	µg/kg	440 J	1100 U	1100 U	1100 U	330 J	6.6 U	5.5 U	5.1 U
Xylenes, Total	271,000	420,000	-	µg/kg	5400	2800 J	830 J	1200 J	17000 J	20 U	16 U	15 U
SVOCs												
2-Methylnaphthalene	-	-	-	µg/kg	55,000	24,000	29,100	30,500	75,000	5,400 U	550 U	32 J
Naphthalene	1,700	4,200	-	µg/kg	***31,700***	***13,000***	***14,000 J***	***15,000 J***	***46,000***	5,400 U	550 U	28 J
Hydrocarbons												
TPH as Diesel Fuel	-	-	-	mg/kg	12,000	8,800	4,300	11,000	19,000	6 J	4 J	5 J
TPH as Gasoline	-	-	-	mg/kg	140 J	530 J	240 J	330 J	710 J	11 U	0.03 J	0.03 J
Explosives Residues												
2,4,6-Trinitrotoluene	16,000	57,000	-	µg/kg	7860	590	220 U	293	395	560	470	327
RDX	4,420	15,670	-	µg/kg	**14,000**	510	220 U	267	394	580	251	210 U
General Chemistry												
Perchlorate	7,820	102,200	-	µg/kg	44 U	22 U	22 U	22 U	23 U	140	430	160
Nitrate as N	-	-	-	mg/kg	0.45 J	0.36 J	0.35 J	0.45 J	0.46 J	2.8	2	0.87
pH	-	-	-	pH unit	9.72	7.55	7.72	7.9	8.44	8.14	7.93	9.16
Metals												
Aluminum	76,000	100,000	14,800	mg/kg	5,030 J	3,960 J	4,590 J	5,030 J	4,490 J	3,300 J	2,180 J	4,230 J
Antimony	31	410	3.06	mg/kg	3.3 U	3.3 U	3.3 U	0.17 UJ	3.5 U	3.3 U	3.3 U	3.2 U
Arsenic	0.39	1.59	6.86	mg/kg	**0.82**	0.62 UJ	**0.78**	0.69 UJ	**1**	0.38 UJ	0.4 UJ	0.51 UJ
Barium	5,375	66,578	173	mg/kg	29.1	28.3	28.2	25.2	37.9	28.8	21.3	29.3
Beryllium	154	1,941	0.669	mg/kg	0.17	0.19	0.17	0.18	0.75	0.24	0.19	0.22
Cadmium	37	451	2.35	mg/kg	0.089	0.048 UJ	0.037 UJ	0.037 UJ	0.034 UJ	0.028 UJ	0.079	0.15
Calcium	-	-	46,000	mg/kg	1,690 J	2,030 J	1,980 J	1,970 J	3,670 J	3,100 J	2,930 J	36,800 J
Chromium	211	448	26.9	mg/kg	3	3	3.3	3.2	2.7	2.2	1.5	2.5
Cobalt	903	1,921	6.98	mg/kg	1.2	1.2	1.5	1.4	1.9	0.58	0.6	1.1
Copper	3,129	40,877	10.5	mg/kg	37.6	1.2	1.1 UJ	1.1 UJ	0.53 UJ	0.38 UJ	0.35 UJ	0.42 UJ
Iron	23,463	100,000	18,400	mg/kg	2,660 J	2,600 J	3,140 J	3,220 J	2,090 J	2,020 J	1,590 J	3,250 J
Lead	150	800	15.1	mg/kg	4.2	1.8	1.6	1.6	1.5	0.83	0.97	1.4
Magnesium	-	-	8,370	mg/kg	1,100	1,070	1,030	1,060	968	842	626	1,180
Manganese	1,762	19,458	291	mg/kg	39	37.2	39.2	39.4	15.8	17.6	17.3	104
Mercury	23.5	307	0.22	mg/kg	0.53	0.062	0.039	0.045	0.084	0.039	0.038	0.043
Nickel	1,564	20,439	15.3	mg/kg	1.3	1.4	1.6	1.6	1.2	0.47	0.43	0.77
Potassium	-	-	4,890	mg/kg	1,440	268	292	309	129	365	374	1,000
Selenium	391	5,110	0.32	mg/kg	0.2 J	0.22 J	0.21 J	0.33 UJ	0.35 UJ	0.33 UJ	0.33 UJ	0.26 J
Sodium	-	-	405	mg/kg	1,810 J	30.9 UJ	37.4 UJ	35.8 UJ	85.8 J	56.1 UJ	33.6 UJ	43.1 UJ
Vanadium	78	1,022	71.8	mg/kg	4.3	5.1	5.9	6	3.9	3.9	3.5	6.5
Zinc	23,463	100,000	77.9	mg/kg	8.9 J	6.6 J	6.4 J	6.4 J	5.6 J	5.2 J	5.7 J	9.8 J

Notes:

Concentrations in **BOLD** indicate detected values above the EPA Region 9 residential PRGs

Concentrations in ***BOLD ITALICS*** indicate detected values above EPA Region 9 industrial PRGs

-' = value not available

ug/kg = micrograms per kilogram

bgs = below ground surface

J = the level stated is an estimated value

EPA = United States Environmental Protection Agency

MCAS = Marine Corps Air Station

mg/kg = milligrams per kilogram

N = nitrogen

pH = negative logarithm of hydrogen ion concentration

PRG = preliminary remediation goal

RDX = cyclotrimethylenetrinitramine

RI = remedial investigation

SVOCs = semivolatile organic compounds

TPH = total petroleum hydrocarbons

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

VOCs = volatile organic compounds

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Table 4-19: Frequency of Detection of the COPCs and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – RI Tier III-A Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[c]	Detections Above Industrial PRG[c]
Ethylbenzene	7	4	57.1	0	0
Toluene	7	2	28.6	0	0
Xylenes, Total	7	4	57.1	0	0
2-Methylnaphthalene	7	5	71.4	0	0
Naphthalene	7	5	71.4	4	4
TPH as Diesel Fuel	7	7	100	-[b]	-[b]
TPH as Gasoline	7	6	85.7	-[b]	-[b]
Perchlorate	7	3	42.9	0	0
2,4,6-Trinitrotoluene	7	7	100	0	0
RDX	7	6	85.7	1	0
Nitrate as N	7	7	100	-[b]	-[b]

Notes:
[a] Number of samples analyzed for the specified analyte, excluding duplicates if any.
[b] No PRG, therefore, no comparison was made.
[c] Comparison was made to EPA Region 9 PRGs, except for naphthalene for which California Modified PRG was used for comparison purposes since it is significantly more protective than EPA Region 9 PRG
% = percent
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RDX = cyclotrimethylenetrinitramine
RI = remedial investigation
TPH = total petroleum hydrocarbons

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Table 4-20: Minimum and Maximum Concentrations of Detected Analytes – RI Tier III-A Investigation

Analyte	PRG (µg/kg)		Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and depth of Maximum Concentration
	Residential	Industrial				
VOCs (µg/kg)						
Ethylbenzene	395,000	395,000	240 J	B-1, LE209, 15 feet bgs	2600 J	B-1, LE211, 20 feet bgs
Toluene	520,000	520,000	330 J	B-1, LE211, 20 feet bgs	440 J	B-1, LE207, 5 feet bgs
Xylenes, Total	271,000	420,000	830 J	B-1, LE209, 15 feet bgs	17000 J	B-1, LE211, 20 feet bgs
SVOCs (µg/kg)						
2-Methylnaphthalene	-	-	32 J	B-1, LE214, 35 feet bgs	75000	B-1, LE211, 20 feet bgs
Naphthalene	1,700	4,200	28 J	B-1, LE214, 35 feet bgs	***46000***	B-1, LE211, 20 feet bgs
Hydrocarbons (mg/kg)						
TPH as Diesel Fuel	-	-	4 J	B-1, LE213, 30 feet bgs	19000	B-1, LE211, 20 feet bgs
TPH as Gasoline	-	-	0.03 J	B-1, LE213, 30 feet bgs; B-1, LE214, 35 feet bgs	710 J	B-1, LE211, 20 feet bgs
Explosives Residues (PRGs and all concentrations in µg/kg)						
2,4,6-Trinitrotoluene	16,000	57,000	293	B-1, LE210, 15 feet bgs (dup)	7,860	B-1, LE207, 5 feet bgs
RDX	4,420	15670	251	B-1, LE213, 30 feet bgs	**14,000**	B-1, LE207, 5 feet bgs
Perchlorate and Nitrate (µg/kg)						
Perchlorate	7,820	102,200	140	B-1, LE212, 25 feet bgs	430	B-1, LE213, 30 feet bgs
Nitrate as N	-	-	350 J	B-1, LE209, 15 feet bgs	2800	B-1, LE212, 25 feet bgs

Notes:
Concentrations in **BOLD** indicate values above the EPA Region 9 or California Modified Residential PRGs.
Concentrations in ***BOLD ITALICS*** indicate values above the EPA Region 9 or California Modified Industrial PRGs.

- = PRG not available
µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
J = the concentration is an estimated value
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RDX = cyclotrimethylenetrinitramine
RI = remedial investigation
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

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4.3.2.2 SEMIVOLATILE ORGANIC COMPOUNDS

Verification of Perchlorate Study

During this Study, eight soil samples and one duplicate were collected from depths of approximately 1.5 feet to 4.5 feet bgs and analyzed for SVOCs (Tables 4-9 and 4-10). The SVOCs detected in the soil samples included diethyl phthalate, di-n-butyl phthalate, and hexachlorobenzene (Tables 4-9 and 4-11). Diethyl phthalate was detected in three samples with concentrations ranging from 72 µg/kg to 250 µg/kg. Di-n-butyl phthalate was detected in two samples with concentrations of 71 µg/kg and 971 µg/kg. Hexachlorobenzene was detected in one sample at a concentration of 220 µg/kg. The location and depth of the only detection of hexachlorobenzene and maximum concentrations of diethyl phthalate and di-n-butyl phthalate were the same (HA09, 4 feet bgs) (Table 4-11). Further investigation in the vicinity of this location was accomplished during the Tier II and Tier III field activities.

None of the SVOCs detected exceeded the EPA Region 9 residential or industrial PRGs (Tables 4-9 and 4-11).

Phase II RI Tier I Soil Sampling

The Phase II RI Tier I investigation involved the collection of 77 soil samples and eight duplicate samples at 1.5 and 5 feet bgs for analysis of SVOCs. The only SVOC detected in this investigation was phenol (Table 4-12). Phenol was detected in 15 samples at concentrations ranging from 83 µg/kg to 1,200 µg/kg (Tables 4-13 and 4-14). None of the detections exceeded the EPA Region 9 residential and industrial PRG for phenol (Table 4-12).

Phase II RI Tier II Soil Sampling

Phase II RI Tier II soil sampling involved the collection of 26 soil samples and three duplicate samples for analysis of SVOCs. These samples were taken from 0.5 feet to 10 feet bgs. The SVOCs detected during this investigation included 2,4-dinitrotoluene, 2-methylnapthalene, BEPH, di-n-butyl phthalate, naphthalene, and n-nitrosodiphenylamine (Table 4-15). 2,4-dinitrotoluene was detected in four samples at concentrations ranging from 120 µg/kg to 7,000 µg/kg (Tables 4-16 and 4-17). 2-Methylnapthalene was detected in three samples at concentrations ranging from 18,000 µg/kg to 270,000 µg/kg (Tables 4-16 and 4-17). Bis (2-ethylhexyl) phthalate was detected in five samples at concentrations ranging from 73 µg/kg to 420 µg/kg (Tables 4-16 and 4-17). Di-n-butyl phthalate was detected in 10 samples, at concentrations ranging from 69 µg/kg to 307,000 µg/kg (Tables 4-16 and 4-17). Naphthalene was detected in three samples at concentrations ranging from 9,900 µg/kg to 128,000 µg/kg, and in one duplicate sample at a concentration of 10,000 µg/kg (Tables 4-16 and 4-17). N-nitrosodiphenylamine was detected in six samples at concentrations ranging from 1,300 µg/kg to 66,700 µg/kg (Tables 4-16 and 4-17). Of all the detected SVOCs, only naphthalene exceeded its EPA Region 9 residential and industrial PRGs in three samples (LE181, LE182, LE183) and one duplicate sample (LE184) (Table 4-15). All these samples were collected from Trench 34 at depths ranging from 2 to 10 feet bgs. Trench 34 was further investigated during the Phase II RI Tier III investigation.

Phase II RI Tier III-A Soil Sampling

Phase II RI Tier III-A soil sampling involved drilling a borehole and collecting eight soil samples (including one duplicate sample) from 5 feet to 35 feet bgs for analysis of SVOCs. 2-Methylnaphthalene and naphthalene were detected in five samples (Tables 4-18 and 4-19). The concentrations at which 2-methylnaphthalene and naphthalene were detected ranged from 32 µg/kg

to 75,000 µg/kg, and 28 µg/kg to 46,000 µg/kg, respectively. The concentrations of 2-methylnaphthalene did not exceed its EPA Region 9 residential or industrial PRGs, while the naphthalene concentrations exceeded its residential and industrial PRGs in four soil samples. The four samples that exceeded the residential and industrial PRGs for naphthalene were collected at depths ranging from 5 to 20 feet bgs. The samples collected at depths greater than 20 feet bgs (25, 30 and 35 feet bgs) did not exceed residential PRGs for naphthalene.

4.3.2.3 PETROLEUM HYDROCARBONS

Verification of Perchlorate Study

Thirty-one soil samples and one duplicate sample were analyzed for petroleum hydrocarbons during the perchlorate verification study. The petroleum hydrocarbons detected were TPH as diesel fuel and TPH as gasoline (Table 4-9). TPH-D was detected in 12 soil samples taken from the surface up to a depth of 4 feet bgs (Tables 4-9 and 4-10). TPH as Gasoline was detected in four samples taken from 1.5 feet to 4 feet bgs (Tables 4-9 and 4-10). The concentration ranges for the detection of TPH as diesel fuel and TPH as gasoline were 1 mg/kg to 27 mg/kg, and 0.1 mg/kg to 0.2 mg/kg, respectively (Table 4-11).

Phase II RI Tier I Soil Sampling and Analysis

Seventy-seven soil samples and eight duplicates were collected for hydrocarbon analyses during the Phase II RI Tier I soil investigation. TPH as motor oils, TPH as diesel fuel, and TPH as gasoline were detected at low concentrations and at relatively low frequencies (Tables 4-12 and 4-13). TPH as gasoline was detected in one sample at the concentration of 0.1 mg/kg (Tables 4-13 and 4-14). TPH as diesel fuel was detected in five samples, at concentrations ranging from 3 to 7 mg/kg (Tables 4-13 and 4-14). TPH as motor oils were detected in 14 samples, with concentrations ranging from 5 mg/kg to 24 mg/kg (Tables 4-13 and 4-14).

The concentration and frequency of detection was higher for heavier hydrocarbons as compared to the lighter ones. This is most likely due to the relatively higher volatility of the lighter hydrocarbons compared to heavier ones.

Phase II RI Tier II Soil Sampling and Analysis

During trenching and potholing, 32 soil samples and four duplicate samples were collected at depths of 0.5-foot to 10 feet bgs for the analysis of hydrocarbons (Table 4-15). TPH as motor oils were most frequently detected, followed by TPH as diesel fuel and TPH as gasoline (Table 4-16). The concentrations of motor oil hydrocarbons, TPH as diesel fuel, and TPH as gasoline ranged from 4 mg/kg to 69 mg/kg, 4 mg/kg to 37,000 mg/kg, and 170 mg/kg to 1,600 mg/kg, respectively (Table 4-17).

Although the frequency of detection of the hydrocarbons increased as the hydrocarbons became heavier, concentrations did not follow this trend. In general, TPH as diesel fuel was detected at the highest concentrations, followed by TPH as gasoline and motor oil hydrocarbons (Table 4-15).

Phase II RI Tier III-A Soil Sampling and Analysis

The Phase II RI Tier III-A soil investigation involved analysis of eight soil samples (including one duplicate) collected from 5 feet to 35 feet bgs for hydrocarbons (Table 4-18). TPH as diesel fuel was detected in all the samples at concentrations ranging from 4 mg/kg to 19,000 mg/kg (Tables 4-19 and 4-20). TPH as gasoline was detected in six samples at concentrations ranging from 0.03 mg/kg to 710 mg/kg (Tables 4-19 and 4-20).

4.3.2.4 EXPLOSIVES RESIDUES

Verification of Perchlorate Study

Explosives residues were not detected in any of the samples above reporting limits during the Perchlorate Verification Study.

Phase II RI Tier I Soil Sampling and Analysis

Explosives residues were not detected in any of the samples above reporting limits during the Phase II RI Tier I soil investigation.

Phase II RI Tier II Soil Sampling and Analysis

The only analyte in the explosives residues group detected during the Phase II RI Tier II soil investigation was 1,3-dinitrobenzene (Table 4-15). Of the 26 samples analyzed, 1,3-dinitrobenzene was detected in one sample at a concentration of 630 µg/kg, which is well below the EPA Region 9 residential and industrial PRGs for this compound (Tables 4-16 and 4-17).

Phase II RI Tier III-A Soil Sampling and Analysis

During the Phase II RI Tier III-A investigation, two explosives residues were detected in the soil samples – 2,4,6-trinitrotoluene and RDX (Table 4-18). 2,4,6-Trinitrotoluene was detected in seven samples, at concentrations ranging from 293 µg/kg to 7,860 µg/kg (Tables 4-19 and 4-20). RDX was detected in six samples, at concentrations ranging from 251 µg/kg to 14,000 µg/kg (Tables 4-19 and 4-20). For 2,4,6-trinitrotoluene, all detections were below EPA Region 9 residential and industrial PRGs. For RDX, all detections were below industrial PRGs. The residential PRG for RDX was exceeded in only one sample (LE207) collected at 5 feet bgs.

4.3.2.5 GENERAL CHEMISTRY

Verification of Perchlorate Study

During the *Verification of Perchlorate Study*, 43 soil samples were collected (including one duplicate) for perchlorate analysis (Table 4-9). Eleven of these samples were collected from depths ranging from 5 feet to 35 feet bgs, during the installation of monitoring wells. The remaining 32 soil samples were collected from the surface to the depth of 4.5 feet bgs. Of the 43 samples analyzed, only four samples showed detectable concentrations of perchlorate (Tables 4-9 and 4-10). The depth of the detections ranged from zero (surface soil samples) to 4 feet bgs, and the concentrations ranged from 29 µg/kg to 320 µg/kg (Tables 4-9 and 4-11). The maximum concentration (320 µg/kg) of perchlorate was detected in the surface soil sample taken from a location SS02 (Table 4-11). Perchlorate was not detected above the reporting limit (21 µg/kg to 25 µg/kg) in any of the 11 samples taken from 5 feet to 35 feet bgs, during the installation of the monitoring wells.

All detected perchlorate concentrations were below the EPA Region 9 residential and industrial PRGs.

Eight soil samples (and one duplicate sample) were collected for the analysis of nitrate during the Perchlorate Verification Study (Table 4-9). Of these eight samples, six showed detectable concentrations of nitrate (Tables 4-9 and 4-10). The maximum and minimum detected concentrations for nitrate were 246 µg/kg and 2,700 µg/kg, respectively (Table 4-11).

The pH of soil samples collected during this Study ranged from 5.89 to 8.97 (Table 4-9).

Phase II RI Tier I Soil Sampling and Analysis

The Phase II RI Tier I soil investigation involved the collection of 77 soil samples and eight duplicates for perchlorate analysis at depths of 1.5 feet and 5 feet bgs (Table 4-12). Perchlorate was detected in four soil samples at concentrations ranging from 33 µg/kg to 910 µg/kg (Tables 4-12, 4-13, and 4-14). None of the detections exceeded the EPA Region 9 residential or industrial PRG for perchlorate.

Nitrate analysis was performed on 77 soil samples, all of which showed detectable nitrate concentrations (Tables 4-12 and 4-13). The minimum and maximum detected concentrations for nitrate were 320 µg/kg and 10,900 µg/kg, respectively (Table 4-14).

The pH of the soil samples collected during Phase II RI Tier I sampling ranged from 5.01 to 9.64 (Table 4-12).

Phase II RI Tier II Soil Sampling and Analysis

During the Phase II RI Tier II soil sampling, 26 samples and three duplicate samples were collected from depths ranging from 0.5-foot to 10 feet bgs for analysis of perchlorate (Table 4-15). Five samples showed detectable perchlorate concentrations, with minimum and maximum concentrations of 22 µg/kg and 1,600 µg/kg, respectively (Tables 4-16 and 4-17). None of the detections exceeded the EPA Region 9 residential or industrial PRG for perchlorate (Table 4-15).

All 26 samples analyzed for nitrate had detected concentrations ranging from 490 µg/kg to 52,700 µg/kg (Tables 4-16 and 4-17).

The pH of the soil samples collected during Phase II RI Tier II sampling ranged from 4.06 to 9.92 (Table 4-15).

Phase II RI Tier III-A Soil Sampling and Analysis

The Phase II RI Tier III-A soil investigation involved the collection of seven soil samples and one duplicate at depths ranging from 5 feet to 35 feet bgs and analysis for perchlorate, nitrate, and pH. Perchlorate was detected in three samples, at concentrations ranging from 140 µg/kg to 430 µg/kg (Tables 4-18, 4-19, and 4-20). None of the concentrations exceeded EPA Region 9 residential and industrial PRGs for perchlorate. Perchlorate was not detected above the reporting limit up to a depth of 20 feet bgs. However, it was detected in all samples collected at depths greater than 20 feet bgs (Table 4-18 and Figure 4-2). The concentration profiles of perchlorate with depth show an increase in concentration from 25 feet to 30 feet bgs followed by a decrease from 30 feet to 35 feet bgs. Nitrate was detected in all the samples, with concentrations ranging from 350 to 2,800 µg/kg (Tables 4-18, 4-19, and 4-20). The pH of soil samples collected during Phase II RI Tier III-A sampling ranged from 7.55 to 9.72 (Table 4-18).

4.3.2.6 METALS

Verification of Perchlorate Study

Eight soil samples and one duplicate collected from 1.5 feet to 4.5 feet bgs were analyzed for metals during the Perchlorate Verification Study (Table 4-9). Table 4-21 provides the frequency of detection of metals. Concentrations of most metals were less than background values, except for cadmium, copper, lead, mercury, nickel, selenium, and zinc (Tables 4-9 and 4-22). None of the metals exceeded their EPA Region 9 residential or industrial PRGs except arsenic. Arsenic exceeded its residential PRG in six soil samples. However, none of these six samples had arsenic concentration

greater than its established background concentration of 6.86 mg/kg (Table 4-9). Table 4-22 presents the minimum and maximum concentration of all detected metals.

Phase II RI Tier I Sampling and Analysis

Seventy-seven soil samples and eight duplicates collected from 1.5 feet and 5 feet bgs were analyzed for metals during the Phase II RI Tier I soil investigation (Table 4-12). Table 4-23 provides the frequency of detection of metals. Concentrations of most of the metals were less than background values, except for beryllium, cadmium, calcium, manganese, mercury, nickel, and selenium (Tables 4-12 and 4-23). None of the metals exceeded their EPA Region 9 residential or industrial PRGs except arsenic. Arsenic exceeded its residential PRG in 47 soil samples and industrial PRG in seven samples. However, none of the concentrations exceeding residential or industrial PRGs exceeded the background arsenic concentration for Former MCAS El Toro. Table 4-24 presents the minimum and maximum concentration of all the detected metals. It can be observed that most of the maximum concentrations of the metals were restricted to the location DP52, at 5 feet bgs.

Phase II RI Tier II Sampling and Analysis

Twenty six soil samples and three duplicates collected from 0.5-foot to 10 feet bgs were analyzed for metals during the Phase II RI Tier II soil investigation (Table 4-15). Table 4-25 provides the frequency of detection of metals and Table 4-26 presents the range of detected concentrations for all the metals. Metals that exceeded background levels include aluminum, antimony, arsenic, barium, beryllium, cadmium, copper, iron, lead, mercury, nickel, potassium, selenium, silver, sodium, thallium, and zinc. EPA Region 9 residential and/or industrial PRGs were exceeded for aluminum, antimony, arsenic, cadmium, copper, lead, thallium, and zinc. Aluminum, cadmium, copper, thallium, and zinc each exceeded their residential PRG in only one soil sample. Lead exceeded its residential PRG in three soil samples and its industrial PRG in one soil sample. Arsenic exceeded its residential PRG in 18 soil samples and its industrial PRG in two samples. However, Former MCAS El Toro background concentration for arsenic was exceeded in only one soil sample.

Table 4-26 presents the minimum and maximum concentration of metals detected during Phase II RI Tier II sampling. It can be observed that the maximum concentrations of few metals exceed the EPA Region 9 residential and/or industrial PRGs. The majority of the minimum concentrations are restricted to the location in Trench 27, at 1-foot bgs, and the majority of the maximum concentrations are restricted to the location in Trench 33, at 3 feet bgs.

Phase II RI Tier III-A Sampling and Analysis

Seven soil samples and one duplicate were collected for metals analysis during Phase II RI Tier III-A soil sampling and analysis (Table 4-18). The samples were collected from depths ranging from 5 feet to 35 feet bgs. Table 4-27 provides the frequency of detection of metals. Concentrations of most of the metals were less than the background values, except for beryllium, copper, mercury, and sodium (Tables 4-18 and 4-27). None of the metals exceeded their EPA Region 9 residential or industrial PRGs except arsenic. Arsenic exceeded its residential PRG in three samples. However, none of these three samples had arsenic concentration greater than its established background of 6.86 mg/kg (Table 4-18). Table 4-28 presents the minimum and maximum concentration of all detected metals.

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Table 4-21: Frequency of Detection of the Metals and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – Perchlorate Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections above Residential PRG[b]	Detections Above Industrial PRG[b]	Detections Above Background
Metals						
Aluminum	9	9	100	0	0	0
Antimony	9	1	11.1	0	0	0
Arsenic	9	7	77.8	7	0	0
Barium	9	9	100	0	0	0
Beryllium	9	9	100	0	0	0
Cadmium	9	5	55.5	0	0	2
Calcium	9	9	100	-[c]	-[c]	0
Chromium	9	9	100	0	0	0
Cobalt	9	9	100	0	0	0
Copper	9	8	88.9	0	0	4
Iron	9	9	100	0	0	0
Lead	9	9	100	0	0	3
Magnesium	9	9	100	-[c]	-[c]	0
Manganese	9	9	100	0	0	0
Mercury	9	6	66.7	0	0	4
Nickel	9	9	100	0	0	1
Potassium	9	9	100	-[c]	-[c]	0
Selenium	9	4	44.4	0	0	3
Sodium	9	3	33.3	-[c]	-[c]	0
Vanadium	9	9	100	0	0	0
Zinc	9	9	100	0	0	4

Notes:
[a] Number of samples analyzed for the specified analytes including duplicates if any.
[b] Comparison was made to EPA Region 9 PRGs. For arsenic, detection limits for some samples exceeded its residential and/or industrial PRG. These samples were not counted.
[c] No PRG; therefore, no comparison was made.
% = percent
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal

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Table 4-22: Minimum and Maximum Concentrations of Detected Metals – Perchlorate Investigation

Analyte	PRG (mg/kg)		MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration (mg/kg)	Location and Depth of Minimum Concentration	Maximum Concentration (mg/kg)	Location and Depth of Maximum Concentration
	Residential	Industrial					
Aluminum	76,000	100,000	14,800	3580	HA01, 4 feet bgs	7290	HA08, 3.5 feet bgs
Antimony	31	410	3.06	1.2	HA09, 4 feet bgs	1.2	HA09, 4 feet bgs
Arsenic	0.39	1.6	6.86	0.7	HA09, 1.5 feet bgs	**1.1**	HA04, 3.5 feet bgs
Barium	5,375	66,578	173	30.1	HA01, 4 feet bgs; and HA06, 4.5 feet bgs	54.1	HA09, 1.5 feet bgs
Beryllium	154	1,941	0.669	0.16	HA09, 1.5 feet bgs	0.36	HA01, 4 feet bgs
Cadmium	37	451	2.35	0.26	HA07, 1.5 feet bgs	5.2	HA04, 3.5 feet bgs
Calcium	-	-	46,000	2090	HA01, 1.5 feet bgs	12800	HA06, 4.5 feet bgs
Chromium	211	448	26.9	1.8	HA01, 4 feet bgs	5.2	HA09, 4 feet bgs
Cobalt	903	1,921	6.98	0.67	HA01, 4 feet bgs	1.5	HA04, 3.5 feet bgs
Copper	3,129	40,877	10.5	1.9	HA08, 3.5 feet bgs	234	HA09, 4 feet bgs
Iron	23,463	100,000	18,400	2190	HA01, 4 feet bgs	4730	HA06, 4.5 feet bgs
Lead	150	800	15.1	0.68	HA01, 4 feet bgs	133	HA09, 1.5 feet bgs (dup)
Magnesium	-	-	8,370	993	HA09, 1.5 feet bgs (dup)	1350	HA08, 3.5 feet bgs
Manganese	1,762	19,458	291	25.6	HA01, 4 feet bgs	84	HA04, 3.5 feet bgs
Mercury	23.5	307	0.22	0.074 J	HA04, 3.5 feet bgs	10.6	HA09, 1.5 feet bgs (dup)
Nickel	1,564	20,439	15.3	0.84	HA01, 4 feet bgs	96	HA04, 3.5 feet bgs
Potassium	-	-	4,890	430	HA01, 4 feet bgs	769	HA04, 3.5 feet bgs
Selenium	391	5,110	0.32	1.4	HA07, 1.5 feet bgs	1.8	HA06, 4.5 feet bgs
Sodium	-	-	405	66.5	HA09, 1.5 feet bgs (dup)	149	HA09, 4 feet bgs
Vanadium	78	1,022	71.8	4.1	HA01, 4 feet bgs	6.7	HA04, 3.5 feet bgs
Zinc	23,463	100,000	77.9	5.7	HA01, 4 feet bgs	772	HA04, 3.5 feet bgs

Notes:
Concentrations in **BOLD** indicate values above the EPA Region 9 Residential PRGs.
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
J = the concentration is an estimated value
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal

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Table 4-23: Frequency of Detection of the Metals and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – Phase II RI Tier I Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[b]	Detections Above Industrial PRG[b]	Detections Above Background
Metals						
Aluminum	85	85	100	0	0	0
Arsenic	85	67	78.8	47	7	0
Barium	85	85	100	0	0	0
Beryllium	85	81	95.3	0	0	1
Cadmium	85	24	28.2	0	0	1
Calcium	85	85	100	-[c]	-[c]	1
Chromium	85	85	100	0	0	0
Cobalt	85	85	100	0	0	0
Copper	85	70	82.3	0	0	1
Iron	85	85	100	0	0	0
Lead	85	85	100	0	0	0
Magnesium	85	85	100	-[c]	-[c]	0
Manganese	85	85	100	0	0	1
Mercury	85	61	71.7	0	0	1
Nickel	85	82	96.5	0	0	1
Potassium	85	85	100	-[c]	-[c]	0
Selenium	85	3	3.5	0	0	2
Sodium	85	37	43.5	-[c]	-[c]	0
Thallium	85	1	1.2	0	0	0
Vanadium	85	85	100	0	0	0
Zinc	85	85	100	0	0	0

Notes:
[a] Number of samples analyzed for the specified analytes including duplicates if any.
[b] Comparison was made to EPA Region 9 PRGs. For arsenic, detection limits for some samples exceeded its residential and/or industrial PRG. These samples were not counted.
[c] No PRG; therefore, no comparison was made
% = percent
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation

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Table 4-24: Minimum and Maximum Concentrations of Detected Metals – Phase II RI Tier I Investigation

Analyte	PRG (mg/kg)		MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration (mg/kg)	Location and Depth of Minimum Concentration	Maximum Concentration (mg/kg)	Location and Depth of Maximum Concentration
	Residential	Industrial					
Aluminum	76,000	100,000	14,800	904	DP55, 5 feet bgs	12800	DP34, 1.5 feet bgs
Arsenic	0.39	1.6	6.86	0.15	DP55, 5 feet bgs	***4.6***	DP56, 5 feet bgs
Barium	5,375	66,578	173	21.2	DP34, 5 feet bgs	129	DP23, 5 feet bgs
Beryllium	154	1,941	0.669	0.047	DP55, 1.5 feet bgs	0.99 J	DP28, 1.5 feet bgs
Cadmium	37	451	2.35	0.0073 J	DP24, 1.5 feet bgs	2.4	DP52, 5 feet bgs
Calcium	-	-	46,000	677	DP55, 5 feet bgs	71000	DP37, 5 feet bgs
Chromium	211	448	26.9	0.77	DP55, 5 feet bgs	16.2	DP52, 5 feet bgs
Cobalt	903	1,921	6.98	0.23	DP55, 5 feet bgs	4.7	DP52, 5 feet bgs
Copper	3,129	40,877	10.5	0.34	DP20, 5 feet bgs (dup)	11.8	DP39, 1.5 feet bgs
Iron	23,463	100,000	18,400	697	DP55, 5 feet bgs	13500	DP52, 5 feet bgs
Lead	150	800	15.1	0.28	DP55, 5 feet bgs	15.1 J	DP39, 1.5 feet bgs
Magnesium	-	-	8,370	239 J	DP55, 5 feet bgs	6230 J	DP52, 5 feet bgs
Manganese	1,762	19,458	291	12.9	DP27, 5 feet bgs (dup)	711	DP26, 5 feet bgs
Mercury	23.5	307	0.22	0.0062 J	DP34, 5 feet bgs; and DP46, 1.5 feet bgs	1.5	DP39, 5 feet bgs
Nickel	1,564	20,439	15.3	0.4	DP22, 5 feet bgs	17.3	DP52, 5 feet bgs
Potassium	-	-	4,890	111 J	DP32, 5 feet bgs	2830 J	DP23, 5 feet bgs
Selenium	391	5,110	0.32	0.16	DP29, 1.5 feet bgs	0.7	DP52, 5 feet bgs
Sodium	-	-	405	6.6 J	DP20, 5 feet bgs; and DP35, 5 feet bgs	357	DP50, 3.5 feet bgs
Thallium	5.16	67	0.42	0.1	DP47, 5 feet bgs	0.1	DP47, 5 feet bgs
Vanadium	78	1,022	71.8	1.8	DP55, 5 feet bgs	38.9	DP52, 5 feet bgs
Zinc	23,463	100,000	77.9	1.9 J	DP55, 5 feet bgs	39.5	DP52, 5 feet bgs

Notes:
Concentrations in ***BOLD ITALICS*** indicate values above the EPA Region 9 Industrial PRGs.
- = PRG not available
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
J = the concentration shown is an estimated value
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation

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Table 4-25: Frequency of Detection of the Metals and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – Phase II RI Tier II Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[b]	Detections Above Industrial PRG[b]	Detections Above Background
Metals						
Aluminum	26	26	100	1	1	1
Antimony	26	5	19	1	0	4
Arsenic	26	23	89	18	2	1
Barium	26	26	100	0	0	3
Beryllium	26	24	92	0	0	1
Cadmium	26	26	100	1	0	8
Calcium	26	26	100	0	0	0
Chromium	26	26	100	0	0	0
Cobalt	26	25	96	0	0	0
Copper	26	26	100	1	0	16
Iron	26	26	100	0	0	1
Lead	26	26	100	3	1	16
Magnesium	26	26	100	-[c]	-[c]	0
Manganese	26	25	96	0	0	0
Mercury	26	25	96	0	0	4
Nickel	26	26	100	0	0	4
Potassium	26	26	100	-[c]	-[c]	1
Selenium	26	2	8	0	0	1
Silver	26	3	12	0	0	3
Sodium	26	10	39	-[c]	-[c]	4
Thallium	26	1	4	1	0	1
Vanadium	26	26	100	0	0	0
Zinc	26	26	100	1	0	14

Notes:
PRG = preliminary remediation goal
[a] Number of samples analyzed for the specified analytes, excluding duplicates if any.
[b] Comparison was made to EPA Region 9 PRGs. For arsenic, detection limits for some samples exceeded its residential and/or industrial PRG. These samples were not counted.
[c] No PRG; therefore, no comparison was made
% = percent
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation

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Table 4-26: Minimum and Maximum Concentrations of Detected Metals – Phase II RI Tier II Investigation

Analyte	PRG (mg/kg)		MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration (mg/kg)	Location and depth of Minimum Concentration	Maximum Concentration (mg/kg)	Location and Depth of Maximum Concentration
	Residential	Industrial					
Aluminum	76,000	100,000	14,800	2560	Trench 6, LE161, 2 feet bgs; Trench 59, LE188, 3 feet bgs	**190000**	Trench 33, LE177, 3 feet bgs
Antimony	31	410	3.06	1	Trench 57, LE189, 3 feet bgs	**103**	Trench 33, LE177, 3 feet bgs
Arsenic	0.39	1.6	6.86	0.19	Trench 29A, LE170, 5 feet bgs	***12.4***	Trench 33, LE177, 3 feet bgs
Barium	5,375	66,578	173	23.8	Trench 29A, LE170, 5 feet bgs	804	Trench 31, LE185, 8 feet bgs
Beryllium	154	1,941	0.669	0.093	Trench 6, LE161, 2 feet bgs	0.67	Trench 59, LE188, 3 feet bgs
Cadmium	37	451	2.35	0.043	Trench 29A, LE171, 3 feet bgs	**156**	Trench 23, LE176, 3 feet bgs
Calcium	-	-	46,000	1540	Trench 6, LE161, 2 feet bgs	22700	Trench 5, LE173, 0.5 feet bgs (dup)
Chromium	211	448	26.9	1.7	Trench 27, LE165, 1 feet bgs	171	Trench 23, LE176, 2 feet bgs
Cobalt	903	1,921	6.98	0.73	Trench 27, LE165, 1 feet bgs	2	Trench 33, LE177, 3 feet bgs
Copper	3,129	40,877	10.5	2.6	Trench 34, LE184, 10 feet bgs (dup)	**16700**	Trench 33, LE177, 3 feet bgs
Iron	23,463	100,000	18,400	1900	Trench 27, LE165, 1 feet bgs	19900	Trench 29A, LE170, 5 feet bgs
Lead	150	800	15.1	4	Trench 27, LE165, 1 feet bgs	***1580***	Trench 33, LE177, 3 feet bgs
Magnesium	-	-	8,370	630	Trench 6, LE161, 2 feet bgs	2670	Trench 33, LE177, 3 feet bgs
Manganese	1,762	19,458	291	24.3	Trench 50, LE191, 6.5 feet bgs	143	Trench 33, LE177, 3 feet bgs
Mercury	23.5	307	0.22	0.012	Trench 32, LE178, 5 feet bgs	1.5	Trench 13, LE166, 1.5 feet bgs
Nickel	1,564	20,439	15.3	0.67	Trench 27, LE165, 1 feet bgs	112	Trench 23, LE176, 3 feet bgs
Potassium	-	-	4,890	254	Trench 27, LE165, 1 feet bgs	7940	Trench 34, LE181, 2 feet bgs
Selenium	391	5,110	0.32	0.21	Trench 31, LE185, 8 feet bgs	4.7	Trench 33, LE177, 3 feet bgs
Silver	391	5,110	0.539	1.1	Trench 31, LE185, 8 feet bgs	5.8	Trench 23, LE176, 3 feet bgs
Sodium	-	-	405	52.5	Trench 27, LE165, 1 feet bgs	8760	Trench 34, LE181, 2 feet bgs
Thallium	5.16	67	0.42	**15.2**	Trench 33, LE177, 3 feet bgs	**15.2**	Trench 33, LE177, 3 feet bgs
Vanadium	78	1,022	71.8	3.1	Trench 59, LE188, 3 feet bgs	11.9	Trench 33, LE177, 3 feet bgs
Zinc	23,463	100,000	77.9	11.8	Trench 34, LE184, 10 feet bgs (dup)	**29100**	Trench 23, LE176, 3 feet bgs

Notes:
Concentrations in **BOLD** indicate values above the EPA Region 9 Residential PRGs
Concentrations in ***BOLD ITALICS*** indicate values above the EPA Region 9 Industrial PRGs
- = PRG not available
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation

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Table 4-27: Frequency of Detection of the Detected Analytes and Comparison with EPA Region 9 Residential and Industrial PRGs – Phase II RI Tier III-A Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[b]	Detections Above Industrial PRG[b]	Detections Above Background Concentration
Metals						
Aluminum	7	7	100	0	0	0
Arsenic	7	3	43	3	0	0
Barium	7	7	100	0	0	0
Beryllium	7	7	100	0	0	1
Cadmium	7	3	43	0	0	0
Calcium	7	7	100	-[c]	-[c]	0
Chromium	7	7	100	0	0	0
Cobalt	7	7	100	0	0	0
Copper	7	2	29	0	0	1
Iron	7	7	100	0	0	0
Lead	7	7	100	0	0	0
Magnesium	7	7	100	-[c]	-[c]	0
Manganese	7	7	100	0	0	0
Mercury	7	7	100	0	0	1
Nickel	7	7	100	0	0	0
Potassium	7	7	100	0	0	0
Selenium	7	4	57	0	0	0
Sodium	7	2	29	-[c]	-[c]	1
Vanadium	7	7	100	0	0	0
Zinc	7	7	100	0	0	0

Notes:
[a] Number of samples analyzed for the specified analytes, excluding duplicates (if any).
[b] Comparison was made to EPA Region 9 PRGs. For arsenic, detection limits for some samples exceeded its residential and/or industrial PRG. These samples were not counted.
[c] No PRG; therefore, no comparison was made.
% = percent
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation

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Table 4-28: Minimum and Maximum Concentrations of Detected Metals – Phase II RI Tier III-A Investigation

Analyte	PRG (mg/kg)		MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration (mg/kg)	Location and depth of Minimum	Maximum Concentration (mg/kg)	Location and depth of Maximum
	Residential	Industrial					
Aluminum	76,000	100,000	14,800	2180 J	B-1, LE213, 30 feet bgs	5030 J	B-1, LE 207, 5 feet bgs; B-1, LE210, 15 feet bgs (dup)
Arsenic	0.39	1.6	6.86	**0.78**	B-1, LE209, 15 feet bgs	**1**	B-1, LE211, 20 feet bgs
Barium	5,375	66,578	173	21.3	B-1, LE213, 30 feet bgs	37.9	B-1, LE211, 20 feet bgs
Beryllium	154	1,941	0.669	0.17	B-1, LE207, 5 feet bgs; B-1, LE209, 15 feet bgs	0.75	B-1, LE211, 20 feet bgs
Cadmium	37	451	2.35	0.079	B-1, LE213, 30 feet bgs	0.15	B-1, LE214, 35 feet bgs
Calcium	-	-	46,000	1690 J	B-1, LE207, 5 feet bgs	36800 J	B-1, LE214, 35 feet bgs
Chromium	211	448	26.9	1.5	B-1, LE213, 30 feet bgs	3.3	B-1, LE209, 15 feet bgs
Cobalt	903	1,921	6.98	0.58	B-1, LE212, 25 feet bgs	1.9	B-1, LE211, 20 feet bgs
Copper	3,129	40,877	10.5	1.2	B-1, LE208, 10 feet bgs	37.6	B-1, LE207, 5 feet bgs
Iron	23,463	100,000	18,400	1590 J	B-1, LE213, 30 feet bgs	3250 J	B-1, LE214, 35 feet bgs
Lead	150	800	15.1	0.83	B-1, LE212, 25 feet bgs	4.2	B-1, LE207, 5 feet bgs
Magnesium	-	-	8,370	626	B-1, LE213, 30 feet bgs	1180	B-1, LE214, 35 feet bgs
Manganese	1,762	19,458	291	15.8	B-1, LE211, 20 feet bgs	104	B-1, LE214, 35 feet bgs
Mercury	23.5	307	0.22	0.038	B-1, LE213, 30 feet bgs	0.53	B-1, LE207, 5 feet bgs
Nickel	1,564	20,439	15.3	0.43	B-1, LE213, 30 feet bgs	1.6	B-1, LE209, 15 feet bgs; B-1, LE210, 15 feet bgs (dup)
Potassium	-	-	4,890	129	B-1, LE211, 20 feet bgs	1440	B-1, LE207, 5 feet bgs
Selenium	391	5,110	0.32	0.2 J	B-1, LE207, 5 feet bgs	0.26 J	B-1, LE214, 35 feet bgs
Sodium	-	-	405	85.8	B-1, LE211, 20 feet bgs	1810 J	B-1, LE207, 5 feet bgs
Vanadium	78	1,022	71.8	3.5	B-1, LE213, 30 feet bgs	6.5	B-1, LE214, 35 feet bgs
Zinc	23,463	100,000	77.9	5.2 J	B-1, LE212, 25 feet bgs	9.8 J	B-1, LE214, 35 feet bgs

Notes:
Concentrations in **BOLD** indicate values above the EPA Region 9 Residential PRGs.
- = PRG not available
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
J = the concentration shown is an estimated value
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation

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4.3.2.7 DIOXINS/FURANS

Verification of Perchlorate Study

Three soil samples (LD-110, LD-129, and LD-141) and one duplicate sample (LD130) were submitted for dioxin and furan analysis during the Perchlorate Verification Study (Table 4-9). The WHO TEFs were used to calculate the 2,3,7,8- TCDD TEQ for each sample (WHO 1997). The 2,3,7,8-TCDD TEQ concentrations were below the EPA Region 9 residential PRGs for all the samples (Table 4-9).

Phase II RI Tier II Sampling and Analysis

Seven soil samples (LE172, LE176, LE177, LE181, LE182, LE183, and LE 187) and two duplicate samples (LE173 and LE184) were submitted for dioxin and furan analysis during Phase II RI Tier II investigations (Table 4-15). The WHO TEFs were used to calculate the 2,3,7,8-TCDD TEQ for each sample (WHO 1997). The 2,3,7,8-TCDD TEQ concentration for one sample (LE177) taken from Trench 33 at 3 feet bgs exceeded the EPA Region 9 residential and industrial PRGs (Table 4-15). The 2,3,7,8-TCDD TEQ concentration for Sample LE 187, collected from Trench 48 at 2 feet bgs, exceeded the residential PRG (Table 4-15). The 2,3,7,8-TEQ concentrations for all the remaining samples were well below residential and industrial PRGs (Table 4-15).

4.3.2.8 RADIOLOGICAL CONTAMINATION

A HRA and radiological surveys were performed at IRP Site 1 to assess radiological contamination. The methodologies and procedures for these studies are presented in Section 1.4.3.4; this section briefly summarizes the findings of these surveys.

The HRA concluded that EOD Training Range (IRP Site 1) was not authorized to receive nuclear or radioactive ordnance, and there are no confirmed reports or evidence of radioactive materials being present at the site. However, based on the concerns regarding unsubstantiated comments that radioactive waste may have been disposed at IRP Site 1, the EOD Training Range should be further investigated.

As IRP Site 1 was one of the sites indicated in the HRA as being potentially radiologically impacted, radiological surveys and soil sampling were performed at the site (Weston 2006). The Station naturally-occurring background Ra-226 concentration was established to be 1.05 pCi/g and was used to compare the naturally-occurring background radiation levels and residual radioactivity in potentially impacted areas.

At IRP Site 1, out of a total of 710,015 scan survey readings collected, 3,313 data points were observed to exceed the approximate scan survey DCGL for the shielded 3-inch by 3-inch detector or the unshielded 2-inch by 2-inch detector.

The Ra-226 concentrations in 26 soil samples collected from the areas with elevated scan readings ranged from nondetect (less than 0.4 pCi/g) to 10.10 pCi/g. The average concentration of Ra-226 was estimated to be 1.12 pCi/g. During soil sampling at IRP Site 1, 16 radiological anomalies were collected and sent to the laboratory for analysis. Items within the anomalies comprised broken ceramic pieces, a metallic wire, a metallic piece, and small screws. As a result of the sampling process, the items were removed from the site.

The risk due to incremental concentration of Ra-226 above background of 0.07 pCi/g (1.12 pCi/g minus 1.05 pCi/g), using EPA's PRG Calculator was estimated to be 5.65×10^{-6}, which is within the NCP risk management range of 10^{-4} to 10^{-6}. For an incremental soil concentration of 0.07 pCi/g

above background, the RESRAD software yielded a maximum dose of 1.06 mrem/year at 50.1 years for a residential farmer scenario, which is less than the regulatory threshold of 25 mrem/year.

The results of the radiological scan surveys and soil sampling indicated that occurrence and distribution of Ra-226 at IRP Site 1 is consistent with the naturally-occurring background. Therefore, site evaluation accomplished (SEA) recommendation was made for IRP Site 1. This recommendation removes radionuclides from the list of COPCs at IRP Site 1 and further consideration under CERCLA.

4.3.2.9 SUMMARY OF THE NATURE AND EXTENT OF SOIL CONTAMINATION AT THE NORTHERN AND SOUTHERN EOD TRAINING RANGES

This section presents the summary of the nature and extent of soil contamination at the Northern and Southern EOD Training Ranges based on the previous studies, and the soil investigations conducted during the Phase II RI. Table 4-29 presents all VOCs, SVOCs, explosives residues, hydrocarbons, and metals detected at the Northern and Southern EOD Training Ranges, along with their maximum concentrations. Figure 4-2 presents COPCs exceeding EPA Region 9 PRGs (excluding metals). Figures 4-3 through 4-6 present metals exceeding background and PRG concentrations.

VOCs detected at the Northern and Southern EOD Training Ranges include acetone, benzene, 2-butanone, carbon tetrachloride, chloroform, ethylbenzene, 2-hexanone, 4-methyl-2-pentanone, PCE, toluene, and xylenes. Concentrations of all detected VOCs were below the EPA Region 9 residential and industrial PRGs.

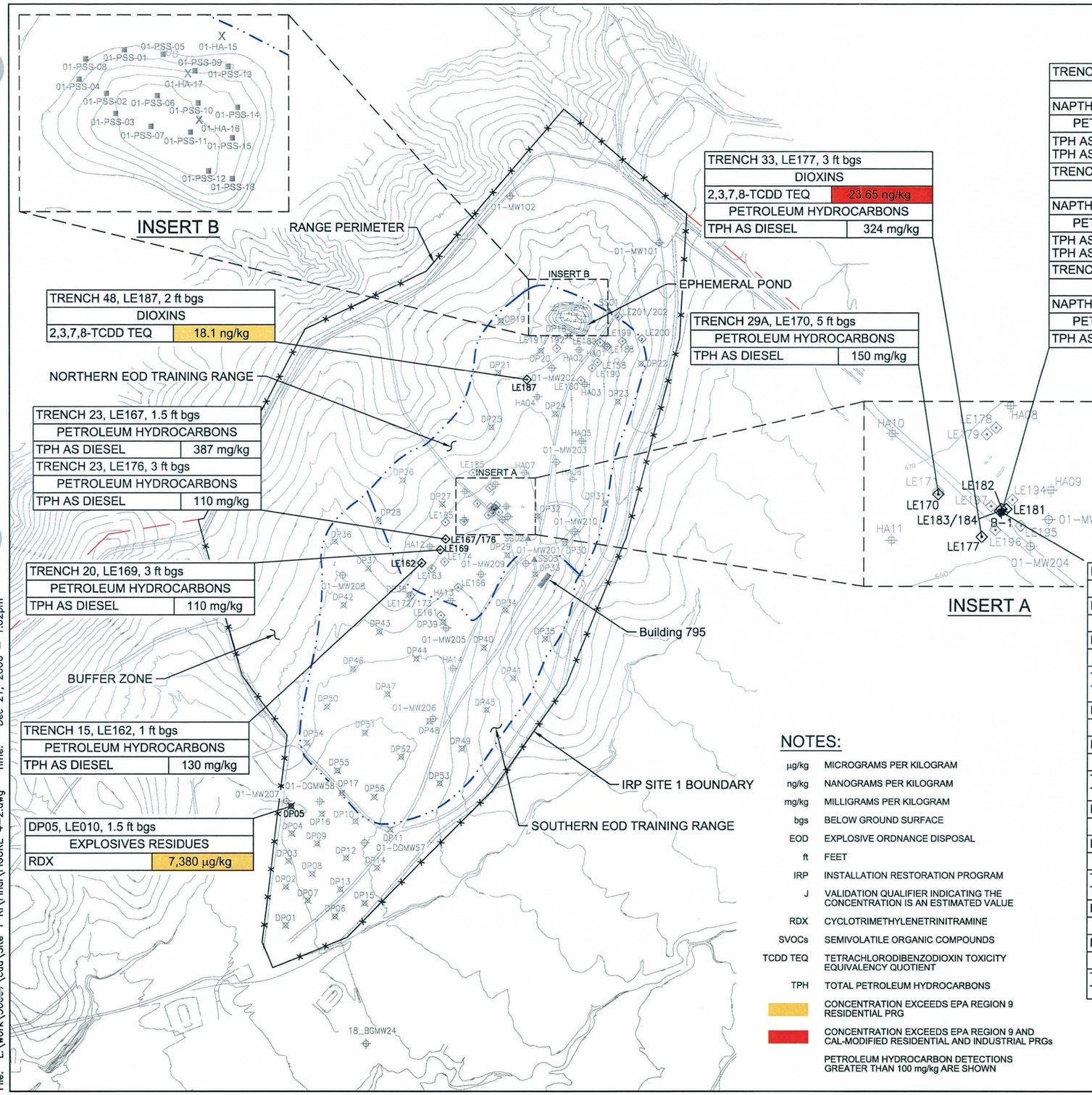
SVOCs detected at the Northern and Southern EOD Training Ranges include diethyl phthalate, di-n-butyl phthalate, hexachlorobenzene, phenol, 2,4-dinitrotoluene, 2-methylnaphthalene, bis(2-ethylhexyl) phthalate, naphthalene, and NDMA. Of all the detected SVOCs, only naphthalene exceeded its California-Modified residential and industrial PRGs at seven locations (Figure 4-2).

Petroleum hydrocarbons detected at the Northern and Southern EOD Training Ranges include TPH as motor oils, TPH as diesel fuel, and TPH as gasoline. There are no PRGs for hydrocarbons. Analyses of soil samples for dioxins/furans indicated that the EPA Region 9 residential PRG of 3.9 ng/kg for 2,3,7,8-TCDD was exceeded only in two samples collected from the Northern and Southern EOD Training Ranges (Table 4-29 and Figure 4-2). The EPA Region 9 industrial PRG of 20 ng/kg for 2,3,7,8-TCDD was exceeded in one sample.

Explosives residues detected at the Northern and Southern EOD Training Ranges include 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, and RDX. All explosives residues detected were below their respective EPA Region 9 industrial PRGs. Residential PRGs were also not exceeded except in the case of RDX, for which two soil samples exceeded the residential PRG of 4,420 µg/kg (Figure 4-2). The maximum concentration of RDX was 14,000 µg/kg.

Perchlorate was detected at low concentrations and at low frequencies at the Northern and Southern EOD Training Ranges. All detections were below the EPA Region 9 residential and industrial PRGs. The maximum concentration of perchlorate detected at the Northern and Southern EOD Training Ranges was 1,600 µg/kg.

Various metals were detected at concentrations exceeding their respective MCAS El Toro background values at locations distributed throughout the Northern and Southern EOD Training Ranges (see Figures 4-3 through 4-6). A comparison of the concentrations of metals with EPA Region 9 residential and industrial PRGs indicated that except for arsenic only a few of the detected concentrations of metals exceeded residential or industrial PRGs (Figures 4-3 through 4-6 and Table 4-29). For the subsurface soil interval of 0 to 10 feet bgs, the maximum detection for lead of 1,580 mg/kg exceeds both the California-modified PRG value of 150 mg/kg and the EPA Region 9 PRG value of 400 mg/kg. However, the 95 percent UCL value of 93.4 mg/kg is below both values.



TRENCH 48, LE187, 2 ft bgs	
DIOXINS	
2,3,7,8-TCDD TEQ	18.1 ng/kg

TRENCH 23, LE167, 1.5 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	387 mg/kg
TRENCH 23, LE176, 3 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	110 mg/kg

TRENCH 20, LE169, 3 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	110 mg/kg

TRENCH 15, LE162, 1 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	130 mg/kg

DP05, LE010, 1.5 ft bgs	
EXPLOSIVES RESIDUES	
RDX	7,380 µg/kg

TRENCH 33, LE177, 3 ft bgs	
DIOXINS	
2,3,7,8-TCDD TEQ	23.65 ng/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	324 mg/kg

TRENCH 29A, LE170, 5 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	150 mg/kg

TRENCH 34, LE181, 2 ft bgs	
SVOCs	
NAPTHALENE	128,000 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	37,000 mg/kg 1,600 J mg/kg
TRENCH 34, LE182, 6 ft bgs	
SVOCs	
NAPTHALENE	9,900 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	3,700 mg/kg 250 J mg/kg
TRENCH 34, LE183/184, 10 ft bgs	
SVOCs	
NAPTHALENE	16,000/10,000 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	4,600/4,900 mg/kg

B-1, LE207, 5 ft bgs	
EXPLOSIVES RESIDUES	
RDX	14,000 µg/kg
SVOCs	
NAPTHALENE	31,700 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	12,000 mg/kg 140 J mg/kg
B-1, LE208, 10 ft bgs	
SVOCs	
NAPTHALENE	13,000 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	8,800 mg/kg 530 J mg/kg
B-1, LE209/210, 15 ft bgs	
SVOCs	
NAPTHALENE	14,000J/15,000J µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	4,300/11,000 mg/kg 240 J/330 J mg/kg
B-1, LE211, 20 ft bgs	
SVOCs	
NAPTHALENE	46,000 µg/kg
PETROLEUM HYDROCARBONS	
TPH AS DIESEL TPH AS GASOLINE	19,000 mg/kg 710 J mg/kg

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- DP16 — DIRECT-PUSH SAMPLING LOCATION
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 — SURFACE SOIL SAMPLING LOCATION
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION, I.D., AND DEPTH — ANALYTE GROUP

TRENCH 15, LE162, 1 ft bgs	
PETROLEUM HYDROCARBONS	
TPH AS DIESEL	130 mg/kg

ANALYTE NAME — CONCENTRATION

PRG Values (µg/kg)		
ANALYTE	RESIDENTIAL	INDUSTRIAL
2,3,7,8-TCDD	3.9	20
RDX	4,420	15,670
NAPTHALENE (IRIS)	56,000	190,000
NAPTHALENE (CAL-MODIFIED)	1,700	4,200

NOTES:

µg/kg	MICROGRAMS PER KILOGRAM
ng/kg	NANOGRAMS PER KILOGRAM
mg/kg	MILLIGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
EOD	EXPLOSIVE ORDNANCE DISPOSAL
ft	FEET
IRP	INSTALLATION RESTORATION PROGRAM
J	VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
RDX	CYCLOTRIMETHYLENETRINITRAMINE
SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS
TCDD TEQ	TETRACHLORODIBENZODIOXIN TOXICITY EQUIVALENCY QUOTIENT
TPH	TOTAL PETROLEUM HYDROCARBONS
	CONCENTRATION EXCEEDS EPA REGION 9 RESIDENTIAL PRG
	CONCENTRATION EXCEEDS EPA REGION 9 AND CAL-MODIFIED RESIDENTIAL AND INDUSTRIAL PRGs
	PETROLEUM HYDROCARBON DETECTIONS GREATER THAN 100 mg/kg ARE SHOWN

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

TPH, SVOCs, Explosives Residues, and Dioxins - Concentrations in Soil Samples Exceeding Screening Criteria

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	4-2

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 4-2.dwg Time: Dec 21, 2006 – 1:02pm

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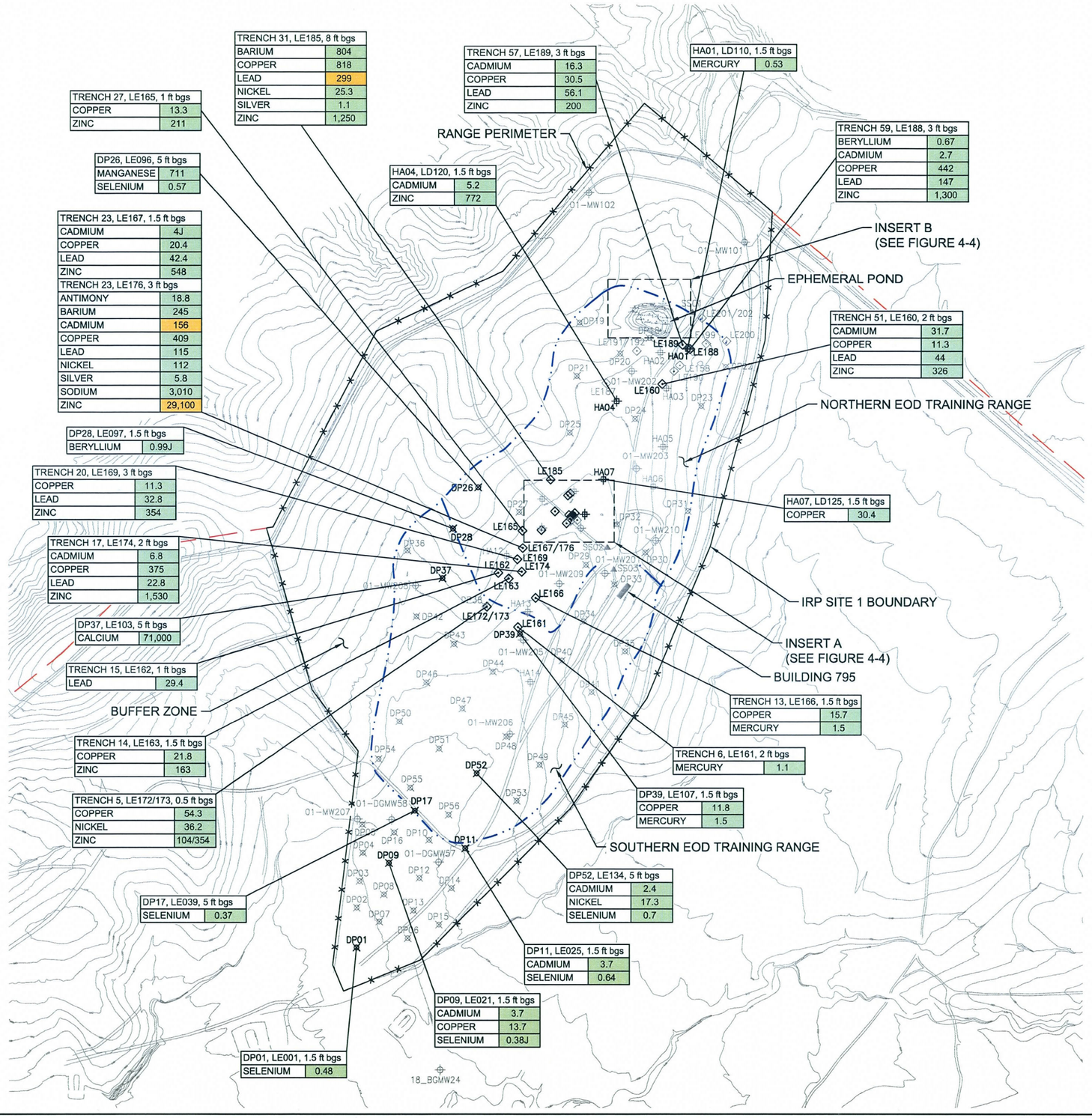

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- DP16 — DIRECT-PUSH SAMPLING LOCATION
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 — SURFACE SOIL SAMPLING LOCATION
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION, I.D., AND DEPTH

HA07, LD125, 1.5 ft bgs	
COPPER	30.4

METAL — CONCENTRATION mg/kg (SEE NOTES)

NOTES:

mg/kg	MILLIGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ft	FEET
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
J	VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
PRG	PRELIMINARY REMEDIATION GOAL

- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE BUT BELOW EPA REGION 9 RESIDENTIAL PRG
- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL PRG
- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE, AND EPA REGION 9 INDUSTRIAL PRGs

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Metal Concentrations (Excluding Arsenic) in Soil Samples Exceeding Background and PRGs - I

IRP Site 1 - EOD Training Range

Former MCAS El Toro

Date: 12-06

Project No. 36097

EarthTech — A Tyco International Ltd. Company

Figure 4-3

File: L:\work\36... \cad\Site 1 RI\Final\FIGURE 4-3.dwg Time: Dec 22, 2006 - 1:46pm

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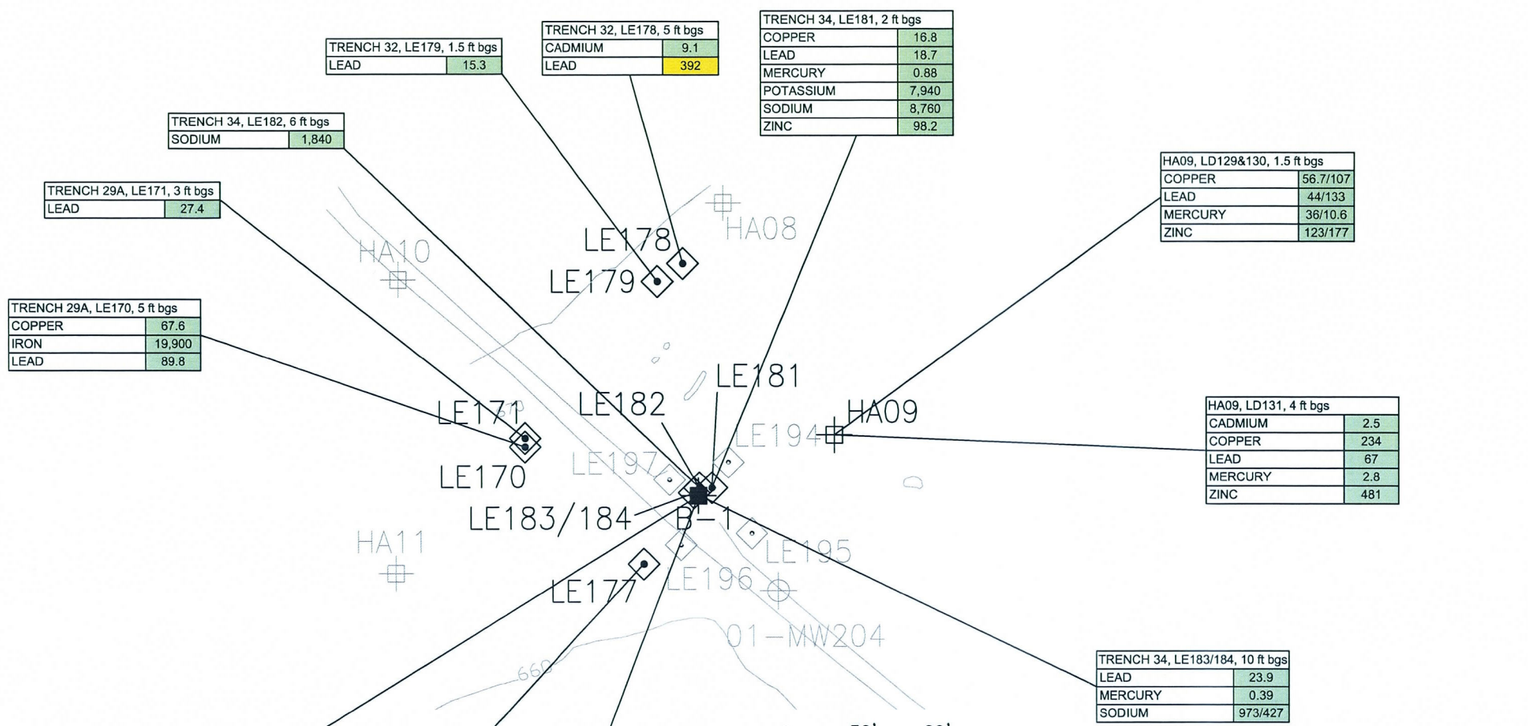

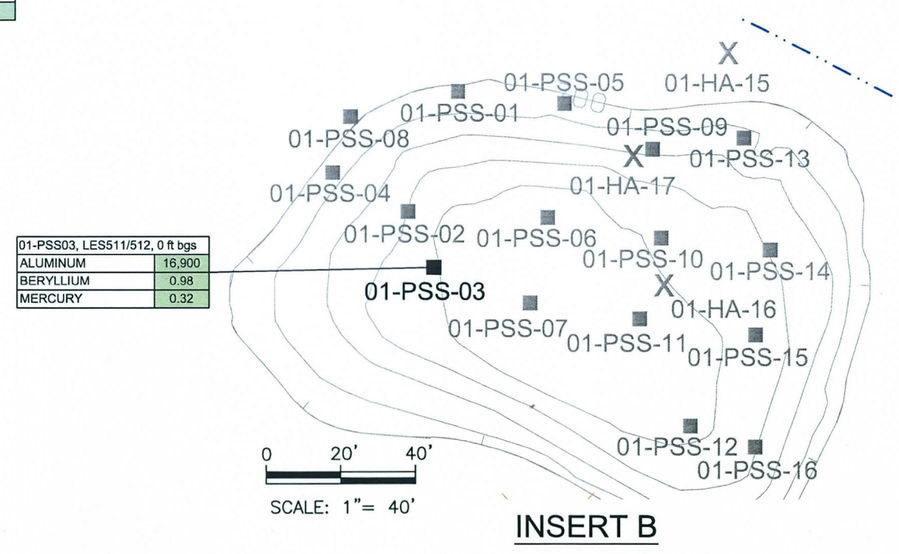

LEGEND:

- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION, I.D., AND DEPTH

HA07, LD125, 1.5 ft bgs	
COPPER	30.4

METAL — CONCENTRATION mg/kg (SEE NOTES)

NOTES:

mg/kg	MILLIGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ft	FEET
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
J	VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
PRG	PRELIMINARY REMEDIATION GOAL

- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE BUT BELOW EPA REGION 9 RESIDENTIAL PRG
- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL PRG
- CONCENTRATION EXCEEDS THE MCAS EL TORO BACKGROUND VALUE, AND EPA REGION 9 INDUSTRIAL PRGs

Phase II Remedial Investigation — Final

Metal Concentrations (Excluding Arsenic) in Soil Samples Exceeding Background and PRGs - II

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	4-4

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 4-4.dwg Time: Dec 22, 2006 - 1:47pm

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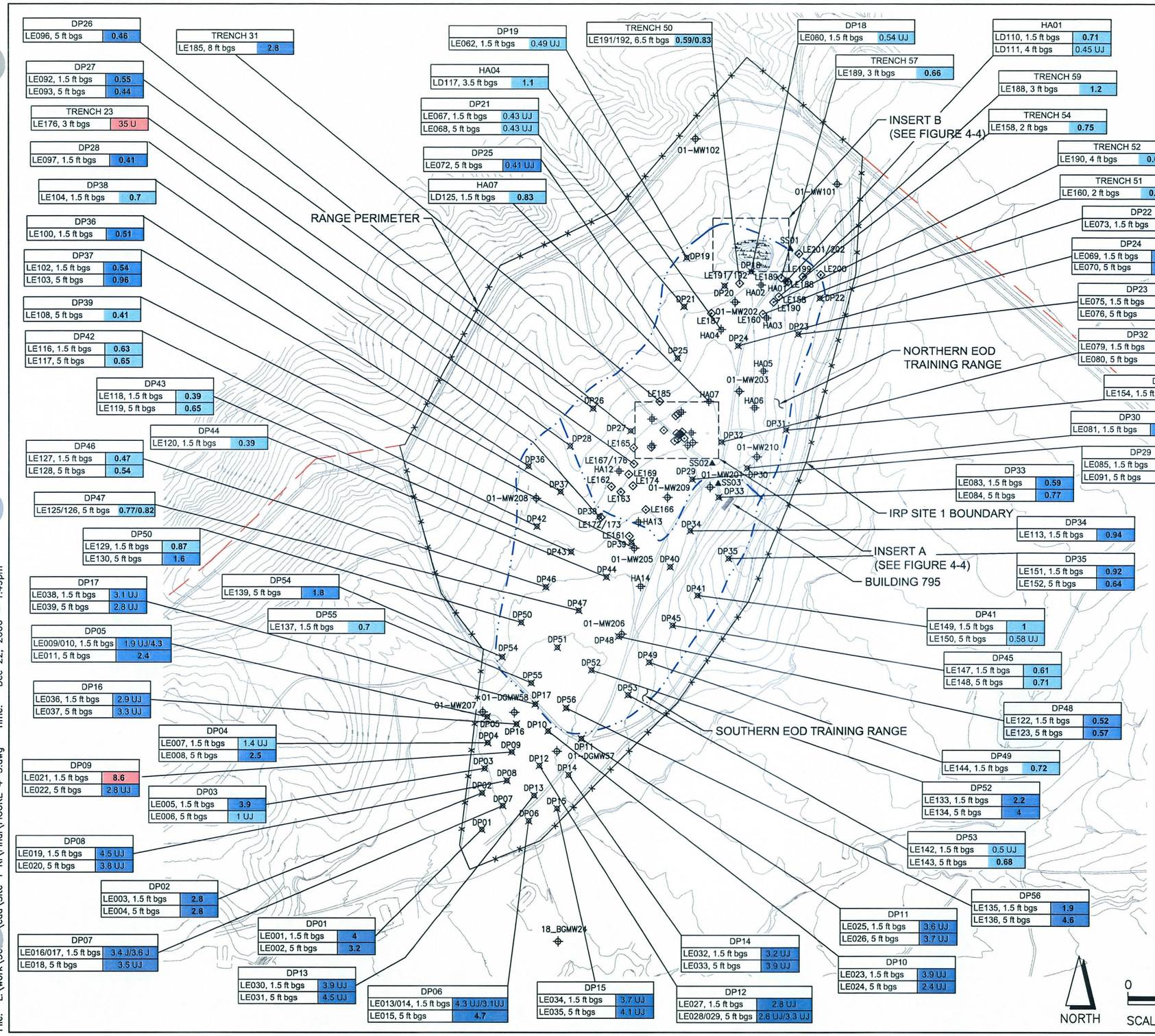

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- DP16 DIRECT-PUSH SAMPLING LOCATION
- HA12 HAND AUGER SAMPLING LOCATION
- 01-PSS-08 SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 SURFACE SOIL SAMPLING LOCATION
- 01-HA-15 HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- B-1 DEEP SOIL BORING
- LE158 SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION, I.D., AND DEPTH

HA07, LD125, 1.5 ft bgs	
COPPER	30.4

METAL — CONCENTRATION mg/kg (SEE NOTES)

NOTES:

- 0.5 UJ — DETECTION LIMIT EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL PRG BUT IS BELOW MCAS EL TORO BACKGROUND VALUE OF 6.86 mg/kg
- 0.71 — DETECTED CONCENTRATION EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL PRG BUT IS BELOW MCAS EL TORO BACKGROUND VALUE
- 3.2 UJ — DETECTION LIMIT EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs BUT IS BELOW MCAS EL TORO BACKGROUND VALUE
- 0.92 — DETECTED CONCENTRATION EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs BUT IS BELOW MCAS EL TORO BACKGROUND VALUE
- 35 U — DETECTION LIMIT EQUALS OR EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs
- 8.6 — DETECTED CONCENTRATION EQUALS OR EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs

bgs BELOW GROUND SURFACE
EPA UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ft FEET
IRP INSTALLATION RESTORATION PROGRAM
MCAS MARINE CORPS AIR STATION
MEC MUNITIONS AND EXPLOSIVES OF CONCERN
PRG PRELIMINARY REMEDIATION GOAL
U VALIDATION QUALIFIER INDICATING THAT ARSENIC WAS NOT
UJ VALIDATION QUALIFIER INDICATING THAT ARSENIC WAS NOT DETECTED AT THE THRESHOLD INDICATED; HOWEVER, THE LEVEL STATED IS AN ESTIMATED VALUE

Phase II Remedial Investigation — Final

Arsenic Concentrations in Soil Samples Exceeding Background and PRGs - I

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech, A Tyco International Ltd. Company	4-5

File: L:\work\30\cad\Site 1 R\Final\FIGURE 4-5.dwg Time: Dec 22, 2006 - 1:49pm

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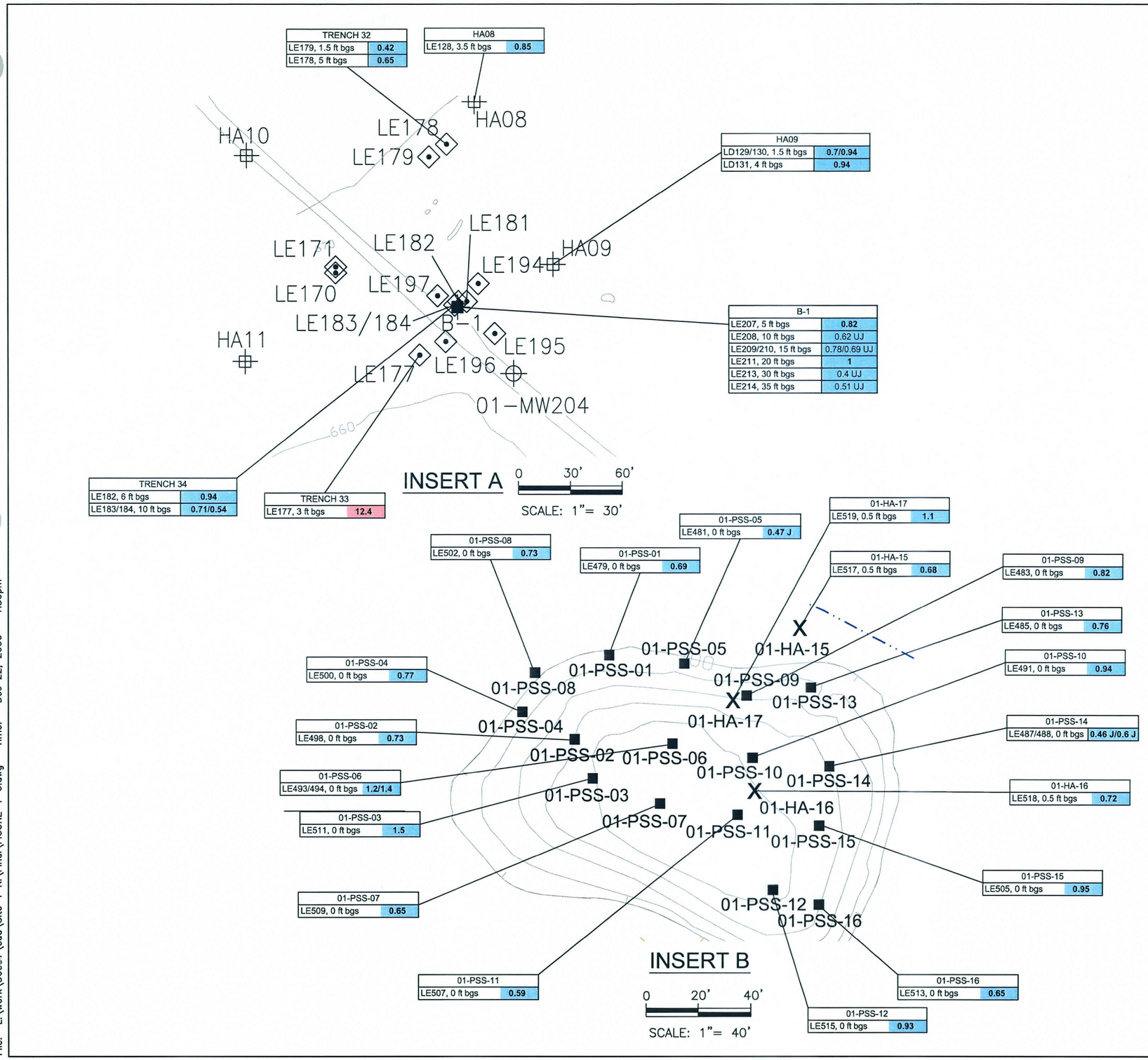

LEGEND:

- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION, I.D., AND DEPTH

HA07, LD125, 1.5 ft bgs	
COPPER	30.4

METAL — CONCENTRATION mg/kg (SEE NOTES)

NOTES:

- 0.5 UJ — DETECTION LIMIT EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL PRG BUT IS BELOW MCAS EL TORO BACKGROUND VALUE OF 6.86 mg/kg
- 0.71 — DETECTED CONCENTRATION EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL PRG BUT IS BELOW MCAS EL TORO BACKGROUND VALUE
- 3.2 UJ — DETECTION LIMIT EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs BUT IS BELOW MCAS EL TORO BACKGROUNDVALUE
- 0.92 — DETECTED CONCENTRATION EQUALS OR EXCEEDS EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs BUT IS BELOW MCAS EL TORO BACKGROUND VALUE
- 35 U — DETECTION LIMIT EQUALS OR EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs
- 8.6 — DETECTED CONCENTRATION EQUALS OR EXCEEDS THE MCAS EL TORO BACKGROUND VALUE AND EPA REGION 9 RESIDENTIAL AND INDUSTRIAL PRGs

bgs	BELOW GROUND SURFACE
EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ft	FEET
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN
PRG	PRELIMINARY REMEDIATION GOAL
U	VALIDATION QUALIFIER INDICATING THAT ARSENIC WAS NOT
UJ	VALIDATION QUALIFIER INDICATING THAT ARSENIC WAS NOT DETECTED AT THE THRESHOLD INDICATED; HOWEVER, THE LEVEL STATED IS AN ESTIMATED VALUE

INSERT B SHOWS THE LOCATIONS OF SEDIMENT SAMPLES COLLECTED FROM THE EPHEMERAL POND

Phase II Remedial Investigation — Final

Arsenic Concentrations in Soil and Sediment Samples Exceeding Background and PRGs - II

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	4-6

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 4-6.dwg Time: Dec 22, 2006 – 1:50pm

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Table 4-29: Summary of Nature and Extent of Soil Contamination at Northern and Southern Training EOD Ranges

VOC Contamination				SVOC Contamination				Explosives Residues and Perchlorate Contamination			
VOCs	Maximum Concentration (µg/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs	SVOCs	Maximum Concentration (µg/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs	Explosives Residues and Perchlorate Contamination	Maximum Concentration (µg/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs
Acetone	8,700	0	0	Diethyl Phthalate	250	0	0	1,3-Dinitrobenzene	630	0	0
Benzene	610	0	0	Di-n-butyl Phthalate	30,700	0	0	2,4,6-Trinitrotoluene	7,860	0	0
2-Butanone	9	0	0	Hexachlorobenzene	220	0	0	RDX	14,000	2	0
Carbon Tetrachloride	2	0	0	Phenol	1,200	0	0	Perchlorate	1,600	0	0
Chloroform	0.9	0	0	2,4-Dinitrotoluene	7,000	0	0				
Ethylbenzene	14,000	0	0	2-Methylnaphthalene	270,000	0	0				
2-Hexanone	50	0	0	Bis(2-ethylhexyl) Phthalate	420	0	0				
4-Methyl-2-Pentanone	2	0	0	Naphthalene	128,000	7	7				
Tetrachloroethene	2	0	0	N-Nitrosodiphenylamine	66,700	0	0				
Toluene	41,000	0	0								
Xylenes	98,000	0	0								

Hydrocarbon Contamination				Dioxins Contamination				Metals Contamination				
Hydrocarbons	Maximum Concentration (mg/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs	Dioxins	Maximum 2,3,7,8-TCDD Toxicity Equivalent Concentration (ng/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs	Metals	Maximum Concentration (mg/kg)	Number of Detections Above Residential PRGs	Number of Detections Above Industrial PRGs	Number of Detections Above MCAS El Toro Background
Motor Oil Hydrocarbons	69	-	-	2,3,7,8-TCDD	23.7	2	1	Aluminum	190,000	1	1	1
TPH as Diesel Fuel	37,000	-	-					Antimony	103	1	0	4
TPH as Gasoline	1,600	-	-					Arsenic	12.4	68	9	2
								Cadmium	156	1	0	11
								Copper	16,700	1	0	21
								Lead	1,580	1	0	19
								Thallium	15.2	1	0	1
								Zinc	29,100	1	0	17

Notes:

- = No PRGs; therefore, no comparison was made
µg/kg = micrograms per kilogram
EOD = explosive ordnance disposal
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
ng/kg = nanograms per kilogram
PRG = preliminary remediation goal
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
2,3,7,8-TCDD =2,3,7,8-tetrachlorodibenzo-p-dioxin

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The detected concentrations of arsenic exceeded its EPA Region 9 residential PRG in 68 samples and industrial PRG in nine samples. However, most of detected arsenic concentrations were well below its established MCAS El Toro background concentration of 6.86 mg/kg.

Results of the Phase II RI Tier III investigation were combined with the results of the Tier I and Tier II investigations to estimate the depth of contamination at IRP Site 1. These results show that minimal VOC, SVOC, and hydrocarbon contamination exists at IRP Site 1 and is restricted to shallow depths (less than 5 feet bgs). The area in the vicinity of Borehole B-1 is likely to be the only location where this contamination extends up to the depth of 20 feet bgs.

For explosives residues and perchlorate, it can be concluded that negligible concentrations of explosives residues and perchlorate exist in IRP Site 1 soil up to the depth of 5 feet bgs. It is likely that the area in the vicinity of Borehole B-1 is the only location where low concentrations of explosives residues and perchlorate exist up to the depth of 35 feet bgs.

A close observation of Figures 4-2 through 4-6 indicates that most of the exceedances above EPA Region 9 residential and/or industrial PRGs for organic COPCs (naphthalene and RDX) and metals were observed for the samples collected in the central portion of IRP Site 1 in the Northern EOD Training Range near the location of Borehole B-1. This may be because most of the recent EOD activities at IRP Site 1 occurred in the Northern EOD Training Range.

The results of the radiological scan surveys and soil sampling indicated that occurrence and distribution of Ra-226 at IRP Site 1 is consistent with the naturally occurring background. Therefore, SEA recommendation was made for IRP Site 1. This recommendation removes radionuclides from the list of COPCs at IRP Site 1 and further consideration under CERCLA.

4.4 NATURE AND EXTENT OF SEDIMENT CONTAMINATION

The assessment of the nature and extent of sediment contamination was performed as a part of Tier III-C investigations of the Phase II RI. This investigation included surface and near-surface sediment sampling within the Ephemeral Pond in the northern portion of the Northern EOD Training Range. Nineteen samples and two duplicates were collected from the bottom of the Ephemeral Pond and analyzed for VOCs, SVOCs, PAHs, explosives residues, petroleum hydrocarbons, perchlorate, total organic carbon, pH, and metals.

4.4.1 Volatile Organic Compounds

Toluene was the only VOC detected in two of the 19 sediment samples (Tables 4-30 and 4-31). The concentrations of toluene were relatively low and ranged from 0.7 to 0.8 μg/kg (Table 4-32).

4.4.2 Semivolatile Organic Compounds

SVOCs were not detected above their laboratory detection limits in any sediment sample collected from the Ephemeral Pond.

4.4.3 Polycyclic Aromatic Hydrocarbons

PAHs were not detected above their laboratory detection limits in any sediment sample collected from the Ephemeral Pond.

4.4.4 Petroleum Hydrocarbons

Low concentrations of TPH as motor oils were detected in all 19 soil samples (Tables 4-30 and 4-31). The maximum concentration observed was 150 mg/kg in a surface sample collected from

location 01-PSS12 (Table 4-32). TPH as diesel was detected in 12 samples at low concentrations ranging from 2 to 6 mg/kg. TPH as gasoline were detected in one sample at a concentration of 1 mg/kg.

4.4.5 Explosives Residues

Explosives residues were not detected above their laboratory detection limits in any sediment sample collected from the Ephemeral Pond.

4.4.6 General Chemistry

Perchlorate was not detected during the Tier III-C sediment sampling. The total organic carbon was detected at concentrations ranging from 920 to 9190 mg/kg in the sediment samples (Table 4-30). The pH of the samples ranged from 7.07 to 9.09 (Table 4-30).

4.4.7 Metals

Concentrations of most of the metals were less than the background values, except for aluminum, beryllium, and mercury (Tables 4-30 and 4-31). None of the metals exceeded their EPA Region 9 residential or industrial PRGs except arsenic. Arsenic exceeded its residential PRG in all the 19 sediment samples. However, none of these samples had arsenic concentration greater than its established background of 6.86 mg/kg (Table 4-32). Table 4-32 presents the minimum and maximum concentration of all detected metals.

4.4.8 Summary of the Results

Organic COPCs were not detected above the EPA Region 9 residential and industrial PRGs in the sediment investigation of the Ephemeral Pond. Among the metals, arsenic exceeded its residential PRG in the samples collected throughout the Ephemeral Pond. However, none of these detections exceeded the established MCAS El Toro background concentration for arsenic.

4.5 Nature and Extent of Groundwater Contamination

Various groundwater monitoring studies have been conducted at IRP Site 1 to delineate the nature and extent of contamination at the site. Brief descriptions of some of the groundwater sampling and analysis activities are presented in Sections 1.4.4 and 2.2.3. This section presents the nature and extent of groundwater contamination at IRP Site 1 based on the results of these studies.

4.5.1 Volatile Organic Compounds

Phase I RI

During the Phase I RI, groundwater samples were collected from two monitoring wells, 01-DGMW57 and 01-DGMW58, and were analyzed for VOCs. Chloromethane was the only VOC detected in samples from both the wells at a concentration of 0.7 µg/L (JEG 1993a).

Groundwater Sampling at IRP Site 1 as Part of Stationwide Groundwater Sampling

Various groundwater monitoring rounds have been conducted at Former MCAS El Toro since 1993, as a part of Stationwide groundwater monitoring. Some of these monitoring rounds involved groundwater sampling of IRP Site 1 monitoring wells for VOCs. Table 4-33 presents the frequency

Table 4-30: Summary of Detected Analytes - Phase II RI Tier III-C Investigation

Analyte	Lab Method	Units	01-PSS01 0 feet bgs LE479/LE480	01-PSS05 0 feet bgs LE481/LE482	01-PSS09 0 feet bgs LE483/LE484	01-PSS13 0 feet bgs LE485/LE486	01-PSS14 0 feet bgs LE487/LE489	01-PSS14 (dup) 0 feet bgs LE488/LE490	01-PSS10 0 feet bgs LE491/LE492	01-PSS06 0 feet bgs LE493/LE495	01-PSS06 (dup) 0 feet bgs LE494/LE496	01-PSS02 0 feet bgs LE498/LE499	01-PSS04 0 feet bgs LE500/LE501	01-PSS08 0 feet bgs LE502/LE503	01-PSS15 0 feet bgs LE505/LE506	01-PSS11 0 feet bgs LE507/LE508	01-PSS07 0 feet bgs LE509/LE510	01-PSS03 0 feet bgs LE511/LE512	01-PSS16 0 feet bgs LE513/LE514	01-PSS12 0 feet bgs LE515/LE516	01-HA15 0.5 feet bgs LE517	01-HA16 0.5 feet bgs LE518	01-HA17 0.5 feet bgs LE519
VOCs																							
Toluene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	0.7 J	0.8 J	4.9 U	5.6 U
Petroleum Hydrocarbons																							
TPH as Motor Oils	8015B DRO	mg/kg	21	43	19	20	48	76	39	110	16	27	12	43	35	22	21	19	36	150	28	48	59
TPH as Diesel	8015B DRO	mg/kg	2 J	2 J	9.4 U	8.8 U	3 J	4 J	2 J	6 J	9.1 U	9.5 U	8.8 U	2 J	4 J	8.8 U	9.4 U	12 U	3 J	6 J	2 J	2 J	3 J
TPH as Gasoline	8015B GRO	mg/kg	9.5 U	11 U	10 U	10 U	10 U	11 U	12 U	10 U	10 U	12 U	10 U	11 U	9.9 U	9.7 U	11 U	13 U	1 J	10 U	10 U	11 U	11 U
General Chemistry																							
Total Organic Carbon (TOC)	Walkly-Black	mg/kg	1400	3390	4120	4280	9190	8930	6150	1680	920	2960	2210	4110	7480	3510	1830	5620	5590	9190	7310	5710	8320
pH	9045	pH	8.98	8.73	9.09	7.92	7.2	7.07	7.56	8.9	8.82	8.46	8.84	8.55	7.62	7.38	7.91	8.72	7.41	7.09	6.98	7.34	8.88
Metals																							
Aluminum	6010B	mg/kg	8580	5880	8700	6800	5090	6360	9670	11900	13700	8350	5950	7210	7400	6850	7980	16900	8200	10200	4220	7970	12800
Arsenic	6010B	mg/kg	0.69	0.47 J	0.82	0.76	0.46 J	0.6 J	0.94	1.2	1.4	0.73	0.77	0.73	0.95	0.59	0.65	1.5	0.65	0.93	0.68	0.72	1.1
Barium	6010B	mg/kg	34.2	24.6	46.4	33.3	30	30.5	47.3	54.2	61.3	32.1	33.4	31.4	30.7	29.9	35	81.7	31.2	41.7	33.2	34.8	72.5
Beryllium	6010B	mg/kg	0.38	0.17	0.33	0.17	0.12	0.17	0.34	0.41	0.52	0.25	0.31	0.27	0.12	0.21	0.28	0.98	0.22	0.29	0.11	0.22	0.57
Cadmium	6010B	mg/kg	0.042	0.13	0.047	0.069	0.08	0.062	0.15	0.016	0.014	0.033	0.046	0.079	0.044	0.043	0.088	0.059	0.036	0.19	0.21	0.094	0.34
Calcium	6010B	mg/kg	9110	2720	12100	2460	2220	2310	3820	11700	11500	5080	9920	4780	2120	2520	3440	16400	2770	3570	2160	3040	16500
Chromium	6010B	mg/kg	3.7	3	4.1	3.3	2.7	3.5	4.7	5.5	6.3	3.4	2.5	3.2	3.5	3.5	3.8	6.9	3.7	4.7	2.6	3.7	7.1
Cobalt	6010B	mg/kg	1.2 J	1 J	1.4 J	1.4 J	1.3 J	1.3 J	1.8 J	1.9 J	2.3	1.2 J	1 J	1.2 J	1.4 J	1.3 J	1.4 J	2.7 J	1.4 J	1.8 J	1.3 J	1.5 J	2.3 J
Copper	6010B	mg/kg	1.1	1.7	1.4	2.2	1.9	2.7	3.4	1.4	1.6	1.2	0.8	2.5	2	1.7	1.7	2.8	1.8	3.4	2.7	2.5	6.4
Iron	6010B	mg/kg	3650	2860	4370	3610	2920	3540	5110	5990	6910	3740	2930	3540	3640	3660	4000	7720	4410	5060	2870	4160	6480
Lead	6010B	mg/kg	2.1	3.4	2.1	4.5	5.5	5.9	6.7	2.6	2.9	2.8	1.8	3.8	6.8	3.3	2.9	5.7	3	7	6.1	5.4	12.1
Magnesium	6010B	mg/kg	1760	1140	1710	1330	1080	1300	1960	2650	3110	1430	1300	1500	1240	1270	1530	3710	1490	1970	990	1470	2830
Manganese	6010B	mg/kg	57.8	47.6	61.1	56.5	56.5	53.2	73.2	82.3	101	47	48.4	59.1	59.9	39.8	47.7	109	52.2	81.2	60.3	60.9	121
Mercury	7471A	mg/kg	0.02	0.05	0.041	0.073	0.096	0.12	0.092	0.042	0.023	0.16	0.013	0.0096	0.035	0.058	0.041	0.32	0.085	0.1	0.033	0.071	0.13
Nickel	6010B	mg/kg	1.5 J	1.4 J	2.3 J	1.6 J	1.5 J	1.6 J	2.5 J	2.6 J	3	1.5 J	1.3 J	1.5 J	1.7 J	1.7 J	1.8 J	3.8 J	1.8 J	2.4 J	1.6 J	2 J	4 J
Potassium	6010B	mg/kg	548	588	579	614	648	777	735	549	564	439	452	628	581	409	598	856	614	1170	721	777	1100
Selenium	6010B	mg/kg	0.28 UJ	0.27 UJ	0.28 UJ	0.27 UJ	0.28 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 U	0.28 UJ	0.27 UJ	0.29 UJ	0.28 UJ	0.29 UJ	0.36 UJ	0.28 UJ	0.31 UJ	0.27 UJ	0.19 J	0.3 UJ
Sodium	6010B	mg/kg	23.3 J	91 UJ	9.7 J	92 UJ	95 UJ	96 UJ	12.7 J	96 UJ	18.9 J	95 UJ	92 UJ	90 UJ	97 UJ	94 UJ	98 UJ	19.5 J	95 UJ	22.4 J	91 UJ	98 UJ	53.2
Vanadium	6010B	mg/kg	6.3	5.3	8.6	6.6	5.4	6.3	8.8	12.8	15.3	6.7	5.4	6.1	7.3	6.5	7.1	14.4	6.7	9.2	6.1	6.9	10.6
Zinc	6010B	mg/kg	8.1 J	8.2 J	8.2 J	9.5 J	10.5 J	12 J	14.9 J	12.8 J	15.3	7.9 J	6.4 J	11.1 J	9.8 J	8.3 J	9.6 J	16.7 J	9.8 J	16.3 J	10.7 J	13.1 J	19.6 J

Notes:

µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
J = the concentration shown is an estimated value
mg/kg = milligrams per kilogram
pH = negative logarithm of hydrogen ion concentration
RI = remedial investigation
TPH = total petroleum hydrocarbons
U = indicates the compound or analyte was analyzed for but was not detected at or above the stated limit
UJ = not detected at the threshold indicated; however, the level stated is an estimated value
VOCs = volatile organic compounds

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Table 4-31: Frequency of Detection of the COPCs and Metals, and Number of Detections Above EPA Region 9 Residential and Industrial PRGs – Phase II RI Tier III-C Sediment Investigation

Analyte	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections Above Residential PRG[c]	Detections Above Industrial PRG[c]	Detections Above Background (metals only)
Toluene	19	2	10.6	0	0	-
TPH as Motor Oils	19	19	100	-[b]	-[b]	-
TPH as Diesel Fuel	19	12	63.2	-[b]	-[b]	-
TPH as Gasoline	19	1	5.3	-[b]	-[b]	-
Metals[c]						
Aluminum	19	19	100	0	0	1
Arsenic	19	19	100	19	0	0
Barium	19	19	100	0	0	0
Beryllium	19	19	100	0	0	1
Cadmium	19	19	100	0	0	0
Calcium	19	19	100	-[b]	-[b]	0
Chromium	19	19	100	0	0	0
Cobalt	19	19	100	0	0	0
Copper	19	19	100	0	0	0
Iron	19	19	100	0	0	0
Lead	19	19	100	0	0	0
Magnesium	19	19	100	-[b]	-[b]	0
Manganese	19	19	100	0	0	0
Mercury	19	19	100	0	0	1
Nickel	19	19	100	0	0	0
Potassium	19	19	100	-[b]	-[b]	0
Selenium	19	1	5.3	0	0	0
Sodium	19	7	36.8	-[b]	-[b]	0
Vanadium	19	19	100	0	0	0
Zinc	19	19	100	0	0	0

Notes:
[a] Number of samples analyzed for the specified analyte excluding 2 duplicates.
[b] No PRG; therefore, no comparison was made.
[c] Comparison was made to EPA Region 9 PRGs.
% = percent
COPCs = chemicals of potential concern
EPA = United States Environmental Protection Agency
PRG = preliminary remediation goal
RI = remedial investigation
TPH = total petroleum hydrocarbons

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Table 4-32: Minimum and Maximum Concentrations of Detected Analytes – Phase II RI Tier III-C Sediment Investigation

Analyte	PRG (µg/kg) Residential	PRG (µg/kg) Industrial	MCAS El Toro Background (0.95 Quantile) (mg/kg)	Minimum Concentration	Location and Depth of Minimum Concentration	Maximum Concentration	Location and Depth of Maximum Concentration
VOCs (µg/kg)							
Toluene	520,000	520,000	-	0.7 J	01-PSS12, LE515/516, 0 feet bgs	0.8 J	01-HA15, LE517, 0.5 feet bgs
Hydrocarbons (mg/kg)							
TPH as Motor Oils	-	-	-	12	01-PSS04, LE500/LE501, 0 feet bgs	150	01-PSS12, LE515/LE516, 0 feet bgs
TPH as Diesel Fuel	-	-	-	2 J	01-PSS01, LE479/LE480, 0 feet bgs; 01-PSS05, LE481/LE482, 0 feet bgs; 01-PSS10, LE491/LE492, 0 feet bgs; 01-PSS08, LE502/LE503, 0 feet bgs; 01-HA15, LE517, 0.5 feet bgs; 01-HA16, LE518, 0.5 feet bgs	6 J	01-PSS06, LE493/LE495, 0 feet bgs; 01-PSS12, LE515/LE516, 0 feet bgs
TPH as Gasoline	-	-	-	1 J	01-PSS16, LE513/LE514, 0 feet bgs	1 J	01-PSS16, LE513/LE514, 0 feet bgs
Metals (mg/kg)							
Aluminum	76,000	100,000	14,800	4,220	01-HA15, LE517, 0.5 feet bgs	16,900	01-PSS03, LE511/LE512, 0 feet bgs
Arsenic	0.39	1.6	6.86	0.46 J	01-PSS14, LE487/LE489, 0 feet bgs	1.5	01-PSS03, LE511/LE512, 0 feet bgs
Barium	5,375	66,578	173	24.6	01-PSS05, LE481/LE482, 0 feet bgs	81.7	01-PSS03, LE511/LE512, 0 feet bgs
Beryllium	154	1,941	0.669	0.11	01-HA15, LE517, 0.5 feet bgs	0.98	01-PSS03, LE511/LE512, 0 feet bgs
Cadmium	37	451	2.35	0.014	01-PSS06 (dup), LE494/LE496, 0 feet bgs	0.34	01-HA17, LE519, 0.5 feet bgs
Calcium	-	-	46,000	2,120	01-PSS15, LE505/LE506, 0 feet bgs	16,500	01-HA17, LE519, 0.5 feet bgs
Chromium	211	448	26.9	2.5	01-PSS04, LE500/LE501, 0 feet bgs	7.1	01-HA17, LE519, 0.5 feet bgs
Cobalt	903	1,921	6.98	1 J	01-PSS04, LE500/LE501, 0 feet bgs; and 01-PSS05, LE481/LE482, 0 feet bgs	2.7 J	01-PSS03, LE511/LE512, 0 feet bgs
Copper	3,129	40,877	10.5	0.8	01-PSS04, LE500/LE501, 0 feet bgs	6.4	01-HA17, LE519, 0.5 feet bgs
Iron	23,463	100,000	18,400	2,860	01-PSS05, LE481/LE482, 0 feet bgs	7,720	01-PSS03, LE511/LE512, 0 feet bgs
Lead	150	750	15.1	1.8	01-PSS04, LE500/LE501, 0 feet bgs	12.1	01-HA17, LE519, 0.5 feet bgs
Magnesium	-	-	8,370	990	01-HA15, LE517, 0.5 feet bgs	3,710	01-PSS03, LE511/LE512, 0 feet bgs
Manganese	1,762	19,458	291	39.8	01-PSS11, LE507/LE508, 0 feet bgs	121	01-HA17, LE519, 0.5 feet bgs
Mercury	23.5	307	0.22	0.0096	01-PSS08, LE502/LE503, 0 feet bgs	0.32	01-PSS03, LE511/LE512, 0 feet bgs
Nickel	1,564	20,439	15.3	1.3 J	01-PSS04, LE500/LE501, 0 feet bgs	4 J	01-HA17, LE519, 0.5 feet bgs
Potassium	-	-	4,890	409	01-PSS11, LE507/LE508, 0 feet bgs	1,170	01-PSS12, LE515/LE516, 0 feet bgs
Selenium	391	5,110	0.32	0.19 J	01-HA16, LE518, 0.5 feet bgs	0.19 J	01-HA16, LE518, 0.5 feet bgs
Sodium	-	-	405	9.7 J	01-PSS09, LE483/LE484, 0 feet bgs	53.2	01-HA17, LE519, 0.5 feet bgs
Vanadium	78	1,022	71.8	5.3	01-PSS05, LE481/LE482, 0 feet bgs	15.3	01-PSS06 (dup), LE494/LE496, 0 feet bgs
Zinc	23,463	100,000	77.9	6.4 J	01-PSS04, LE500/LE501, 0 feet bgs	19.6 J	01-HA17, LE519, 0.5 feet bgs

Note:
Concentrations in **BOLD** indicate values above the EPA Region 9 or California Modified Residential PRGs.
Concentrations in ***BOLD ITALICS*** indicate values above the EPA Region 9 or California Modified Industrial PRGs.

- = PRG not available
µg/kg = micrograms per kilogram
bgs = below ground surface
dup = duplicate sample
EPA = United States Environmental Protection Agency
J = the concentration shown is an estimated value
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RI = remedial investigation
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

of detection of VOCs in a few of the IRP Site 1 monitoring wells sampled from 1996 until March 2004. Table 4-34 presents detected VOCs and their concentrations. It can be observed from Tables 4-33 and 4-34, that very few VOCs have been detected in the samples from IRP Site 1 monitoring wells and at very low concentrations. Moreover, the absence of consistent detection of VOCs in any one of the monitoring wells suggests no or minimal VOC contamination.

The VOCs that have been detected at IRP Site 1 include, trichloroethene (TCE), PCE, carbon tetrachloride, 1,2-dichloroethene (1,2-DCE), chloroform, benzene, toluene, freon-113, bromodichloromethane, chlorodibromomethane, methylene chloride, 1,2-dichloropropane, 1,2-dichloroethane, acetone, and methyl disulfide (Table 4-34). The detections of TCE, PCE, and carbon tetrachloride in samples collected from 01-MW101, 01-MW102, and 01-MW201 during Nov-96, Mar-97, and Jul-97 were reported as artifacts of the specific sampling procedure used and therefore were not considered representative of groundwater quality at these sampling locations (CDM 1998).

Tier I and Tier III-A Groundwater Sampling and Analysis

As described in Section 2.2.3.1, Tier I and Tier III-A groundwater sampling involved two similar sampling rounds. In the first sampling round conducted in January and February 2002, 12 monitoring wells (18_BGMW24, 01-DGMW57, 01-DGMW58, 01-MW101, 01-MW102, and 01-MW201 through 01-MW207) were sampled (see Figure 2-4). The second sampling round was conducted in June and July 2002, which involved sampling of newly installed monitoring wells (01-MW208, 01MW209, and 01-MW210) for various parameters including VOCs. Table 4-35 presents the summary of various analytes detected during Tier I and Tier III-A groundwater monitoring. Tables 4-36 and 4-37 present the frequency and summary of VOC detection during Tier I groundwater sampling.

VOCs were detected in Monitoring Wells 01-DGMW57, 01-MW102, 01-MW201, 01-MW202, 01-MW206, 01-MW207, and 18_BGMW24 during January 2002 sampling (Tables 4-35 and 4-36). Some of these results, such as the detection of VOCs in 01-DGMW57, were inconsistent with historical results (see Table 4-33). Therefore, confirmation sampling was conducted in February 2002 for Monitoring Wells 01-DGMW57, 01-MW202, and 01-MW207, in which VOCs were detected at a relatively high frequency during January 2002 sampling. The results of this confirmation sampling for all VOCs were below reporting limits (Tables 4-35 and 4-36). It was concluded that the January 2002 results were indeed anomalous, and no additional samples were collected from those wells for VOC analysis. In June 2002, three newly-installed wells were sampled for VOCs (01-MW208, 01-MW209, and 01-MW210), and TCE was not detected in any of the three wells.

In general, very few VOCs were detected in IRP Site 1 groundwater (Table 4-37). These VOCs included benzene, cis-1,2-dichloroethene, ethylbenzene, methylene chloride, toluene, TCE, and xylenes. The MCLs were exceeded only for TCE, in three Monitoring Wells 01-DGMW57, 01-MW202, and 01-MW207 during January 2002 sampling, however, TCE was below reporting limits in the confirmation samples collected from these wells in February 2002.

Therefore, based on the results of confirmation sampling conducted in February 2002 and sampling conducted in June 2002, it can be concluded that negligible VOC contamination exists at IRP Site 1.

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Table 4-33: Frequency of Detection of VOCs in IRP Site 1 Wells – Stationwide Groundwater Sampling

Well I.D.	Date	Number of VOCs Detected	Number of Detections above MCLs
01-DGMW57	7-Feb-96	0	0
	8-Apr-1996	0	0
	20-Nov-1996	0	0
	25-Mar-1997	0	0
	27-July-1999	0	0
01-DGMW58	28-Feb-96	0	0
	5-Apr-96	0	0
	18-Nov-96	1	0
	13-Mar-97	0	0
	6-Aug-99	1	0
01-MW101	2-Apr-96	1	0
	20-Nov-96	3	1*
	13-Mar-97	4	0
	11-Jul-97	3	2*
01-MW101	12-Sep-97	1	0
	23-Oct-97	2	0
	31-Oct-97	3	0
	6-Aug-99	0	0
01-MW102	2-Apr-96	1	0
	20-Nov-96	1	1*
	13-Mar-97	4	0
	9-Jul-97	1	0
	12-Sep-97	0	0
	12-Sep-97	0	0
	23-Oct-97	3	0
	31-Oct-97	1	0
	28-Jul-99	0	0
01-MW201	8-Apr-96	0	0
	18-Nov-96	0	0
	13-Mar-97	1	0
	9-Jul-97	2	2*
	12-Sep-97	1	0
	12-Sep-97	1	0
	23-Oct-97	1	0
	31-Oct-97	0	0
	28-Jul-99	0	0
	25-Sep-01	0	0
	14-Mar-02	0	0
	23-Sep-02	0	0
	19-Mar-03	0	0
	22-Sep-03	0	0
	18-Mar-04	0	0

Notes:

* The reported detections above MCLs in samples collected from 01-MW101, 01-MW102, and 01-MW201 during Nov-96, Mar-97, and Jul-97 were reported as artifacts of the specific sampling procedure used and therefore were not considered representative of groundwater quality at these sampling locations (CDM 1998).

I.D. = identification
IRP = Installation Restoration Program
MCLs = maximum contaminant levels
VOCs = volatile organic compounds

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Table 4-34: Summary of Detected VOCs in IRP Site 1 Wells– Stationwide Groundwater Sampling

Analyte	Well I.D.	Date	Concentration (µg/L)
TCE	01-DGMW58	18-Nov-1996	1.0
	01-MW101	20-Nov-1996	**18***
		13-Mar-97	0.9 J
		11-Jul-1997	2.0
		11-Jul-1997	2.0
	01-MW102	20-Nov-1996	**8.0***
		13-Mar-1997	0.8 J
PCE	01-MW101	11-Jul-1997	**19***
		11-Jul-1997	**16***
		12-Sep-1997	0.4 J
		12-Sep-1997	0.5 J
	01-MW201	09-Jul-1997	**13***
Carbon Tetrachloride	01-MW101	11-Jul-1997	**2***
		11-Jul-1997	**2***
	01-MW201	09-Jul-1997	**1***
1,2-Dichloroethene	01-MW102	23-Oct-1997	0.4 J
Chloroform	01-MW101	20-Nov-1996	2
		13-Mar-1997	2
		23-Oct-1997	0.7 J
	01-MW102	13-Mar-1997	0.9 J
	01-MW201	13-Mar-1997	0.5 J
Benzene	01-MW201	12-Sep-1997	1 J
		12-Sep-1997	0.4 J
Toluene	01-MW101	02-Apr-1996	0.9
	01-MW102	02-Apr-1996	0.9
Freon-113	01-MW101	23-Oct-1997	0.4 J
		31-Oct-1997	0.9 J
	01-MW102	23-Oct-1997	2 J
Bromodichloromethane	01-MW101	20-Nov-1996	2
		13-Mar-1997	2
	01-MW102	13-Mar-1997	0.7 J
Chlorodibromomethane	01-MW101	13-Mar-1997	2
	01-MW102	13-Mar-1997	0.6 J
1,2-Dichloroethane	01-MW101	31-Oct-1997	0.5 J
	01-MW102	23-Oct-1997	**2**
	01-MW102	31-Oct-1997	**1**
	01-MW201	23-Oct-1997	0.4 J
	01-MW201	19-Mar-2003	0.4 J
Acetone	01-MW201	16-Mar-2005	2 J
Methyl Disulfide	01-DGMW58	6-Aug-1999	11 JN
Methylene Chloride	01-MW101	31-Oct-1997	0.6 J
1,2-Dichloropropane	01-MW102	09-Jul-1997	4.0

Notes:
Concentrations in **BOLD** indicate values greater than MCLs.
* The reported detections of TCE, PCE, and carbon tetrachloride in samples collected from 01-MW101, 01-MW102, and 01-MW201 during Nov-96, Mar-97, and Jul-97 were reported as artifacts of the specific sampling procedure used and therefore were not considered representative of groundwater quality at these sampling locations (CDM 1998).

µg/L = micrograms per liter
CDM = Camp Dresser & McKee
I.D. = identification
IRP = Installation Restoration Program
J = the concentration shown is an estimated value
JN = estimated value, tentative identification of this analyte was based on presumptive evidence
MCLs = maximum contaminant levels
PCE = tetrachloroethene
TCE = trichloroethene
VOCs = volatile organic compounds

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Table 4-35: Summary of Detected Analytes in Groundwater

Analyte	MCL/AL	Units	01-MW-101 LE053 1/14/2002	01-MW-102 LE054 1/14/2002	01-MW-102 LE056 1/14/2002	01-MW-102 LE225 6/20/2002	01-MW-201 LE086 1/16/2002	01-MW-201 LE224 6/19/2002	01-MW-202 LE057 1/15/2002	01-MW-202 LE206 2/15/2002	01-MW-202 LE223 6/18/2002	01-MW-203 LE058 1/15/2002	01-MW-204 LE045 1/9/2002	01-MW-205 LE087 1/16/2002	01-MW-206 LE047 1/10/2002	01-MW-207 LE052 1/11/2002	01-MW-207 LE205 2/15/2002	01-MW-207 LE221 6/17/2002	01-MW-208 LE218 6/14/2002	01-MW-209 LE217 6/14/2002	01-MW-209 LE219 6/14/2002	01-MW-210 LE216 6/12/2002	01-MW-210 LE226 7/13/2002
VOCs																							
Benzene	1	µg/L	1 U	1 U	1 U	NA	1 U	NA	0.4 J	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	6	µg/L	1 U	1 U	1 U	NA	1 U	NA	1	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	NA
Ethylbenzene	700	µg/L	1 U	1 U	1 U	NA	1 U	NA	3.1	1 U	NA	1 U	1 U	1 U	1 U	2	1 U	NA	1 U	1 U	1 U	1 U	NA
Methylene Chloride	-	µg/L	3 UJ	4 UJ	228	NA	1 J	NA	3 U	4 UJ	NA	3 U	3 U	3 U	0.4 J	0.3 J	4 UJ	NA	3 U	3 U	3 U	3 U	NA
Toluene	150	µg/L	1 U	1 U	1 U	NA	1 U	NA	0.8 J	1 U	NA	1 U	1 U	1 U	1 U	0.3 J	1 U	NA	1 U	1 U	1 U	1 U	NA
Trichloroethene (TCE)	5	µg/L	1 U	1 U	1 U	NA	1 U	NA	**19**	1 U	NA	1 U	1 U	1 U	1 U	**10**	1 U	NA	1 U	1 U	1 U	1 U	NA
Xylenes, Total	1,750	µg/L	1 U	1 U	1 U	NA	1 U	NA	4.9	1 U	NA	1 U	1 U	1 U	1 U	2.1	1 U	NA	1 U	1 U	1 U	1 U	NA
SVOCs																							
Bis(2-ethylhexyl) Phthalate	4	µg/L	10 U	10 U	**49**	NA	10 U	NA	10 U	NA	NA	10 U	10 U	10 U	10 U	10 U	NA	NA	9.6 U	9.6 U	9.6 U	9.6 U	NA
Hydrocarbons																							
Motor Oils	-	mg/L	1 U	1 U	1 U	NA	1 U	NA	0.05 J	NA	NA	1 U	0.06 J	1 U	0.07 J	1 U	NA	NA	0.1	0.09 J	0.1	0.08 J	NA
PHC as Diesel Fuel	-	mg/L	1 U	1 U	1 U	NA	1 U	NA	1 U	NA	NA	0.2 J	1 U	1 U	1 U	1 U	NA	NA	0.05 J	0.06 J	0.07 J	0.07 J	NA
PHC as Gasoline	-	mg/L	1 U	1 U	1 U	NA	1 U	NA	1 U	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	0.03 J	0.02 J	0.1 U	0.04 J	NA
General Chemistry																							
NDMA	0.002*	µg/L	NA	0.002 U	NA	NA	0.002 U	NA	0.002 U	NA	NA	NA	NA	NA	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA
Nitrate as N	10	mg/L	2	1.7	1.9	NA	**15.4**	NA	9.6 J	NA	NA	**20.1**	6.1	7.8	7.5	9.2	NA	NA	3.8	8.9	3.8	2.8	NA
pH	-	pH	7.61	7.49	7.54	NA	7.8	NA	7.16	NA	NA	7.28	7.76	7.59	7.74	7.02 U	NA	NA	NA	NA	NA	NA	NA
Metals	-																						
Aluminum	1000	µg/L	13.6 UJ	12.8 UJ	22.3 UJ	NA	44.3 UJ	NA	41.9 UJ	NA	NA	21.9 UJ	7.6 UJ	44.9 UJ	11.9 UJ	100 U	NA	NA	48 UJ	41 UJ	35 UJ	43 UJ	NA
Antimony	6	µg/L	5.1 UJ	1.8 UJ	10 U	NA	10 U	NA	10 U	NA	NA	10 U	10 U	10 U	10 U	10 U	NA	NA	60 U	60 U	60 U	60 U	NA
Arsenic	50	µg/L	2 U	2 U	1.5	NA	2.9	NA	4.1	NA	NA	4.4	1.3	3.5	3.3	2 U	NA	NA	10 U	10 U	2.3 UJ	1.5 UJ	NA
Barium	1000	µg/L	13.6	7.6	6	NA	12.3	NA	71	NA	NA	6.7	43.2	87.8	18	7.7 J	NA	NA	45	110	46	23	NA
Beryllium	4	µg/L	0.21 UJ	2 U	2 U	NA	2 U	NA	2 U	NA	NA	2 U	2 U	2 U	2 U	2 U	NA	NA	0.061 UJ	0.057 UJ	5 U	0.11 UJ	NA
Cadmium	5	µg/L	2 U	2 U	2 U	NA	0.28 UJ	NA	0.11 UJ	NA	NA	0.11 UJ	0.39 UJ	0.23 UJ	0.63 UJ	0.62 UJ	NA	NA	0.99 UJ	1.5 UJ	0.71 UJ	2.1 UJ	NA
Calcium	-	µg/L	42,600	104,000	104,000	NA	85,900	NA	166,000	NA	NA	93,400	60,100 J	86,300	77,000 J	92,300 J	NA	NA	110,000	93,800	114,000	48200	NA
Chromium	50	µg/L	**157**	25.4	19.7	NA	2.1	NA	1.4 J	NA	NA	0.92 J	2.5 J	0.43 UJ	1.2 UJ	3.8 J	NA	NA	1.9 UJ	1.1 UJ	1.1 UJ	2 UJ	NA
Cobalt	-	µg/L	1.7 UJ	6.3	5.6	NA	5 U	NA	5 U	NA	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	50 U	0.49 UJ	50 U	0.27 UJ	NA
Copper	1300*	µg/L	7.6 UJ	8.5 UJ	6.9 UJ	NA	2.9 UJ	NA	5.4 UJ	NA	NA	5.2 UJ	2.7 UJ	2.8 UJ	4.3 UJ	3.7 UJ	NA	NA	5.9 UJ	4.9 UJ	2.8 UJ	8.1 UJ	NA
Iron		µg/L	1,610	1,010	884	NA	19.7 UJ	NA	34.4 UJ	NA	NA	18.1 UJ	39 UJ	11.4 UJ	7 UJ	36.4 J	NA	NA	29 UJ	130	19 UJ	28 UJ	NA
Lead	15*	µg/L	2.6 UJ	2.5 UJ	5 U	NA	1.2 UJ	NA	1.5 UJ	NA	NA	1.4 UJ	5 U	1.5 UJ	5 U	0.94 J	NA	NA	4.5 UJ	4.7 UJ	3.4 UJ	9.2	NA
Magnesium	-	µg/L	9,830	3,690	3,710	NA	2,410	NA	5,310	NA	NA	3,600	2,820	2,400	6,460	17,600	NA	NA	14,100	9,200	14,400	3800	NA
Manganese	-	µg/L	13.8	37.9	33	NA	5 U	NA	2.6	NA	NA	5 U	2.7 J	5 U	1.2 UJ	97.1	NA	NA	39	260	39	4.3 UJ	NA
Mercury	2	µg/L	0.43	0.5	0.5	NA	0.15 J	NA	0.17 J	NA	NA	0.26 J	0.34	0.19 J	0.24	0.14 J	NA	NA	0.19	0.19	0.18	0.19	NA
Nickel	100	µg/L	**286**	**1,300**	**1,250**	NA	6.5	NA	4.7	NA	NA	0.41 UJ	3.1 UJ	1 UJ	1 UJ	3.2 J	NA	NA	2.7 UJ	2.2 UJ	2.6 UJ	1.3 UJ	NA
Potassium		µg/L	3,020 J	1,550 J	1,560 J	NA	1,350 J	NA	1,860 J	NA	NA	1,630 J	756 J	993 J	2,120 J	990 J	NA	NA	4,700 J	2,100 J	5,100 J	4300 J	NA
Selenium	50	µg/L	10 U	10 U	10 U	NA	3.2	NA	10 U	NA	NA	2.5	10 U	10 U	5.2 UJ	4.8 UJ	NA	NA	5.6	5 U	2.9	3.6	NA
Silver	-	µg/L	10 U	10 U	10 U	NA	10 U	NA	10 U	NA	NA	10 U	10 U	10 U	10 U	10 U	NA	NA	10 U	0.47 UJ	10 U	0.69 UJ	NA
Sodium	-	µg/L	48,000	66,900	67,300	NA	40,100	NA	42,500	NA	NA	64,000	38,600 J	42,600	37,000 J	32,000 J	NA	NA	76,500	50,700	79,700	57500	NA
Thallium	2	µg/L	2.5 UJ	2.4 U	2.4 U	NA	2.4 U	NA	2.4 U	NA	NA	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	NA	NA	1.9 UJ	1.2 UJ	3.1 UJ	1.7 UJ	NA
Vanadium	-	µg/L	2.8 UJ	4.1 UJ	3.7 UJ	NA	6.7 UJ	NA	7.2 UJ	NA	NA	7.9 UJ	11.1	14.5	10.7	8.1 J	NA	NA	5.7	2.3 UJ	5.9	3 UJ	NA
Zinc	-	µg/L	3.2	12.4	9.6	NA	5.9 J	NA	22.6 J	NA	NA	12.9 J	36.8	17.2 J	18.3	7.1 J	NA	NA	13	83	9.7	6.1	NA

Analyte	MCL/AL	Units	01-DGMW57 LE048 1/11/2002	DGMW-57 LE204 2/14/2002	01-MW-57 LE222 6/17/2002	01-DGMW58 LE050 1/11/2002	01-DGMW58 LE051 1/11/2002	18-BGMW24 LE089 1/21/2002
VOCs								
Benzene	1	µg/L	1 U	1 U	NA	1 U	1 U	1 U
cis-1,2-Dichloroethene	6	µg/L	1	1 U	NA	1 U	1 U	1 U
Ethylbenzene	700	µg/L	3.6	1 U	NA	1 U	1 U	1 U
Methylene Chloride	-	µg/L	3 U	3 UJ	NA	3 U	3 U	3 U
Toluene	150	µg/L	0.8 J	1 U	NA	1 U	1 U	0.4 J
Trichloroethene (TCE)	5	µg/L	**27**	1 U	NA	1 U	1 U	1 U
Xylenes, Total	1,750	µg/L	4.6	1 U	NA	1 U	1 U	1 U
SVOCs								
Bis(2-ethylhexyl) Phthalate	4	µg/L	10 U	NA	NA	10 U	10 U	10 U
Hydrocarbons								
Motor Oils	-	mg/L	1 U	NA	NA	1 U	1 U	1 U
PHC as Diesel Fuel	-	mg/L	1 U	NA	NA	1 U	1 U	0.03 J
PHC as Gasoline	-	mg/L	1 U	NA	NA	1 U	1 U	1 U
General Chemistry								
NDMA	0.002*	µg/L	NA	NA	NA	0.002 U	0.002 U	NA
Nitrate as N	10	mg/L	3.6	NA	NA	9.2	9.6	8.2
pH	-	pH	7.01	NA	NA	7.05	7.03	7.54
Metals	-							
Aluminum	1000	µg/L	13.2 J	NA	NA	100 U	100 U	102
Antimony	6	µg/L	2.1 J	NA	NA	10 U	10 U	10 U
Arsenic	50	µg/L	2	NA	NA	2 U	2 U	5.7 UJ
Barium	1000	µg/L	16	NA	NA	36.7	31.5	36.9
Beryllium	4	µg/L	2 U	NA	NA	0.14 J	2 U	2 U
Cadmium	5	µg/L	0.77 J	NA	NA	0.68 UJ	0.16 UJ	0.17
Calcium	-	µg/L	67,900 J	NA	NA	98,300 J	129,000 J	87,300
Chromium	50	µg/L	7	NA	NA	49.8	47.7	1.8 J
Cobalt	-	µg/L	1.6 UJ	NA	NA	3.8 J	4.4 J	5 U
Copper	1300*	µg/L	17	NA	NA	5.4 J	1.7 UJ	4.9 UJ
Iron		µg/L	128 J	NA	NA	1220 J	1190 J	95.8
Lead	15*	µg/L	4.9 J	NA	NA	1.2 J	5 U	5 U
Magnesium	-	µg/L	27,300	NA	NA	16,200	17,800	38,800
Manganese	-	µg/L	25.7	NA	NA	24.7	28.6	1.6 UJ
Mercury	2	µg/L	0.16 J	NA	NA	0.12 J	0.13 J	0.24
Nickel	100	µg/L	39.1 J	NA	NA	**598 J**	**892 J**	1.3 UJ
Potassium		µg/L	3,230 J	NA	NA	1,520 J	1,250 J	2,710
Selenium	50	µg/L	11.1 U	NA	NA	6.4 UJ	9 UJ	29.9
Silver	-	µg/L	0.31 J	NA	NA	0.39 J	10 U	10 U
Sodium	-	µg/L	62,900 J	NA	NA	31,800 J	42,200 J	72,500
Thallium	2	µg/L	**4.1**	NA	NA	**3.8**	**2.8**	3.7 UJ
Vanadium	-	µg/L	5.1 J	NA	NA	7.7 J	8.9 J	15.5
Zinc	-	µg/L	14.5	NA	NA	14	9.6 J	8.6 UJ

Notes:

* the value represents action level

Concentrations in **BOLD** indicate values above MCL or Action Level

-' = value not available

ug/L = micrograms per liter

AL = action level

J = the level stated is an estimated value

MCL = maximum contaminant level

mg/L = milligrams per liter

N = nitrogen

NA = the sample was not analyzed for the particular analyte

NDMA = n-nitrosodimethylamine

pH = negative logarithm of hydrogen ion concentration

PHC = petroleum hydrocarbons

SVOCs = semivolatile organic compounds

TCE = trichloroethene

U = not detected at the threshold indicated

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

VOCs = volatile organic compounds

Table 4-36: Frequency of VOC Detections – RI Tier I and Tier III-A Groundwater Sampling

Well I.D.	Date	Number of VOCs Analyzed	Number of VOCs Detected	Number of Detections above MCLs
01-DGMW57	11-Jan-02	34	5	1
	14-Feb-02	34	0	0
01-DGMW58	11-Jan-02	34	0	0
	11-Jan-02	34	0	0
01-MW101	14-Jan-02	34	0	0
01-MW102	14-Jan-02	34	0	0
	14-Jan-02	34	1	0
01-MW201	16-Jan-02	34	1	0
01-MW202	15-Jan-02	34	6	1
	15-Feb-02	34	0	0
01-MW203	15-Jan-02	34	0	0
01-MW204	9-Jan-02	34	0	0
01-MW205	16-Jan-02	34	0	0
01-MW206	10-Jan-02	34	1	0
01-MW207	11-Jan-02	34	5	1
	15-Feb-02	34	0	0
01-MW208	14-Jun-02	34	0	0
01-MW209	14-Jun-02	34	0	0
	14-Jun-02	34	0	0
01-MW210	12-Jun-02	34	0	0
18-BGMW24	21-Jan-02	34	1	0

Notes:
I.D. = identification
MCLs = maximium contaminant levels
RI = remedial investigation
VOCs = volatile organic compounds

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Table 4-37: Summary of VOC Detections – RI Tier I and Tier III-A Groundwater Sampling

Analyte	MCL (µg/L)	Number of Samples Analyzed[a]	Number of Detections	Frequency of Detection (%)	Detections above MCLs	Minimum Concentration (µg/L)	Well I.D. at which Minimum Concentration was Detected	Maximum Concentration (µg/L)	Well I.D. at which Maximum Concentration was Detected
Benzene	1	21	1	4.76	0	0.4 J	01-MW202	0.4 J	01-MW202
cis-1,2-Dichloroethene	6	21	2	9.53	0	1	01-MW202 and 01-DGMW57	1	01-MW202 and 01-DGMW57
Ethylbenzene	700	21	3	14.29	0	2	01-MW207	3.6	01-DGMW57
Methylene Chloride	-	21	4	14.29	-[b]	0.3 J	01-MW207	228	01-MW102
Toluene	150	21	4	19.05	0	0.3 J	01-MW207	0.8 J	01-MW202 and 01-DGMW57
Trichloroethene (TCE)	5	21	3	14.29	3	10	01-MW207	27	01-DGMW57
Xylenes, Total	1750	21	3	14.29	0	2.1	01-MW207	4.9	01-MW202

Notes:
[a] Number of samples analyzed for the specified analyte (including duplicates if any).
[b] The chemical does not have a MCL.
% = percent
µg/L = micrograms per liter
I.D. = identification
J = the concentration shown is an estimated value
MCL = maximum contaminant level
RI = remedial investigation
VOC = volatile organic compound

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4.5.2 Semivolatile Organic Compounds

Phase 1 RI

Groundwater samples were collected from Monitoring Wells 01-DGMW57 and 01-DGMW58 for analysis of SVOCs during the Phase I RI. SVOCs were not detected above reporting limits in any of the samples.

Groundwater Sampling at IRP Site 1 as Part of Stationwide Groundwater Sampling

Analysis of groundwater samples from IRP Site 1 monitoring wells for SVOCs was performed as a part of various Stationwide groundwater monitoring rounds. Table 4-38 presents a summary of SVOCs detected during these groundwater monitoring events. It can be observed that SVOCs were detected sparingly during these monitoring rounds and at very low concentrations. Few of the SVOCs that were detected in the IRP Site 1 groundwater include BEPH, diethyl phthalate, fluorene, butyl benzyl phthalate, diethyl phthalate, and di-N-butyl phthalate.

RI Tier I and Tier III-A Groundwater Sampling and Analysis

Only one SVOC, BEPH, was detected above the reporting limit during Tier I and Tier III-A groundwater sampling (Table 4-35). BEPH was detected at a concentration of 49 micrograms per liter (µg/L) in the groundwater sample from the Well 01-MW102.

4.5.3 Explosives Residues

Groundwater Sampling at IRP Site 1 as Part of Stationwide Groundwater Sampling

The monitoring round five of the Stationwide groundwater monitoring conducted in 1997 involved the collection of groundwater samples from five monitoring wells at IRP Site 1 (01-DGMW57, 01-DGMW58 01-MW102, 01-MW101, and 01-MW201) and analysis for explosives residues. Explosives residues were not detected above their detection limits in any groundwater sample.

Phase II RI Tier I and Tier III-A Groundwater Sampling and Analysis

Eighteen groundwater samples were analyzed for explosives residues during Phase II RI. Explosives residues were not detected above their detection limits in any groundwater sample.

4.5.4 Petroleum Hydrocarbons

RI Tier I and Tier III-A Groundwater Sampling and Analysis

Eighteen groundwater samples were analyzed for TPH as motor oils, TPH as diesel fuel, and TPH as gasoline. Low concentrations (less than 0.2 mg/L) of these hydrocarbons were detected in Monitoring Wells 01-MW202, 01-MW203, 01-MW204, 01-MW206, 01-MW208, 01-MW209, 01-MW210, and 18_BGMW24 (Tables 4-35 and 4-39).

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Table 4-38: Summary of SVOC Detections at IRP Site 1 – Stationwide Groundwater Investigation

Well	Date	Number of Compounds Analyzed	Number of Compounds Detected	Compound Detected	Concentration (µg/L)
01-DGMW57	10/12/92	64	0		
	06/14/93	64	0		
	02/07/96	64	0		
	04/08/96	64	0		
	11/20/96	64	0		
	03/25/97	64	0		
01-DGMW58	12/14/92	64	0		
	06/14/93	64	0		
	06/14/93	64	0		
	04/05/96	64	0		
	11/18/96	64	1	Diethyl Phthalate	26
01-MW101	04/02/96	64	0		
	11/20/96	64	0		
01-MW102	04/02/96	64	1	Bis(2-Ethylhexyl)Phthalate (BEPH)	49
	11/20/96	64	0		
01-MW201	04/08/96	64	1	Fluorene	0.14
	11/18/96	64	3	Butyl Benzyl Phthalate	3 J
				Diethyl Phthalate	5.8 J
				Di-N-Butyl Phthalate	1.9 J

Notes:
µg/L = micrograms per liter
J = the concentration shown is an estimated value
IRP = Installation Restoration Program
SVOC = semivolatile organic compound

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Table 4-39: Summary of Hydrocarbon Detections – RI Tier I and Tier III-A Groundwater Investigation

Hydrocarbons	Number of Samples Analyzed	Number of Detections	Minimum Detected Concentration (mg/L)	Location of the Minimum Concentration	Maximum Detected Concentration (mg/L)	Location of the Maximum Concentration
TPH as Motor Oils	18	7	0.05 J	01-MW202	0.1	01-MW208 and 01-MW209
TPH as Diesel Fuel	18	6	0.03 J	18_BGMW24	0.2 J	01-MW203
TPH as Gasoline	18	3	0.02 J	01-MW209	0.04 J	01-MW210

Notes:
J = the concentration shown is an estimated value
mg/L = milligrams per liter
RI = remedial investigation
TPH = total petroleum hydrocarbons

4.5.5 Perchlorate

Stationwide Perchlorate Evaluation

In October 1998, January - February 1999, July - August 1999, and March 2005, Stationwide perchlorate sampling was performed concurrent with groundwater monitoring to assess the presence and concentration of perchlorate in groundwater throughout Former MCAS El Toro. The results of the 1998 investigation were presented in the *Draft Evaluation of Perchlorate in Groundwater Technical Memorandum*, (BNI 1999a). The results of the 1999 investigation were presented in the *Groundwater Monitoring Data Summary Report, 1999 Monitoring Round 9, 10, & 11* (CDM 2000b). The results of the 2005 investigation were presented in the *Groundwater Monitoring Data Summary Report, March 2005 Monitoring Round 21* (CDM 2005).

In the 1998 investigation (Column 1 of Table 4-40), wells sampled at IRP Site 1 included 01-MW101, 01-DGMW57, and 01-DGMW58 (see Figure 2-4). The concentrations of perchlorate in all the wells were less than State and Federal provision action levels of 18 and 32 µg/L (in effect in 1999), respectively, except for one well (01-MW201) where the perchlorate concentration was 280 µg/L.

The 1999 perchlorate analysis (Columns 2 and 3 of Table 4-40) included Wells 01-DGMW57, 01-DGMW58, 01-MW101, 01-MW102, and 01-MW201. Perchlorate concentrations were observed to be less than 17 µg/L in all the wells except for Well 01-MW201 where the perchlorate concentration was 380 µg/L and 350 µg/L during the sampling conducted in May 1999 and July 1999, respectively. The 2005 perchlorate analysis included only Well 01-MW201 and the concentration for that well was 70 µg/L (Column 4 of Table 4-40).

Verification of Perchlorate

Following the review of the Stationwide *Draft Evaluation of Perchlorate in Groundwater Technical Memorandum* (BNI 1999a), the regulatory agencies requested that additional wells be installed to confirm the groundwater flow direction and gradient, and to collect groundwater samples from wells screened across the water table for perchlorate analysis. In response to these comments, a Verification Study for perchlorate was designed to provide information pertaining to the nature and extent of perchlorate in groundwater. Six groundwater monitoring wells were installed (01-MW202, 01-MW203, 01-MW204, 01-MW205, 01-MW206, 01-MW207) and sampled in addition to the six previously existing wells (Figure 2-4).

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Table 4-40: Perchlorate Sampling Results – Stationwide Perchlorate Evaluation and Verification of Perchlorate Study

Well	Perchlorate Concentration (µg/L)				
	Column 1 10/98	Column 2 05/99	Column 3 07/99 - 08/99	Column 4 03/05	Column 5 11/99
01MW101	NA	2J	4U	NA	4UJ
01MW102	NA	2J	2J	NA	4UJ
01MW201	280	380	350J	70	324
01MW202	NA	NA	NA	NA	8UJ
01MW203	NA	NA	NA	NA	10U
01MW204	NA	NA	NA	NA	8U
01MW205	NA	NA	NA	NA	4UJ
01MW206	NA	NA	NA	NA	4UJ
01MW207	NA	NA	NA	NA	7J
01MW208	NA	NA	NA	NA	NA
01MW209	NA	NA	NA	NA	NA
01MW210	NA	NA	NA	NA	NA
01DGMW57	4U[a]	2J	3J	NA	4UJ
01DGMW58	4U[b]	17	5	NA	7J
18BGMW24	NA	NA	NA	NA	4UJ

Notes:

[a] Replicate samples were collected for the EPA (two replicates) and DTSC (two replicates) and analyzed at laboratories designated by these agencies. The EPA samples were reported to contain 4.53 µg/L and 4.31 µg/L perchlorate (validated data). The DTSC samples were reported to contain 6.01 µg/L and 5.06 µg/L perchlorate (data not validated) (BNI 1999a).

[b] Replicate samples were collected for the EPA (two replicates) and DTSC (two replicates) and submitted to laboratories designated by these agencies. The EPA samples were reported to contain 2.77 µg/L and 2.89 µg/L perchlorate (validated data). Only one of the DTSC replicates was analyzed and perchlorate was not reported (<4 µg/L) (data not validated).

[c] Duplicate samples were analyzed.

< = less than
µg/L = micrograms per liter
DTSC = Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
J = the concentration shown is an estimated value
NA = not analyzed
U = not detected above the indicated laboratory reporting limit
UJ = indicates the compound or analyte was analyzed for but was not detected; and the sample detection limit is an estimated value

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Perchlorate was detected in three of the 12 groundwater samples (Column 5 of Table 4-40). In Wells 01-DGMW58 and 01-MW207, a perchlorate concentration of 7 µg/L was measured, and a concentration of 324 µg/L was measured in 01-MW201. Thus the State and Federal provisional action levels of 18 and 32 µg/L (in effect in 1999), respectively, were exceeded in only one well, i.e., 01-MW201. Subsequent to the utilization of the Federal Action Level, the State Notification Level of 6 µg/L was issued (OEHHA 2005). Perchlorate exceeded the State Notification Level in Wells 01-DGMW58, 01-MW207, and 01-MW201.

Phase II RI Tier I and Tier III Groundwater Sampling and Analysis

As a part of the Phase II RI, groundwater monitoring for perchlorate was conducted during the Tier I and Tier III investigations. The results of these sampling events are summarized in Table 4-41. Figure 4-7 shows perchlorate results obtained during the most recent sampling round for each monitoring well and piezometer, and results of Hydropunch™ sampling.

Tier I groundwater sampling was conducted to establish the baseline conditions. The results of this sampling indicated essentially a similar pattern of perchlorate contamination as found during the Verification Study for perchlorate in 1999. A relatively high concentration of perchlorate was detected in Monitoring Well 01-MW201, while all the other monitoring wells showed low (less than 8 µg/L) or nondetect concentrations of perchlorate. Of the 12 wells sampled, two wells (01-MW201 and 01-MW202) indicated perchlorate concentrations greater than the California public health goal of 6 µg/L. One of these wells (01-MW201) indicated perchlorate concentrations greater than the drinking water equivalent level (DWEL) for perchlorate of 24.5 µg/L (EPA 2006).

Subsequent to Tier I, groundwater investigations as a part of Tier III of Phase II RI included installing additional monitoring wells and piezometers, conducting additional rounds of groundwater monitoring, and collecting Hydropunch™ samples to delineate the extent of perchlorate in groundwater. The most recent perchlorate concentrations from all monitoring wells and Hydropunch™ locations are presented on Figure 4-7.

Tier III-A. Three groundwater monitoring wells (01-MW208, 01-MW209, and 01-MW210) were installed and groundwater samples were collected from eight monitoring wells at IRP Site 1 in June 2002 (Figure 4-7). Perchlorate concentrations in six monitoring wells equaled or exceeded California public health goal and notification level (6 µg/L) for perchlorate (Table 4-41). Three of these wells (01MW201, 01MW209, and 01MW210) showed perchlorate concentrations greater than the DWEL for perchlorate of 24.5 µg/L (EPA 2006). The samples collected from Monitoring Wells 01-MW209 and 01-MW210 installed in the vicinity of 01-MW201 showed relatively high concentrations of perchlorate (greater than 100 µg/L). All other monitoring wells showed low (less than 9 µg/L) or nondetect concentrations of perchlorate.

Tier III-B. Tier III-A results indicated a potential for a more widespread perchlorate contamination at IRP Site 1. Therefore, 16 piezometers were installed at IRP Site 1 and areas south of IRP Site 1 during Tier III-B investigations (Figure 4-7). Additionally, five rounds of groundwater sampling were conducted from February 2003 to August 2004 during Tier III-B investigations. Twenty-three monitoring wells were sampled during each Tier III-B groundwater sampling round except February-March 2003 sampling event in which 24 monitoring wells were sampled.

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Table 4-41. Perchlorate Sampling Results Summary - Phase II RI

Location	Sampling Zone	January 2002 Concentration (Tier I)	June 2002 Concentration (Tier III-A)	February-March 2003 Concentration (Tier III-B)	June 2003 Concentration (Tier III-B)	October-November 2003 Concentration (Tier III-B)	March 2004 Concentration (Tier III-B)	July-August 2004 Concentration (Tier III-B)	September 2004 Concentration (Tier III-C)	November 2004 Concentration (Tier III-C)	January - February 2005 Concentration (Tier III-D)	March 2005 Concentration (Tier III-D)
Monitoring Wells and Piezometers (ug/L)												
01-PZ01	Bedrock	NS	NS	**8.4**	**10**	**7.9**	**8.8 J**	**12.3 J**	NS	NS	NS	NS
01-PZ02	Bedrock	NS	NS	3 U	1.6 J	1.6 J	1.8 J	2.6 J	NS	NS	NS	NS
01-PZ03	Bedrock	NS	NS	**11.1**	**9.7**	**7.2**	**6.3 J**	5.4	NS	NS	NS	NS
01-PZ04	Bedrock	NS	NS	**13.5**	**7.4**	2.9 J	2.2 J	3.3	NS	NS	NS	NS
01-PZ05	Bedrock	NS	NS	3 U	1.6 J	2 J	2.1 J	2.6 J	NS	NS	NS	NS
01-PZ06	Bedrock	NS	NS	2.2 J	1.2 J, 3 U	0.8 J	3 UJ	1.6 J	NS	NS	NS	NS
01-PZ07	Bedrock	NS	NS	**250**	**398**	**460, 459**	**442**	**459**	NS	NS	NS	NS
01-PZ08	Bedrock	NS	NS	**49**	**21.2**	**24.3**	**33.3**	**57.6, 56.3**	NS	NS	NS	NS
01-PZ09	Bedrock	NS	NS	**74.2**	**94.7**	**88.9**	**94.8, 97.2**	**93.6**	NS	NS	NS	NS
01-PZ10	Bedrock and Alluvium	NS	NS	4.7	**6.8**	**10.3**	**13.7**	**17.6**	NS	NS	NS	NS
01-PZ11	Bedrock	NS	NS	**14.8**	**16.4**	**17.9**	**18.6**	**15.4**	NS	NS	NS	NS
01-PZ12	Bedrock	NS	NS	3 U	1.1 J	1.4 J	3 UJ	2.1 J	NS	NS	NS	NS
01-PZ13	Alluvium	NS	NS	3 U	1.2 J	1.8 J	2.4 J	4.3	NS	4.1	NS	NS
01-PZ14	Alluvium	NS	NS	5.8, 5.9	**7**	**7.2**	5.9 J	**6.1**	NS	5.3	NS	NS
01-PZ15	Alluvium	NS	NS	**34.6**	**40.1, 40.2**	**36.8**	**34.5 J, 34.7 J**	**37.4**	NS	**40.7, 40.8**	NS	NS
01-PZ16	Alluvium	NS	NS	4.3	5.5	4.5, 5.1	5.3 J	**7.7, 8.2**	NS	5.6	NS	NS
01-MW101	Bedrock	4 U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
01-MW102	Bedrock	4	**8.6**	2.3 J, 2.4 J	3.3, 2.8 J	3	2.8 J	3.7	NS	NS	NS	NS
01-MW201	Bedrock	**280**	**218**	**267, 273**	**193**	**135**	**94.6**	**95.3, 96.3**	NS	NS	NS	NS
01-MW202	Bedrock	**7.2 J**	**7.8**	**16.3**	**23.1**	***30.1, 30.3***	**21**	**17.8**	NS	NS	NS	NS
01-MW203	Bedrock	4 UJ	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
01-MW204	Bedrock and Alluvium	4 U	NS	NS	NS	NS	1.2 J	1.8 J	NS	NS	NS	NS
01-MW205	Bedrock and Alluvium	4 U	NS	NS	NS	NS	2.9 J, 3.1	3.3	NS	NS	NS	NS
01-MW206	Bedrock	4 U	NS	NS	NS	NS	NS	NS	NS	1.97 J	NS	NS
01-MW207	Bedrock	4.2	**6**	5.3	5.4	**6.1**	5.2	**6.1**	NS	5.8	NS	NS
01-MW208	Bedrock	NS	4 U	3 U	1.4 J	1.4 J	3 U	2.3 J	NS	NS	NS	NS
01-MW209	Bedrock	NS	**338**	**343**	**351**	**325**	**281**	**294**	NS	NS	NS	NS
01-MW210	Bedrock	NS	**79.6, 148**	**238**	**290**	**306**	**264**	**297**	NS	NS	NS	NS
01-MW211	Bedrock	NS	NS	NS	NS	NS	NS	NS	**34.8**	**32.6**	NS	NS
01-MW212	Bedrock	NS	NS	NS	NS	NS	NS	NS	3 U	1.1 J	NS	NS
01-MW213	Alluvium	NS	NS	NS	NS	NS	NS	NS	**94.9**	**105**	NS	NS
01-MW214	Alluvium	NS	NS	NS	NS	NS	NS	NS	**145, 146**	**124**	NS	NS
[illegible]-MW215	Bedrock	NS	NS	NS	NS	NS	NS	NS	**121**	**114**	NS	NS
[illegible]W216	Alluvium	NS	NS	NS	NS	NS	NS	NS	3 U	1.6 J	NS	NS
[illegible]W217	Bedrock	NS	NS	NS	NS	NS	NS	NS	1.9 J	NS	NS	NS
[illegible]-MW218	Bedrock	NS	NS	NS	NS	NS	NS	NS	**13.9, 14.1**	NS	NS	NS
01-MW219	Bedrock	NS	NS	NS	NS	NS	NS	NS	3 U	NS	NS	NS
01-MW220	Bedrock	NS	NS	NS	NS	NS	NS	NS	1.6 J	NS	NS	NS
01-MW221	Bedrock	NS	NS	NS	NS	NS	NS	NS	2.8 J	NS	NS	NS
01-MW222	Bedrock	NS	NS	NS	NS	NS	NS	NS	3 U	NS	NS	NS
01-MW223	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**74.6**
01-MW224	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.6 J
01-DGMW57	Bedrock and Alluvium	4 U	4 U	NS	NS	NS	NS	NS	NS	1.6 J	NS	NS
01-DGMW58	Bedrock	4 U	NS	NS	NS	NS	NS	NS	NS	2.1 J	NS	NS
18BGMW24	Bedrock	4 U	NS	3 U	NS	NS	NS	NS	NS	1.2 J	NS	NS
Hydropunch Samples (ug/L)												
01-HPA1	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**109, 112**	NS
01-HPA1	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**125**	NS
01-HPA2	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**10.1**	NS
01-HPA3	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	2.2 J	NS
01-HPA4	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPA5	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	4.6, 2.4	NS
01-HPA6	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**51.9**	NS
01-HPA7	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**185**	NS
01-HPA7	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**115**	NS
01-HPA8	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**27**	NS
01-HPA9	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**219**
01-HPA10	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**7.5**
01-HPB1	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**59.6**	NS
01-HPB1	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3.4	NS
01-HPB2	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.99 J	NS
01-HPB3	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.3 J	NS
01-HPB3	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	1 J	NS
01-HPB4	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.5 J	NS
01-HPB4	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	2 J	NS
01-HPB5	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.93 J	NS
01-HPB5	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.3 J	NS
01-HPB6	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPC2	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**60.4**	NS
[illegible]-HPC2	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**36.8**	NS
[illegible]PC3	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.2 J	NS
[illegible]PC3	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
[illegible]-HPC4	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPC4	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS

Table 4-41. Perchlorate Sampling Results Summary - Phase II RI

Location	Sampling Zone	January 2002 Concentration (Tier I)	June 2002 Concentration (Tier III-A)	February-March 2003 Concentration (Tier III-B)	June 2003 Concentration (Tier III-B)	October-November 2003 Concentration (Tier III-B)	March 2004 Concentration (Tier III-B)	July-August 2004 Concentration (Tier III-B)	September 2004 Concentration (Tier III-C)	November 2004 Concentration (Tier III-C)	January - February 2005 Concentration (Tier III-D)	March 2[illegible] Concentration (Tier III-D)
01-HPC5	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.6 J	NS
01-HPC5	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPD1	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**13.3**	NS
01-HPD2	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**40.9**	NS
01-HPD2	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**35.2**	NS
01-HPD3	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**11.7**	NS
01-HPD4	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**37.7**	NS
01-HPD5	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPD5	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	3 U	NS
01-HPE1	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**28.3**	NS
01-HPE2	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	**35.6**	NS
01-HPE2	Bedrock	NS	NS	NS	NS	NS	NS	NS	NS	NS	**39.3**	NS
01-HPE3	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.7, 3.2	NS
01-HPE4	Alluvium	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.6, 1.3	NS

Notes:

Concentrations in **BOLD** indicate values that exceed California public health goal (6 µg/L) for perchlorate.

Concentrations in ***BOLD in highlighted cells*** indicate values that exceed California public health goal (6 µg/L) and tap water PRG (25.5 µg/L) for perchlorate.

ug/L = micrograms per liter

J = the concentration shown is an estimated value

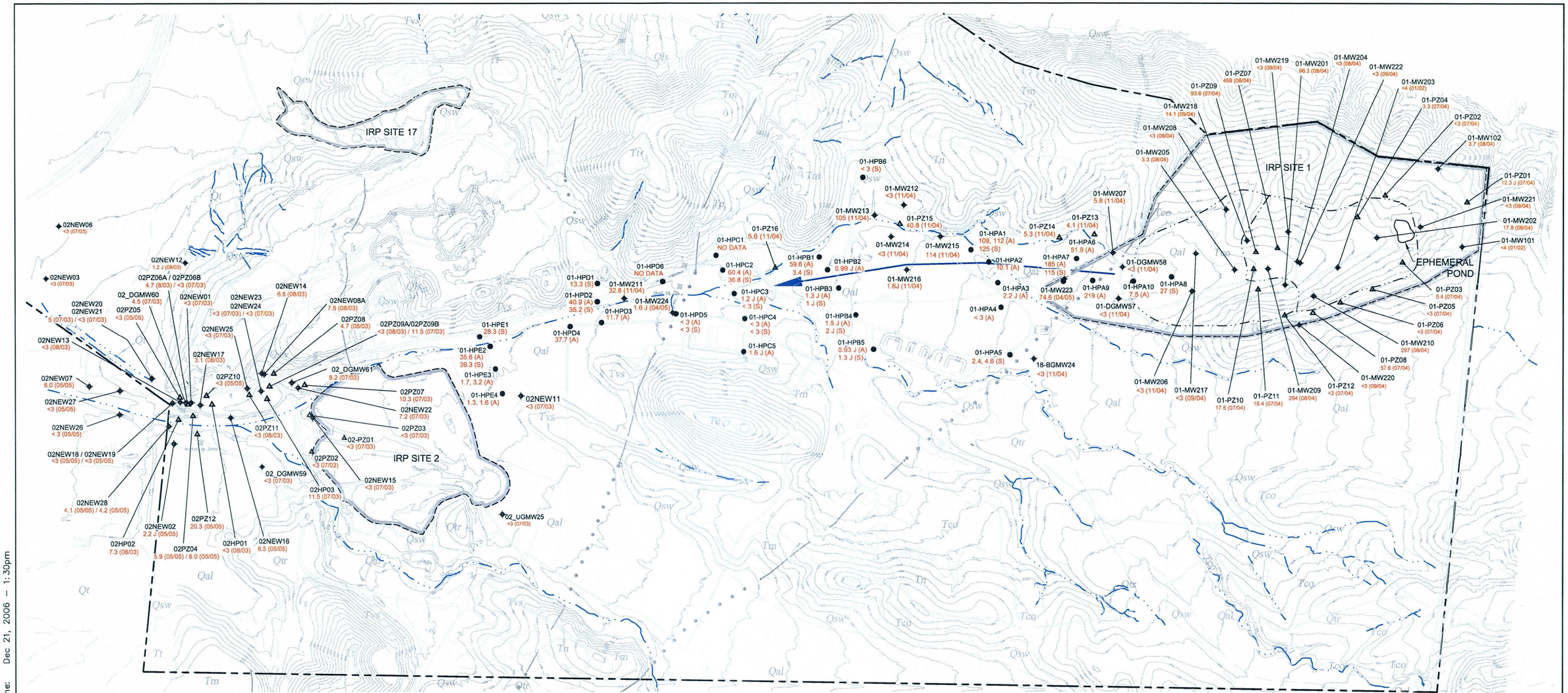
NA = not analyzed

NS = not sampled

PRG = preliminary remediation goal

U = indicates the compound or analyte was analyzed for but was not detected at or above the stated limit

UJ = indicates the compound or analyte was analyzed for but was not detected; and the sample detection limit is an estimated value



LEGEND:

01-HPE1 ●	HYDROPUNCH SAMPLING LOCATION
1.6 J (A) < 3 (S) J	HYDROPUNCH PERCHLORATE CONCENTRATION (A INDICATES ALLUVIUM SAMPLE, S INDICATES WEATHERED BEDROCK SAMPLE, J INDICATES ESTIMATED VALUE)
01-MW209 ✦	4-INCH GROUNDWATER MONITORING WELL
01-PZ11 ▲	2-INCH PIEZOMETER
	MCAS EL TORO BOUNDARY
	EOD TRAINING RANGE BOUNDARY
	IRP SITE BOUNDARY (1, 2, AND 17)
	STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
	GENERAL GROUNDWATER GRADIENT DIRECTION
	GEOLOGIC FAULT, DOTTED WHERE INFERRED
	EXISTING FENCE

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NOTE:

SAMPLE CONCENTRATIONS WITHOUT DATES WERE COLLECTED DURING THE PHASE II RI TIER III-D, JANUARY-MARCH 2005

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
RI	REMEDIAL INVESTIGATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Perchlorate Concentrations in Groundwater

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure 4-7
Project No. 36097	EarthTech — A Tyco International Ltd. Company	

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 4-7.dwg Time: Dec 21, 2006 - 1:30pm

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The following bullets summarize the salient findings of Tier III-B groundwater sampling:

- The perchlorate concentrations consistently exceeded its California public health goal and notification level (6 μg/L) during all sampling rounds in samples collected from 10 monitoring wells/piezometers including, 01-PZ01, 01-PZ07, 01-PZ08, 01-PZ09, 01-PZ11, 01-PZ15, 01-MW201, 01-MW202, 01-MW209, and 01-MW210 (Table 4-41).
- The wells/piezometers that consistently indicated perchlorate concentrations higher than its DWEL of 24.5 μg/L (EPA 2006) during all sampling rounds included 01-PZ07, 01-PZ09, 01-PZ15, 01-MW201, 01-MW209, and 01-MW210.
- The perchlorate concentrations were less than its California public health goal and notification level of 6 μg/L during all sampling rounds in samples collected from seven monitoring wells/piezometers including 01-PZ02, 01-PZ05, 01-PZ06, 01-PZ12, 01-PZ13, 01-MW102, and 01-MW208.
- Relatively high concentrations of perchlorate (ranging from 21.2 to 460 μg/L) were generally observed in the wells located in the central portion of IRP Site 1 in the Northern EOD Training Range. These wells/piezometers include 01-PZ07, 01-PZ08, 01-PZ09, 01-MW201, 01-MW209, and 01-MW210.
- The perchlorate concentrations in the groundwater samples collected from piezometers south of IRP Site 1 were generally low (less than 8 μg/L) except for 01-PZ15 where perchlorate concentrations as high as 40.2 mg/L were detected.

Tier III-C. Tier III-B groundwater sampling results indicated a need to further delineate the perchlorate contamination within the IRP Site 1 boundary and the area south of IRP Site 1 in the vicinity of Piezometer 01-PZ15. To achieve this purpose, 12 additional monitoring wells were installed and two rounds of groundwater monitoring were conducted for perchlorate. The 12 new monitoring wells were sampled during the first monitoring round conducted in September 2004 and 16 monitoring wells were sampled during the second monitoring round conducted in November 2004. The following bullets summarize the salient findings of Tier III-C groundwater investigations:

- South of IRP Site 1, perchlorate concentrations exceeding the California public health goal of 6 μg/L were detected in the samples collected from Monitoring Wells 01-MW211, 01-MW213, 01-MW214, and 01-MW215 (see Figure 4-7 and Table 4-41).
- Relatively high concentrations of perchlorate (greater than 95 μg/L) were detected in Wells 01-MW213, 01-MW214, and 01-MW215 installed north and south of 01-PZ15, in the vicinity of the convergence of IRP Site 1 and the adjacent tributary. The perchlorate concentrations in Wells 01-MW212 and 01-MW216, installed east and west of 01-PZ15, were less than its California public health goal of 6 μg/L suggesting that lateral extent of perchlorate contamination is limited.
- Perchlorate was detected at concentrations less than its California public health goal of 6 μg/L in all the monitoring wells installed within the boundary of IRP Site 1 during the Tier III-C investigations (01-MW216, 01-MW217, 01-MW219, 01-MW220, 01-MW221, and 01-MW222) except for Monitoring Well 01-MW218, where perchlorate was detected at concentrations of 13.9 and 14.1 μg/L.

Tier III-D. To better understand the geology and hydrogeology of the site, and further delineate perchlorate contamination, 31 soil boreholes and two monitoring wells (01-MW223 and 01-MW224) were installed in the southern portion and the areas south of IRP Site 1. The following bullets summarize the salient findings of Tier III-D groundwater sampling:

- Perchlorate concentrations greater than its California public health goal (6 µg/L) were detected in all five Hydropunch™ samples collected from boreholes in the southern portion of IRP Site 1 (01-HPA6, 01-HPA7, 01-HPA8, 01-HPA9, and 01-HPA10). The highest perchlorate concentration of 185 µg/L was detected in the sample collected from the alluvium from borehole location 01-HPA7. A groundwater sample collected from the monitoring well installed in the vicinity of 01-HPA7 (01-MW223) showed a perchlorate concentration of 74.6 µg/L.
- Perchlorate concentrations exceeding the respective California public health goal of 6 µg/L were reported in all five Hydropunch™ samples collected from boreholes in the southern portion of IRP Site 1 (01-HPA6, 01-HPA7, 01-HPA8, 01-HPA9, and 01-HPA10). Of these samples, the highest perchlorate value was reported in the Hydropunch™ sample from Borehole 01-HPA8 at a concentration of 219 µg/L. The alluvium Hydropunch™ sample collected from the alluvium in Borehole 01-HPA7 had a concentration of 185 µg/L; a groundwater sample collected from monitoring well 01-MW223 (also from the alluvium) installed in the vicinity of 01-HPA7, had a perchlorate concentration of 74.6 µg/L.
- Perchlorate is present primarily in the bedrock in the central portion of IRP Site 1. However, south of IRP Site 1, perchlorate contamination is present both in the saturated bedrock as well as in the saturated alluvium. Concentrations of perchlorate in groundwater decrease with distance downgradient of IRP Site 1.
- For each east-west oriented line of borehole locations, perchlorate concentrations were highest in the Hydropunch™ sample collected from the borehole closest to the western reach of Borrego Canyon Wash. Therefore, the relatively high concentrations of perchlorate (greater than the perchlorate DWEL of 24.5 µg/L [EPA 2006]) south of IRP Site 1 appear to closely follow the western reach of Borrego Canyon Wash. This indicates the western reach of Borrego Canyon Wash between IRP Site 1 and IRP Site 2 likely lies above the primary flow path and area of perchlorate -contamination in groundwater.

IRP Site 2 Perchlorate. IRP Site 2, located approximately 4,000 feet downgradient from IRP Site 1, was a former operational landfill, and was used from the late 1950's until about 1980. Groundwater within the bedrock in the IRP Site 2 area is primarily contaminated with TCE and PCE, which are being evaluated separately from perchlorate. The *Draft Evaluation of Perchlorate in Groundwater* for MCAS El Toro (BNI 1999a) reported that perchlorate was not detected in the three wells for which it was analyzed during the sampling event in 1998 (02DGMW59, 02DGMW60, and 02UGMW25). However, during the periodic basewide sampling that is conducted at MCAS El Toro, perchlorate has been detected at IRP Site 2 intermittently beginning in 1999 (CDM 2002a). Since that time, perchlorate concentrations at IRP Site 2 have ranged from nondetect (with a reporting limit of 3 µg/L) to 20.7 µg/L (Table 4-42), and except for slight fluctuations, have remained consistent from 1998 to present.

The general groundwater flow direction at IRP Site 2 is toward the southwest, at a depth of 50 to 70 feet bgs, which is consistent with the gradual increase in groundwater depth from IRP Site 1 to IRP Site 2 that was evident during the Phase II RI Tier III-D field activities. Groundwater at IRP Site 2 consists of groundwater flow from IRP Site 1, the unnamed tributary that IRP Site 1 drains into, and Borrego Canyon Wash. The convergence of the tributary that IRP Site 1 drains into and Borrego Canyon Wash occurs at IRP Site 2. South of IRP Site 2, the groundwater flow direction abruptly changes toward the northwest and the depth significantly increases to approximately 130 feet bgs (Earth Tech 2004b). The geology at IRP Site 2 is similar to the geology at IRP Site 1, in that there are multiple hydrogeologic zones contributing to a very complex hydrogeologic regime. The Draft

Technical Memorandum, Aquifer Test, IRP Site 2, Magazine Road Landfill, Former MCAS El Toro (Earth Tech 2004b) provides detailed hydrogeologic information for IRP Site 2.

Figure 4-7 shows perchlorate concentrations at IRP Site 2 during spring 2005 (some wells have not been sampled since 2003). Perchlorate concentrations in the northernmost IRP Site 2 wells (02PZ07, 02NEW22, and 02_DGMW61) (Figure 4-7) are less than the southernmost IRP Site 1 Tier III-D Hydropunch™ samples at location 01-HPE2. However, the IRP Site 2 wells are believed to be screened in more competent bedrock than zones sampled in IRP Site 1 Tier III-D Hydropunch™ samples at location 01-HPE2 (alluvium and weathered bedrock). The greatest perchlorate concentrations in IRP Site 2 wells appear to be in the area of monitoring well 02PZ12, screened within alluvium and bedrock, near the vicinity of Borrego Canyon Wash (Figure 4-7). The lateral extent of perchlorate contamination to the southeast of IRP Site 2 is defined by monitoring well 02NEW02 at 2.2 µg/L, and the southwestern (downgradient) extent is defined in wells 02NEW07, 02NEW27, and 02NEW26 at 6.0 µg/L, less than 3 µg/L, and less than 3 µg/L, respectively. Although monitoring wells 02NEW20 and 02NEW21 were subsequently removed in late 2003, the perchlorate concentrations obtained from these wells during sampling in 2003 (5 µg/L and less than 3 µg/L, respectively), helps to define the southwestern (downgradient) extent of contamination. Due to perchlorate concentrations at IRP Site 2 similar to the southernmost IRP Site 1 Tier III-D Hydropunch samples (approximately 1,400 feet to the north), and a lack of additional possible sources, the perchlorate at IRP Site 1 is most likely the source of perchlorate in groundwater at IRP Site 2.

4.5.6 N-Nitrosodimethylamine

Phase II RI Tier I Groundwater Sampling and Analysis

Samples were collected from five groundwater monitoring wells, 01-MW102, 01-MW201, 01-MW202, 01-MW207, and 01-DGMW58 in January 2002 for analysis of NDMA (Table 4-35). NDMA was not detected in any of the samples above the reporting limit of 2 µg/L.

4.5.7 Metals

Groundwater Sampling at IRP Site 1 as Part of Stationwide Groundwater Sampling

Analysis of groundwater samples from IRP Site 1 monitoring wells for metals was performed as a part of various Stationwide groundwater monitoring rounds. Table 4-43 presents a summary for metals analyses during these sampling rounds. The detected metals at IRP Site 1 include aluminum, antimony, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, vanadium and zinc. Metals that exceeded MCLs were antimony, chromium, and nickel (Table 4-43), although for antimony, only the reporting limits of non-detected concentrations exceeded the MCL of 6 µg/L.

RI Tier I and Tier III-A Groundwater Sampling and Analysis

Eighteen samples were analyzed for metals as a part of Phase II RI Tier I and Tier III-A groundwater sampling. The metals detected in these samples include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc (Table 4-35). Most of these metals were detected below MCLs. The metals that exceeded the MCLs include chromium, nickel, and thallium (Table 4-44).

4.5.8 General Chemistry

Groundwater Sampling at IRP Site 1 as Part of Stationwide Groundwater Sampling

Total dissolved solids, chloride, sulfate, nitrate/nitrite, alkalinity, bicarbonate, and carbonate were analyzed as part of Stationwide groundwater sampling (CDM 1998). Concentrations of total dissolved solids ranged from 296 mg/L to 823 mg/L. Concentrations of chloride ranged from 21.0 mg/L to 324 mg/L. Concentrations of sulfate ranged from 10.4 mg/L to 275.0 mg/L. Concentrations of nitrate/nitrite expressed as nitrogen ranged from 1.2 mg/L to 20.4 mg/L in IRP Site 1 groundwater. The alkalinity of groundwater at IRP Site 1 ranged from 96 mg/L to 260 mg/L expressed as calcium carbonate. Bicarbonate concentrations ranged from 96 mg/L to 298 mg/L as calcium carbonate. Carbonate was not detected in any samples collected (Table 4-45).

RI Tier I and Tier III-A Groundwater Sampling and Analysis

The concentrations ranging from 1.7 mg/L to 20.1 mg/L of nitrate expressed as nitrogen were observed in IRP Site 1 groundwater during Phase II RI groundwater sampling (Table 4-35). The range of pH for groundwater was detected at 7.01 to 7.8 (Table 4-35).

4.5.9 Radionuclides

A Phase I and Phase II evaluation of radionuclides was performed at Former MCAS El Toro including IRP Site 1 in October and November 1999, and January 2001, respectively (Earth Tech 2000). The methods and procedures for these evaluations are presented in Section 1.4.4.5; this section summarizes the results and conclusions of these investigations. Sampling results are presented in Table 4-46.

The Phase I radionuclide evaluation concluded that origin of the radionuclides in the groundwater is natural and not anthropogenic. This conclusion was based on the following analytical results:

1. Potential anthropogenic radionuclides at concentrations indicative of a release were not reported, although americium241 (an anthropogenic radionuclide) was detected at a concentration equivalent to the minimum detectable activity in two samples.
2. The comparison of uranium isotopes indicated that their ratios were consistent with those for naturally occurring uranium.

The Phase II evaluation of radionuclides confirmed that the radionuclides detected in groundwater at Former MCAS El Toro are naturally occurring. This conclusion was based on the following results:

1. The isotopic ratios for all the samples (except one) fell within the expected range of 137.54 to 138.22, which corresponds to naturally occurring uranium.
2. Uranium236, which is not a naturally occurring isotope of uranium, was not found in any of the analyzed samples.
3. Strontium90 and americium241 were not detected above the reporting limit in the limited number of samples analyzed for these analytes.
4. Gross alpha was less than the California drinking water standard of 15 picoCuries per liter (pCi/L) in all the samples (except one).
5. Gross beta was less than the California MCL of 50 pCi/L in all samples.

Table 4-42. Perchlorate Sampling Results Summary - IRP Site 2

Well ID	Basewide Monitoring Round 8 October 1998 (µg/L)	Basewide Montirong Round 10 April-May 1999 (µg/L)	Basewide Monitoring Round 11 July 1999 (µg/L)	IRP Site 1 Perchlorate Investigation March-April 2000 (µg/L)	Basewide Monitoring Round 12 June 2000 (µg/L)	IRP Site 2 Aquifer Test Pre-Test Sampling Event 1 June 2002 (µg/L)	IRP Site 2 Aquifer Test Pre-Test Sampling Event 2 November 2002 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 1 February 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 2 February 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 3 February 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 4 February 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 5 March 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 6 March 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 7 March 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 8 March 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 9 March 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 10 April 2003 (µg/L)
02NEW01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW02	–	4 U	2 J	4 U	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW06	–	–	–	**8 U**	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW07	–	–	–	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02NEW08A	–	**11**	**9**	–	**8.2**	4 U, 4 U	3.6 J	**8**	**7.7**	**6.8**	**6.8**	**6.2**	**6.4 J**	**7**	**6.4**	5.9, **6.4**	**7.3, 7.2**
02NEW11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW12	–	4 U	4 UJ	–	4 U, 4 U	–	–	–	–	–	–	–	–	–	–	–	–
02NEW13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3.9 J, 4.1 J, 4.1 J, 3.9 J	3.4	3.4
02NEW14	–	–	–	–	–	4 U	4 U	–	–	–	–	–	–	–	–	–	–
02NEW15	–	4 U	4 U	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02NEW16	–	3 J	6	–	–	**9**	**8.4**	–	–	–	–	–	–	–	–	–	–
02NEW17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW20	–	–	–	**8 U, 8 U**	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW21	–	–	–	4, 4, 4 U	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW22	–	–	–	–	–	4 U	4.2	–	–	–	–	–	–	–	–	–	–
02NEW23	–	–	–	**8 U**	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW24	–	–	–	**8 U**	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW25	–	–	–	–	–	4 U	4 U	–	–	–	–	–	–	–	–	–	–
02NEW26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02NEW28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02HP01	–	–	–	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02HP02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02HP03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ02	–	–	–	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02PZ03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ04	–	–	–	–	–	–	**6.7 U**	–	–	–	–	–	–	–	–	–	–
02PZ05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ06A	–	–	–	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02PZ06B	–	–	–	–	–	–	4 U	–	–	–	–	–	–	–	–	–	–
02PZ07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ09A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ09B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02PZ12	–	–	–	–	–	–	**12.4 J**	–	–	–	–	–	–	–	–	–	–
02UGMW25	4 U	4 U	2 J	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02DGMW59	4 U	4 U	4 U	–	–	–	–	–	–	–	–	–	–	–	–	–	–
02DGMW60	4 U	4 U	4 U	–	–	–	4 U, 4 U	3.9	3.8	3	2.9 U	2.7 J	3.2 J	3.8, 3.8	3.6	3.1	3.6
02DGMW61	–	5	5	–	–	4 U	4 U	–	**7.6, 5.7, 5.3**	5.2	5.9 J, **6.3 U**, 6.1	5.6	5.8 J	**6.8**	**6.4**	**6.7, 6.3**	**7.1**

Table 4-42. Perchlorate Sampling Results Summary - IRP Site 2

Well ID	IRP Site 2 Aquifer Test Sampling Event 11 April 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 12 April 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 13 April 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 14 May 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 15 May 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 16 May 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 17 June 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 18 June 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 19 June 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 20 June 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 21 June 2003 (µg/L)	IRP Site 2 Aquifer Test Sampling Event 22 July 2003 (µg/L)	IRP Site 2 Aquifer Test Post-Test Sampling July-August 2003 (µg/L)	IRP Site 2 MNA Monitoring Event 1 September 2004 (µg/L)	IRP Site 2 MNA Monitoring Event 2 May 2005 (µg/L)	IRP Site 2 MNA Monitoring Event 3 August 2005 (µg/L)
02NEW01	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--
02NEW02	--	--	--	--	--	--	3 U	2.8 J, 3.8, 8.2, 3.7, 4.4	3.8	3.5 J	4.2	4.3	3.4 J	--	2.2 J	3 U
02NEW03	--	--	--	--	--	--	--	--	--	--	--	--	2.3 J	--	--	--
02NEW06	--	--	--	--	--	--	--	--	--	--	--	--	2.2 J	--	--	--
02NEW07	--	--	--	--	--	--	--	--	--	--	--	--	5.1, 5.1 J	--	6	**6.8**
02NEW08A	**7.4**	**8.1 J**	**6.2**	**6.3 J**	5.9	4.6	4.9	**8**	**8.2**	**8.3 J**	**8.1**	**8.3, 8.2**	**7.5, 7.2**	--	--	**15.5**
02NEW11	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02NEW12	--	--	--	--	--	--	--	--	--	--	--	--	1.2 J	--	--	3.8
02NEW13	3.2	3.7 J	2.6 J	2.4 J	2.5 J	1.7 J	3 U	2.9 J	3.1	2.6 J	2.8 J	2.8 J	2.3 J	--	--	--
02NEW14	--	--	--	--	--	--	--	--	--	--	--	--	**6.8**	--	--	--
02NEW15	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02NEW16	--	--	--	--	--	--	--	--	--	--	--	--	**10.3**	--	**6.5**	**7.2**
02NEW17	--	--	--	--	--	--	--	--	--	--	--	--	3.1	--	--	--
02NEW18	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	3 U	3 U
02NEW19	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	3 U	3 U
02NEW20	--	--	--	--	--	--	--	--	--	--	--	--	5	--	--	--
02NEW21	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--
02NEW22	--	--	--	--	--	--	--	--	--	--	--	--	**7.2 J**	--	--	--
02NEW23	--	--	--	--	--	--	--	--	--	--	--	1.8 J	--	--	--	--
02NEW24	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--	--
02NEW25	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--	--
02NEW26	--	--	--	--	--	--	--	--	--	--	--	--	--	2.3 J	3 U	5.1 J
02NEW27	--	--	--	--	--	--	--	--	--	--	--	--	--	3 U	3 U	3 U
02NEW28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.1, 4.2	**10.3, 10.5**
02HP01	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--
02HP02	--	--	--	--	--	--	--	--	--	--	--	--	**7.3**	--	--	--
02HP03	--	--	--	--	--	--	--	--	--	--	--	--	**11.6**	--	--	--
02PZ01	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02PZ02	--	--	--	--	--	--	--	--	--	--	--	--	3 U, 3 U	--	--	1.9 J
02PZ03	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02PZ04	--	--	--	--	--	--	--	--	--	--	--	--	**6.8**	--	5.9, 6	**7.5, 7.6**
02PZ05	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	3 U	3 U
02PZ06A	--	--	--	--	--	--	--	--	--	--	--	--	4.7	--	--	--
02PZ06B	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--
02PZ07	--	--	--	--	--	--	--	--	--	--	--	--	**10.3**	--	--	--
02PZ08	--	--	--	--	--	--	--	--	--	--	--	--	4.7	--	--	**6.5 J**
02PZ09A	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	--
02PZ09B	--	--	--	--	--	--	--	--	--	--	--	--	**11.5**	--	--	--
02PZ10	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	3 U	3 U
02PZ11	--	--	--	--	--	--	--	--	--	--	--	--	3 U, 3 U	--	--	--
02PZ12	--	--	--	--	--	--	--	--	--	--	--	--	**20.7 J**	--	**20.3**	**16.7**
02UGMW25	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02DGMW59	--	--	--	--	--	--	--	--	--	--	--	--	3 U	--	--	3 U
02DGMW60	3.2	3.7 J	2.5 J	2.2 J	2.2 J	2.2 J, 1.9 J	2 J	3.8	3.6	3.7	3.6	4.3	4.5 J	--	--	--
02DGMW61	**7.6**	**8.4**	6, **6.3**	**6.5 J**	**6.9**	6	**6.1**	**9.6**	**9.7, 10.1**	**10.7**	**11**	**11.5**	**8.2 J**	--	--	--

Notes:

-- = the well was not sampled for perchlorate during the sampling event indicated.

ug/L = micrograms per liter

J = the concentration is an esimate

ID = identification

IRP = Installation Restoration Program

MNA= Monitored Natural Attenuation

U = the analyte was not detected above the reporting limit shown

UJ = not detected at the threshold indicated; however, the level stated is an estimated value

Bold indicates concentration above the California public health goal for perchlorate of 6 µg/L.

Table 4-43: Metals Sampling Results at IRP Site 1 – Stationwide Groundwater Monitoring

Well Number	Screen Depth (ft bgs)	Sample Date	Aluminum	Antimony	Arsenic	Barium	Calcium	Chromium	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Vanadium	Zinc
MCL (µg/L)			1,000	6	50	1,000	-	50	1,300	-	15	-	-	100	-	50	-	-	-	-
01_DGMW57	83	12/10/92	31.0 U	12.1 U	0.7 B	18.2 B	94,600	3.7 U	1.4 B	2.3 U	0.6 U	37,800	74.7	12.6 B	4,860 B	7.7	2.1 U	99,600	4.3 B	3.8 B
		6/14/93	19.2 B	**12.0 B**	1.7 B	12.1 BE	74,400	2.9 U	2.7 B	14.6 B	0.4 U	30,600	44.4	8.1 B	3,650 B	32.5 B	1.2 U	83,200	4.1 B	5.5 B
		2/7/96	200.0 U	60.0 U	10.0 U	200.0 U	68,000	10.0 U	25.0 U	100.0 U	3.0 U	27,000	37.0	40.0 B	2,530 J	9.0	10.0 U	60,000	50 U	20.0 U
		2/7/96	200.0 U	60.0 U	10.0 U	200.0 U	68,000	10.0 U	25.0 U	100.0 U	3.0 U	28,000	62.0	40.0 B	2,580 J	7.0	10.0 U	62,000	50 U	20.0 U
		4/8/96	55.9	NA	NA	12.3	70,400	1.2	2.9	NA	NA	29,600	44.7	35.4	3,360 J	12.8	NA	75,400	4.7	8.6
		11/20/96	12.2 B	60.0 U	10.0 U	11.5 B	62,800	10.0 U	3.3 B	100.0 U	1.1 B	26,500	5.4 B	64.7	2,870 B	5.0 U	10.0 U	63,700	3.1 B	5.9 B
		3/25/97	200.0 U	60.0 U	10.0 U	10.9 B	67,400	10.0 U	3.8 B	100.0 U	5.0 U	28,000	5.8 B	55.9	3,160	6.2	10.0 U	63,400	3.3 B	4.3 B
01_DGMW58	77	12/14/92	31.0 U	12.1 U	1.4 B	16.8 B	87,000	3.7 U	1.0 B	17.2 B	0.6 U	13,200	45.4	**110.0**	2,040 B	2.7 B	2.3 B	36,400	9.1 B	2.4 B
		6/14/93	10.2 B	9.0 U	2.6 B	23.3 BE	90,300	2.9 U	0.7 U	13.2 B	0.4 U	12,100	2.4 B	91.8	1,150 B	6.9	1.2 U	44,100	11.1 B	2.8 B
		6/14/93	13.2 B	9.0 U	2.1 B	22.7 BE	89,400	2.9 U	0.7 U	8.2 U	0.4 U	12,000	2.2 B	96.9	1,200 B	8.2 S	1.2 U	43,800	11.9 B	2.2 B
		2/28/96	200.0 U	60.0 U	10.0 U	200.0 U	81,000	13.0	25.0 U	184.0	3.0	11,000	18.0	**110.0**	1,750 J	5.0 U	10.0 U	36,000	50 U	24.0
		2/28/96	200.0 U	60.0 U	10.0 U	200.0 U	82,000	11.0	25.0 U	340.0	4.0	13,000	51.0	**110.0**	1,750 J	5.0 U	10.0 U	36,000	50 U	31.0
		4/5/96	34.5 U	NA	NA	23.1	78,900	1.7	2.0	NA	NA	11,000	1.2	98.5	1,150 J	3.9	NA	40,900	12.1	7.2
		11/18/96	200.0 U	60.0 U	10.0 U	25.2 B	83,900	10.0 U	25.0 U	100.0 U	5.0 U	11,300	15.0 U	89.4	1,070 B	5.0 U	10.0 U	36,400	10.6 B	6.9 B
		3/13/97	200.0 U	60.0 U	10.0 U	22.1 B	87,300	10.0 U	3.6 B	23.8 B	1.6 B	11,500	1.6 B	**157.0**	968 B	5.1	10.0 U	30,400	7.9 B	6.1 B
01_MW101	148	4/2/96	57.7 U	NA	NA	7.6	55,500	2.1	2.0 U	NA	NA	16,000	86.1	22.3	7,630 J	3.4 U	NA	87,800	4.9	6.6
		11/20/96	53.3 B	60.0 U	10.0 U	25.5 B	42,300	10.0 U	1.8 B	100.0 U	0.9 B	13,200	16.2	12.1 B	8,940	5.0 U	10.0 U	66,700	2.9 B	9.1 B
		3/13/97	14.0 B	60.0 U	10.0 U	10.3 B	42,700	10.0 U	8.8 B	13.3 B	1.4 B	11,500	11.0 B	24.2 B	8,530	3.0 B	10.0 U	58,100	50 U	9.3 B
		7/11/97	15.9 B	2.3 B	1.4 U	12.3 B	38,900	2.5 B	3.4 B	19.7 B	0.8 U	9,930	15.3	60.8	5,660	2.0 U	0.7 U	56,000	2.2 B	18.8 B
		7/11/97	27.3 B	1.3 U	1.4 U	11.2 B	37,000	1.6 B	3.3 B	7.4 B	0.8 U	9,380	13.4 B	58.3	5,350	3.9 B	0.7 U	52,400	2.2 B	10.8 B
		10/24/97	33.4 U	1.7 B	1.2 U	6.0 B	39,200	1.1 B	1.2 B	14.0 U	0.7 U	9,710	19.6	**207.0**	4,220 B	2.4 U	0.7 U	53,300	1.0 B	9.1 B
01_MW102	135	4/2/96	34.9 U	NA	NA	29.1	129,000	**530.0**	3.9 U	NA	NA	19,800	158.0	**852.0**	9,760 J	3.4 U	NA	170,000	7.7	55.5
		11/20/96	94.6 B	60.0 U	2.9 B	9.2 B	102,000	**70.9**	12.6 B	2,350.0	5.0 U	8,100	35.9	**227.0**	4,400 B	5.0 U	10.0 U	82,300	4.6 B	15.5 B
		3/13/97	200.0 U	60.0 U	10.0 U	7.1 B	113,000	10.0 U	2.6 B	17.2 B	5.0 U	6,740	64.3	**445.0**	3,740 B	4.2 B	10.0 U	74,600	2.1 B	8.2 B
		7/9/97	35.9 B	1.7 B	1.4 U	8.8 B	107,000	3.5 B	26.0	66.5 B	0.8 U	6,150	61.4	**843.0**	3,400 B	2.0 U	0.7 U	77,400	3 B	194.0
		10/24/97	33.4 U	1.4 U	1.2 U	3.4 B	109,000	2.0 B	2.5 B	14.0 U	1.0 B	5,180	121.0	**1,390.0**	2,980 B	2.4 U	0.7 U	71,900	1.9 B	16.8 B
01_MW201	57	4/8/96	34.5 U	NA	NA	8.3	104,000	24.2	5.2	NA	NA	16,600	19.4	44.4	9,680	3.4 U	NA	121,000	4.0	6.3 U
		11/18/96	200.0 U	60.0 U	10.0 U	5.2 B	88,000	2.8 B	2.1 B	112.0	2.1 B	6,270	123.0	**548.0**	3,520 B	5.0 U	10.0 U	52,200	50.0 U	18.3 B
		3/13/97	200.0 U	60.0 U	2.1 B	2.0 B	86,500	0.7 B	2.8 B	13.6 B	5.0 U	4,880 B	10.0 B	**105.0**	2,730 B	5.4	10.0 U	42,200	2.8 B	5.4 B
		7/9/97	23.8 U	1.3 U	1.5 B	8.9 B	99,200	4.2 B	7.4 B	17.5 B	0.8 U	3,950 B	12.7 B	**224.0**	2,440 B	4.6 B	0.7 U	50,100	4.3 B	17.0 B
		10/24/97	33.4 U	1.4 U	1.8 B	8.1 B	99,400	1.4 B	1.4 B	14.0 U	1.0 B	3,520 B	3.6 B	**120.0**	2,280 B	2.4 U	0.7 U	46,900	4.2 B	8.5 B

Notes:
Source: CDM 1998
All units are micrograms per liter (µg/L)
Concentrations in **BOLD** indicate the values above Cal-EPA primary MCLs
B = The value is below the reporting limit but above the minimum detection limit
bgs = below ground surface
Cal-EPA = California Environmental Protection Agency
CDM = Camp Dresser & McKee
IRP = Installation Restoration Program
J = The level stated is an estimated value
MCL = maximum contaminant level
NA = The analyte was not analyzed
U = Not detected at the threshold indicated

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Table 4-44: Frequency of Detection of Metals – RI Tier I and Tier III-A Groundwater Sampling

Metal	Number of Detections*	Number of Detections Above MCLs	Maximum Concentration (µg/L)
Aluminum	2	0	102
Antimony	1	0	2.1 J
Arsenic	8	0	4.4
Barium	18	0	110
Beryllium	1	0	0.14 J
Cadmium	2	0	0.77 J
Calcium	18	0	166,000
Chromium	12	1	157
Cobalt	4	0	6.3
Copper	2	0	17
Iron	9	0	1,610
Lead	4	0	9.2
Magnesium	18	0	38,800
Manganese	12	0	260
Mercury	18	0	0.5
Nickel	9	5	1,300
Potassium	18	0	5,100 J
Selenium	6	0	29.9
Silver	2	0	0.39 J
Sodium	18	0	79,700
Thallium	3	3	4.1
Vanadium	10	0	15.5
Zinc	17	0	83

Note:
*A total of 18 samples (including duplicates) were analyzed.
µg/L = micrograms per liter
J = the concentration is an estimated value
MCLs = maximum contaminant levels
RI = remedial investigation

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Table 4-45. General Chemistry Results, Stationwide Groundwater Sampling

Well Location	Sample Date	Total Dissolved Solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Nitrate/Nitrite (mg-N/L)	Alkalinity (mg-$CaCO_3$)	Bicarbonate (mg-$CaCO_3$)	Carbonate (mg-$CaCO_3$)
01-MW101	2-Apr-96	NA	168.0	24.9	NA	NA	NA	NA
	20-Nov-96	406	83.8	85.0	1.2	138	138	2 U
	13-Mar-97	388	64.3	69.3	1.2	152	152	2 U
	11-Jul-97	303	64.5	14.5	2.0 U	137	137	2 U
	11-Jul-97	310	76.5	17.6	2.0 U	135	135	2 U
	24-Oct-97	296	77.5	12.4	1.9	96	96	2 U
01-MW102	02-Apr-96	NA	324.0	45.7	NA	NA	NA	NA
	20-Nov-96	581	166.0	42.0	1.8	246	246	2 U
	13-Mar-96	597	131.0	10.4	1.6	260	260	2 U
	09-Jul-97	600	138.0	20.0 U	4.0 U	236	236	2 U
	24-Oct-97	586	129.0	13.8	1.7	231	231	2 U
01-MW201	08-Apr-96	NA	202.0	70.4	NA	NA	NA	NA
	18-Nov-96	522	36.4	53.8	20.4	179	179	2 U
	13-Mar-97	447	62.0	99.3	18.7	187	187	2 U
	09-Jul-97	463	42.0	76.9	11.7	177	177	2 U
	24-Oct-97	496	37.4	72.7	9.5	169	169	2 U
01-DGMW57	10-Dec-92	808	91.6	250.0	1.7	235	235	NA
	14-Jun-93	602	79.5	139.0	1.5	237	237	NA
	07-Feb-96	494	58.0	81.0	3.1	244	298	2 U
	08-Apr-96	NA	59.5	94.2	NA	NA	NA	NA
	20-Nov-96	508	61.7	80.7	2.3	250	250	2 U
	25-Mar-97	505	59.6	73.6	2.4	249	249	2 U
01-DGMW58	14-Dec-92	429	61.2	21.1	5.8	234	234	NA
	14-Jun-93	462	24.5	58.2	NA	251	251	NA
	14-Jun-93	468	24.8	58.5	7.7	252	252	NA
	28-Feb-96	404	21.0	23.0	11.0	227	277	2 U
	05-Apr-96	NA	23.5	21.7	NA	NA	NA	NA
	18-Nov-96	441	38.5	16.2	9.9	211	211	2 U
	13-Mar-97	409	59.9	19.1	8.1	210	210	2 U
18-BGMW24	12-Nov-92	731	56.3	251.0	8.6	204	204	NA
	09-Jul-93	733	50.2	242.0	7.4	206	206	NA
	07-Feb-96	718	53.0	222.0	12.0	238	290	2 U
	26-Nov-96	808	49.9	253.0	9.7	254	254	2 U
	26-Nov-96	822	55.5	275.0	9.8	254	254	2 U
	25-Mar-97	823	55.5	239.0	10.4	258	258	2 U

Notes:

mg-$CaCO_3$ = milligrams as calcium carbonate

mg-N/L = milligrams per liter as nitrogen

mg/L = milligrams per liter

NA = not analyzed

U = the analyte was not detected above the reporting limit indicated

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Table 4-46. Summary of Phase I and Phase II Evaluation of Radionuclides Results

Analyte	Units	MCL	Phase I Radionuclide Investigation				Phase II Radionuclide Investigation		
			01-MW201 LD001 10/25/1999	01-MW203 LD094 11/19/1999	01-MW207 LD089 11/18/1999	01-MW207 (dup) LD090 11/18/1999	01-MW201 LD224 1/8/2001	01-MW203 LD223 1/23/2001	01-MW207 LD225 1/30/2001
Am^{241}	pCi/L		<0.048 ± 0.029	<0.044 ± 0.027	<0.021 ± 0.21	0.036 ± 0.032	NA	NA	NA
Gross Alpha	pCi/L	15[a,b]	<2.1 ± 1.2	<2.8 ± 1.6	7.2 ± 2.1	6.0 ± 1.7	NA	NA	NA
Gross Beta	pCi/L	50[b]	0.6 ± 0.96	3.6 ± 1.5	6.9 ± 1.6	3.8 ± 1.1	NA	NA	NA
Pb^{210}	pCi/L		<0.60 ± 0.36	<0.65 ± 0.41	<0.69 ± 0.45	<0.73 ± 0.46	NA	NA	NA
Ra^{226}	pCi/L	3[a]	<0.15 ± 0.10	<0.14 ± 0.070	0.36 ± 0.19	0.47 ± 0.21	NA	NA	NA
Ra^{228}	pCi/L		<0.90 ± 0.054	<0.81 ± 0.050	<1.19 ± 0.73	<1.69 ± 1.0	NA	NA	NA
Ra^{Total}	pCi/L	5[a,b,c]	<0.90	0.81	0.36	0.47	NA	NA	NA
Th^{228}	pCi/L		<0.74 ± 0.30	<0.017 ± 0.036	<0.085 ± 0.040	<0.094 ± 0.047	NA	NA	NA
Th^{230}	pCi/L		<0.26 ± 0.17	0.051 ± 0.032	0.183 ± 0.064	0.168 ± 0.065	NA	NA	NA
Th^{232}	pCi/L		<0.30 ± 0.14	<0.031 ± 0.016	0.095 ± 0.045	<0.055 ± 0.031	NA	NA	NA
U^{234}	pCi/L		0.35 ± 014	0.86 ± 0.016	3.02 ± 0.44	3.2 ± 0.47	NA	NA	NA
U^{235}	pCi/L		0.023 ± 0.039	0.071 ± 0.038	0.274 ± 0.086	0.295 ± 0.093	NA	NA	NA
U^{238}	pCi/L		0.153 ± 0.091	0.74 ± 0.15	2.94 ± 0.43	3.09 ± 0.45	NA	NA	NA
U^{total}	pCi/L	20[b]	0.526	1.67	6.23	6.59	NA	NA	NA
Adjusted Gross Alpha	pCi/L		[d]	[d]	0.97	[d]	NA	NA	NA
Proportion U^{235}	%		-	1.46	1.42	1.45	NA	NA	NA
Proportion U^{238}	%		-	98.54	98.58	98.55	NA	NA	NA
Geochron U^{238} : U^{235} Ratio	-		NA	NA	NA	NA	137.94	138.21	137.7
LLNL U^{238} : U^{235} Ratio	-		NA	NA	NA	NA	137.89	137.83	137.74
Tritium	TU		NA	NA	NA	NA	<0.8 ± 0.5	<0.8 ± 0.5	2.7 ± 0.6
Tritium	pCi/L	20,000[a,b]	NA	NA	NA	NA	<2.6 ± 1.6	<2.6 ± 1.6	8.6 ± 1.9
$Oxygen^{18}$	%		NA	NA	NA	NA	-4.9	-5	-5.9
$Hydrogen^{2}$	%		NA	NA	NA	NA	-34	-35	-35

Notes:

[a] = Federal MCL

[b] = California MCL

[c] = radium 226 + 228

[d] = negative

0.6 ± 0.96 = analytical result (0.6) and error (±0.96)

- =Relative proportion of uranium isotopes was not calculated since U235 was not detected.

% = parts per thousand

< = the analyte was not detected above the concentration shown

Ra = radium

Th = Thorium

Pb = lead

U = Uranium

± = plus or minus

adjusted gross alpha = gross alpha - total uranium

dup = duplicate sample

GeoChron = GeoChron Laboratory

LLNL = Lawrence Livermore National Laboratory

MCL = maximum contaminant level

NA = not analyzed

pCi/L = picoCuries per liter

TU = tritium units (1TU = 3.2 pCi/L)

U^{238} : U^{235} = ratio of $uranium^{238}$ to $uranium^{235}$

Am = americium

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4.5.10 Summary of the Nature and Extent of Groundwater Contamination at IRP Site 1

The following summarizes the conclusions regarding the nature and extent of groundwater contamination at IRP Site 1 based on the results of Basewide groundwater monitoring results, Verification of Perchlorate Study and Phase I and Phase II evaluation of radionuclides in groundwater:

1. Very few VOCs have been detected at IRP Site 1 during Stationwide groundwater monitoring and Phase II RI Tier I groundwater sampling events. The concentrations of detected VOCs have been generally low and below MCLs. This suggests that negligible VOC contamination exists at IRP Site 1.
2. SVOCs were detected only sparingly and at very low concentrations during the Stationwide groundwater monitoring, and only one SVOC was detected during Phase II RI Tier I groundwater sampling. This suggests that negligible SVOC contamination exists at IRP Site 1.
3. Low concentrations of motor oil hydrocarbons, TPH-D, and TPH-G were detected at some IRP Site 1 monitoring wells.
4. The highest perchlorate concentrations exceeding the perchlorate DWEL (24.5 µg/L [EPA 2006]) by over an order of magnitude were observed in the central portion of IRP Site 1 in the Northern EOD Training Range.
5. Relatively high concentrations of perchlorate (greater than the DWEL of 24.5 µg/L [EPA 2006]) were observed south of the central source area particularly in the aquifer between IRP Site 1 and IRP Site 2 beneath the western reach of Borrego Canyon Wash. Perchlorate is predominantly present in the bedrock at IRP Site 1; however, downgradient of IRP Site 1 perchlorate is present both in the saturated bedrock and the saturated alluvium. The concentrations decrease with distance from IRP Site 1 and after convergence of other groundwater sources (Borrego Canyon Wash and the tributary adjacent to IRP Site 1).
6. NDMA was not detected in any of the samples collected from five monitoring wells, 01-MW102, 01-MW201, 01-MW202, 01-MW207, and 01-DGMW58 above the reporting limit of 2 µg/L.
7. The Phase I and Phase II radionuclide evaluations proved that radionuclides at IRP Site 1 are naturally occurring and are not related to site activities.

4.6 NATURE AND EXTENT OF SURFACE WATER CONTAMINATION

Surface water samples were collected during Tier III-C of the Phase II RI. Three samples were collected from the Ephemeral Pond in the northern portion of the Northern EOD Training Range (one filtered), and two samples were collected from the southern portion of IRP Site 1 (one filtered), where surface water flows into the headwaters of the western reach of Borrego Canyon Wash, near Monitoring Well 01-MW207 (Figure 4-7). Samples were analyzed for VOCs, SVOCs, PAHs, perchlorate, hydrocarbons, general chemistry, and metals. The filtered samples were only analyzed for metals. Table 4-47 presents a summary of detected analytes in the surface water samples.

4.6.1 Volatile Organic Compounds

The only VOC that was detected above its laboratory detection limit was acetone (a common laboratory contaminant) in two surface water samples (Table 4-47).

4.6.2 Semivolatile Organic Compounds

SVOCs were not detected above their laboratory detection limits in any of the surface water samples.

4.6.3 Polycyclic Aromatic Hydrocarbons

PAHs were not detected above their laboratory detection limits in any of the surface water samples.

4.6.4 Explosives Residues

The only explosive residue detected in any of the surface water samples was RDX, detected in the downgradient stream sample, at a concentration of 1 µg/L (Table 4-47).

4.6.5 Perchlorate

Perchlorate was not detected above its detection limit in any surface water sample.

4.6.6 Hydrocarbons

Low concentrations of TPH as motor oils, TPH as diesel, and TPH as gasoline were detected in three surface water samples collected near the Ephemeral Pond and western reach of Borrego Canyon Wash. The maximum concentrations of TPH as motor oils, TPH as diesel, and TPH as gasoline were 0.09 mg/L, 0.08 mg/L, and 0.05 mg/L, respectively (Table 4-47).

4.6.7 General Chemistry

The concentrations ranging from 0.029 to 0.36 mg/L of nitrate (expressed as nitrate) were observed in surface water samples. The range of pH for surface water was detected at 7.02 to 7.29.

4.6.8 Metals

The metals detected in surface water samples at IRP Site 1 include, aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc. Of these metals aluminum, arsenic, barium, copper, iron, lead, and mercury exceeded their National Recommended Water Quality Criteria or risk-based screening values for aquatic life (see Table 4-47). The maximum sodium concentration of 6,350 µg/L was below the Water Quality Objective of 180,000 µg/L for the Irvine Forebay I portion of the Lower Santa Ana River Basin (CRWQCB 1995).

4.7 DATA VALIDATION

Samples were submitted to the Naval Facilities Engineering Service Center (NFESC)-evaluated or the Navy-approved laboratories for analysis by methods cited in the Phase II RI Work Plan (Earth Tech 2001a). The primary laboratory, Applied Physics and Chemistry Laboratory of Chino, California, is certified by the California State Environmental Laboratory Accreditation Program (ELAP) (Certificate #1431). Other laboratories used were Paradigm Analytics of Wilmington, NC (for dioxins) and Maxxam Analytics of Waterloo, Ontario, Canada (for NDMA). Laboratory data was validated by Laboratory Data Consultants of Carlsbad, CA, in accordance with

- *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis* (EPA 1999),
- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis* (EPA 1994).

Table 4-47: IRP Site 1 Ephemeral Pond and IRP Site 1 Stream Surface Water Sample Results

Analyte	NRWQC (Human Health)	Risk-based Screening Values (Aquatic Life)	01-POND LE524	01-POND-OUTFALL LE619	01-POND-OUTFALL LE620	01-STREAM LE622	01-STREAM LE623
VOCs (µg/L)							
Acetone	–	1,500 [1]	50 U	6 J	NA	6 J	NA
Explosives Residues (µg/L)							
RDX	–	186 [3]	1 U	1 U	NA	1	NA
Hydrocarbons (mg/L)							
TPH as Motor Oil	–	–	0.09 J	0.07 J	NA	0.04 J	NA
TPH as Diesel	–	–	0.08 J	0.02 J	NA	0.01 J	NA
TPH as Gasoline	–	–	0.05	0.03 J	NA	0.05 U	NA
General Chemistry (mg/L)							
Alkalinity	–	–	57.6	62.9	NA	79	NA
Hardness	–	–	NA	53	NA	66	NA
Ammonia	–	–	0.79	0.36	NA	0.28	NA
pH	5 - 9 [5]	–	7.02	7.02	NA	7.29	NA
Chloride	–	–	0.68	2.6	NA	2.2	NA
Fluoride	–	–	0.07 J	0.058 J	NA	0.075 J	NA
Nitrate as N	2258 [5]	–	0.088	0.36	NA	0.029 J	NA
Sulfate	–	–	0.73	1.8	NA	1.8	NA
Metals (µg/L)							
Aluminum	–	87 [5]	**2,840**	**3,740**	**131**	**1,390**	61.7 J
Antimony	5.6 [4]	30 [1]	10 U	10 U	10 U	4.7 J	3.4 J
Arsenic	0.018 [4]	150 [2]	5 U	**1.2**	**1.1**	**0.8**	**0.69**
Barium	1000 [5]	4 [1]	**50.2**	**39.3**	**33.5**	**45.9**	**43.3**
Beryllium	4 [4]	0.66 [1]	2 U	0.1	0.043 J	0.048 J	0.1 U
Cadmium	5 [8]	1.47 [2,6]	0.24 J	2 U	2 U	2 U	2 U
Calcium	–	–	17200	17900	17000	22900	23400
Chromium	50 [8]	11 [2,7]	7.9	3.3 J	1.6 J	2.4 J	2.5 J
Cobalt	–	23 [1]	1.1 J	1.1 J	0.44 J	0.55 J	0.32 J
Copper	1300 [4]	5.5 [2,6]	4.1 J	5.3	2.5 J	**9.6**	**8.1**
Iron	300 [5]	1000 [5]	**1890**	**1140**	81.3	**725**	32.3 J
Lead	–	1.4 [2,6]	**3.1** J	0.93	0.35	0.95	0.59
Magnesium	–	–	3360	3830	3280	3790	3660
Manganese	50 [5]	120 [1]	26.4	24.2	15.1	13.8	3.5 J
Mercury	–	0.77 [4]	0.21 J	**0.89**	0.082 J	0.3 J	0.56
Nickel	610 [4]	32.2 [2,6]	4.1 J	3.5	2.8	2.6	3
Potassium	–	–	3440	2650	2470	5140	5230
Selenium	170 [4]	5 [2]	10 U	0.4 J	0.2 J	0.37 J	1 U
Sodium	–	–	4060	6150	6350	4140	4360
Vanadium	–	20 [1]	6.1 J	3.8 J	2.5 J	3.9 J	1.3 J
Zinc	7400 [4]	73 [2,6]	20.8	15.3	12.1	19.3	17

Notes:

Concentrations in **BOLD** indicate values exceeding NRWQC (Human Health) or Risk-based Screening Thresholds.

NRWQC (Human Health) = National Recommended Water Quality Criteria (Based on human health carcinogenic risk of 10^{-6} for water and organism consumption)

[1]US GL – Tier II Secondary Chronic Values

[2]California Toxics Rule

[3]Talmage

[4] NRWQC

[5] NRWQC – non-priority pollutants

[6]hardness adjusted value

[7]hexavalent chromium

[8]NRWQC refers to MCL

– No aquatic threshold established.

ug/L = micrograms per liter

IRP = Installation Restoration Program

J = the concentration shown is an estimated value

mg/L = milligrams per liter

NA = not analyzed

NRWQC = National Recommended Water Quality Criteria

pH = negative logarithm of hydrogen ion concentration

RDX = cyclotrimethylenetrinitramine

TPH = total petroleum hydrocarbons

U = indicates the compound or analyte was analyzed for but was not detected at or above the stated limit

VOCs = volatile organic compounds

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Laboratory data were validated as specified in U.S. Navy Engineering Command, Southwest Division, Environmental Work Instruction EW#1. Level D validation was performed on 20 percent or more of the samples, with the balance validated at Level C.

The data validation findings are summarized, indicating the findings of the review process. Data are reported flagged with appropriate qualifiers to indicate usability.

Data may be assigned the following qualifiers:

J estimated concentration

U not detected (including not present because of blank contamination)

R rejected data (unusable)

Combinations of qualifiers such as UJ are possible.

Some individual results were reported twice (because of method required dilutions or duplication between methods). The results were evaluated and the highest concentration (or lowest detection limit) was used.

The data were found usable for the purposes intended except as discussed below:

- Three samples, (LD121 – LD123) analyzed for VOCs during the 1999 Perchlorate Investigation, had the nondetect acetone results flagged with R due to the continuing calibration exceeding the allowable criteria. The analyte is not considered a major risk driver or contaminant of concern at the site and no corrective action was required.
- Seven samples (LD133-LD139), analyzed for VOCs during the 1999 Perchlorate Investigation, had the nondetect 1,2-dichloroethane results flagged with R due to the relative response factor in the continuing calibration exceeding the allowable criteria. There is no other evidence of contamination in the samples and the compound was not detected in other samples at the site. No corrective action was required.
- Soil samples collected during the EBS investigation, analyzed for volatile organics, had the nondetect acetone results flagged as rejected. The initial calibration relative response factor was outside the criteria required by the validation guidance. The laboratory procedures were evaluated and it was determined the laboratory was performing within the specifications of the method. As the compound is not considered a significant driver of decisions at the site, no further corrective action was warranted.

5. Contaminant Fate and Transport

This section presents an analysis of fate and transport of contaminants in the environment at IRP Site 1. The results of investigations conducted to evaluate the nature and extent of contamination in various environmental media, including soil, sediments in the Ephemeral Pond, groundwater, and surface water at IRP Site 1, are presented in Section 4 of this Report. The following bullets summarize salient findings of the analysis of these results:

- Low concentrations of VOCs, SVOCs, explosives residues, perchlorate, and hydrocarbons, were detected at a few locations in surface and subsurface soil at IRP Site 1.
- Low concentrations of one VOC (toluene) and hydrocarbons were detected at a few locations in surface sediment samples collected from the Ephemeral Pond.
- Metal concentrations in the soil and sediment samples collected from IRP Site 1 were generally consistent with background concentrations of metals in soil at Former MCAS El Toro.
- Low concentrations of perchlorate were detected at a few locations in surface and subsurface soil at IRP Site 1.
- Perchlorate concentrations exceeding its DWEL of 24.5 µg/L (EPA 2006) and California public health goal of 6 µg/L were detected in groundwater in the central portion of IRP Site 1 and south of IRP Site 1. The perchlorate concentrations in the central portion of the site exceed the DWEL by over one order of magnitude.
- Low concentrations of VOCs, explosives residues, hydrocarbons and metals were detected in the surface water samples at IRP Site 1.

These findings indicate that perchlorate is the significant contaminant at IRP Site 1. Therefore, presentation of fate and transport analysis for IRP Site 1 has been divided into the following two parts:

- Fate and transport of perchlorate
- Fate and transport of organic chemicals (VOCs, SVOCs, explosives residues, hydrocarbons) and metals

5.1 Fate and Transport of Perchlorate

The fate and transport of perchlorate at IRP Site 1 depend upon its physiochemical properties, sources and release mechanisms, and degree of various natural attenuation mechanisms, including biodegradation, dilution, dispersion, and sorption.

5.1.1 Physiochemical Properties of Perchlorate

Perchlorate (ClO_4^-) is an inorganic anion that originates as a contaminant in ground and surface waters from the dissolution of perchloric acid and its salts, including ammonium, potassium, magnesium, or sodium (EPA 1999). Perchlorate releases in the United States are primarily associated with releases of ammonium perchlorate (Urbansky 2002); however, naturally-occurring perchlorate has been found in Texas and New Mexico where it is largely thought to be associated with electrical discharges (lightning strikes), evaporite deposition or possibly the use of fertilizers from the Atacama Desert in Chile (Jackson, et al. 2005 and Hurst, 2004). Specific uses of ammonium perchlorate include solid rocket fuel oxidizer, explosives, chemicals, and pyrotechnics (EPA 1999).

All perchlorate salts, including ammonium perchlorate are highly soluble in water (Xu et al. 2003) (Table 5-1). Upon dissolving in water, ammonium perchlorate dissociates completely (up to the solubility limit) to ammonium and perchlorate ions (Urbansky 1998). Due to its high solubility, and poor adsorption to soil, perchlorate is not retarded during groundwater transport and can spread over large distances when released into groundwater (Xu et al. 2003 and Logan 2001). The oxidation state of chlorine in perchlorate is +7; therefore, perchlorate is a strong oxidizing agent. However, perchlorate reduction is extremely nonlabile (slow) due to the high activation energy associated with its reduction (Urbansky 1998). Therefore, natural chemical reduction in the environment is not expected to be significant (EPA 1999).

Table 5-1: Physiochemical Properties of Ammonium Perchlorate

Physical Property	Value
Molecular Weight	117.49
Density	1.952
Solubility (w/w %)	24.922

Note: *Source: EPA 1999
EPA = United States Environmental Protection Agency
w/w % = percentage by weight

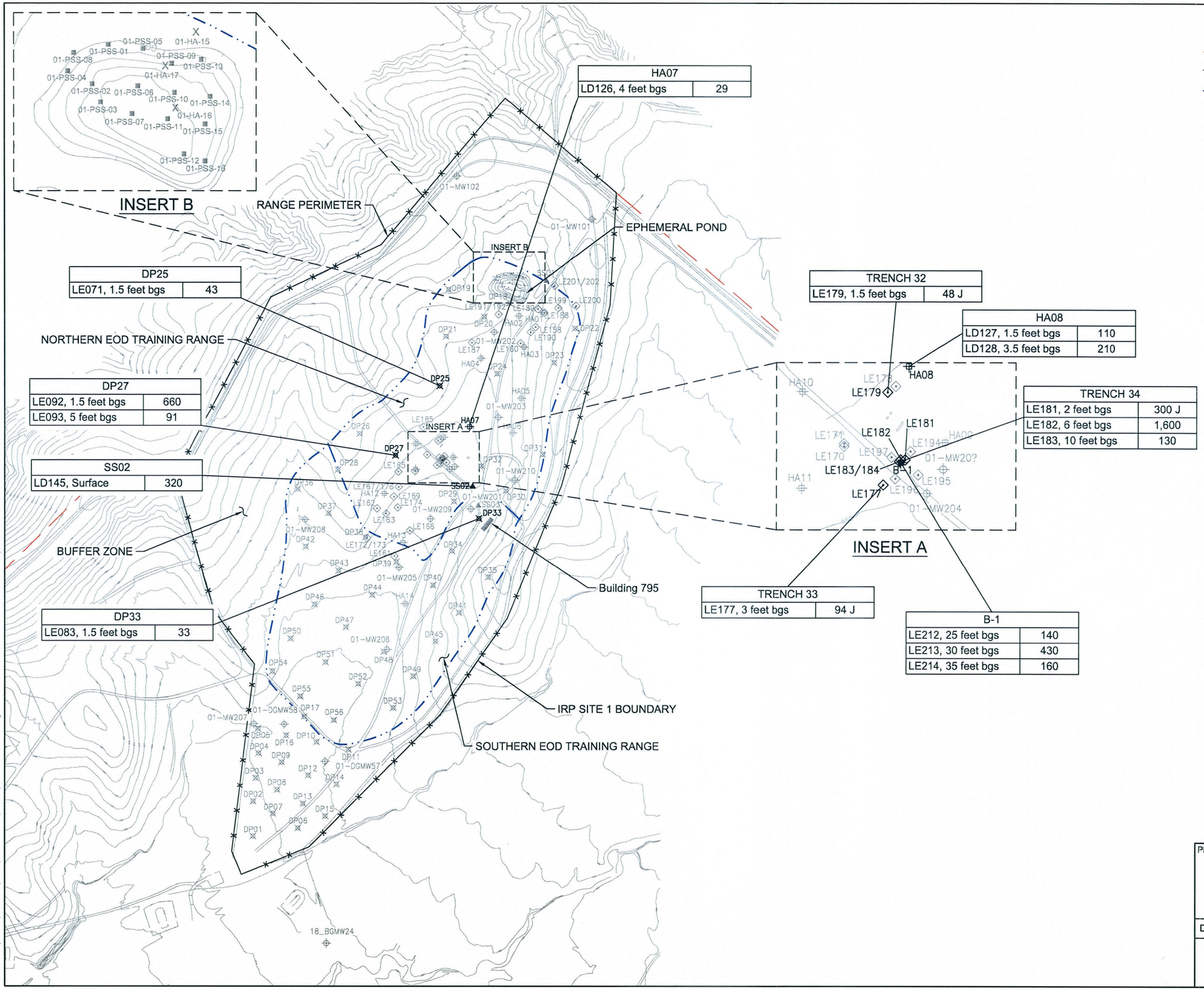
Studies have shown that perchlorate is amenable to biological degradation under anaerobic conditions (Xu 2003). Some bacteria can use perchlorate as an electron acceptor while oxidizing a large range of substrates. Research has also shown that perchlorate-degrading bacteria are widely distributed in the natural environment (Coates et al. 1999 and Marquese 2001).

5.1.2 Perchlorate Sources and Release Mechanisms

The EOD activities performed at IRP Site 1 included the use of explosives. Additionally, limited historical information (interviews with former Base workers, as well as reviews of various Station documents) suggests that rocket motors or JATO units were disposed at IRP Site 1. The explosives and rocket motors disposed at IRP Site 1 might have contained ammonium perchlorate. Therefore, EOD operations constitute the primary source of perchlorate release into the environment at IRP Site 1. Most probably this release occurred in the Northern EOD Training Range near the center of IRP Site 1. The following observations support this hypothesis:

- Information on historical activities indicates that most of the recent EOD activities occurred in the Northern EOD Training Range.
- The largest density of subsurface anomalies indicating the locations of trenches and pits used in detonation of munitions was observed in the Northern EOD Training Range during the geophysical surveys.
- The highest perchlorate concentrations in groundwater at IRP Site 1 have been observed in the central portion of IRP Site 1 in the Northern EOD Training Range.
- The detected concentrations of perchlorate in soil were primarily observed in the samples collected in the Northern EOD Training Range near the central portion of IRP Site 1 (see Figure 5-1 and Table 5-2).

Although no JATO units were recovered during trenching activities conducted under Tier II of the RI, and there is no other evidence suggesting the final disposition of the units, current data do not support the existence of any other source either at IRP Site 1 or south of IRP Site 1 where perchlorate concentrations have been detected in the groundwater.



LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- DP16 — DIRECT-PUSH SAMPLING LOCATION
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 — SURFACE SOIL SAMPLING LOCATION
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE LOCATION

HA07	
LD126, 4 feet bgs	29

SAMPLE I.D., AND DEPTH — CONCENTRATION µg/kg (SEE NOTES)

NOTES:

µg/kg	MICROGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
J	VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
MCAS	MARINE CORPS AIR STATION

EPA REGION 9 RESIDENTIAL PRG FOR PERCHLORATE IS 7,820 µg/kg

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Locations of Perchlorate Detections in Soil

IRP Site 1 - EOD Training Range

Former MCAS El Toro

Date: 12-06

Project No. 36097

EarthTech — A Tyco International Ltd. Company

Figure 5-1

File: L:\work\3...\cad\Site 1 RI\Final\FIGURE 5-1.dwg Time: Dec 21, 2006 - 1:36pm

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Table 5-2: Summary of Perchlorate Detections in Soil in the Northern EOD Training Range

Investigation	Location ID	Sample Depth (feet bgs)	Perchlorate Concentration (mg/kg)
Verification of Perchlorate Study	HA07	4	29
	HA08	1.5	110
	HA08	3.5	210
	SS02	Surface	320
Phase II RI, Tier I Investigation	DP25	1.5	43
	DP27	1.5	660
	DP27	5	91
	DP33	1.5	33
Phase II RI, Tier II and Tier III Investigations	T33 (LE177)	3	94
	T32 (LE179)	1.5	48
	T34 (LE181)	2	300
	T34 (LE182)	6	1,600
	T34 (LE184)	10	130
	T31 (LE185)	8	22

Notes:
bgs = below ground surface
EOD = explosive ordnance disposal
ID = identification
mg/kg = milligrams per kilogram
RI = remedial investigation

Once the soil is contaminated due to release of perchlorate, it can serve as a source for secondary contamination of other environmental media, including groundwater and surface water. The potential release mechanisms for contamination of groundwater and surface water due to contaminated soil at IRP Site 1 include:

- Infiltration of storm water from the soil surface to the vadose zone and into groundwater
- Dissolution of contaminants from the soil matrix into surface water runoff
- Groundwater and surface water transport

The release of perchlorate to groundwater and surface water was assessed by collecting groundwater and surface water samples and analyzing them for perchlorate (see Section 4 for details). Perchlorate was not detected in any surface water sample; however, widespread detections of perchlorate were observed in the groundwater. Therefore, ongoing perchlorate migration into surface water is regarded as insignificant at IRP Site 1. The only significant migration route is migration into groundwater. The following section discusses the migration and transformation mechanisms for perchlorate in groundwater.

5.1.3 Perchlorate Uptake by Plants from Soil

Most of the data on the uptake of perchlorate by plants is related to the concentration of perchlorate in irrigation water. There are few data available on the uptake of perchlorate by plants from the soil. Ellington and others (2001) investigated the uptake of perchlorate from soil by tobacco plants and calculated a bioconcentration factor of approximately 282. The food chain risk for small mammals and birds in this ecological risk assessment is driven by the ingestion of plant materials with estimated perchlorate concentrations based on this BCFp of 282.

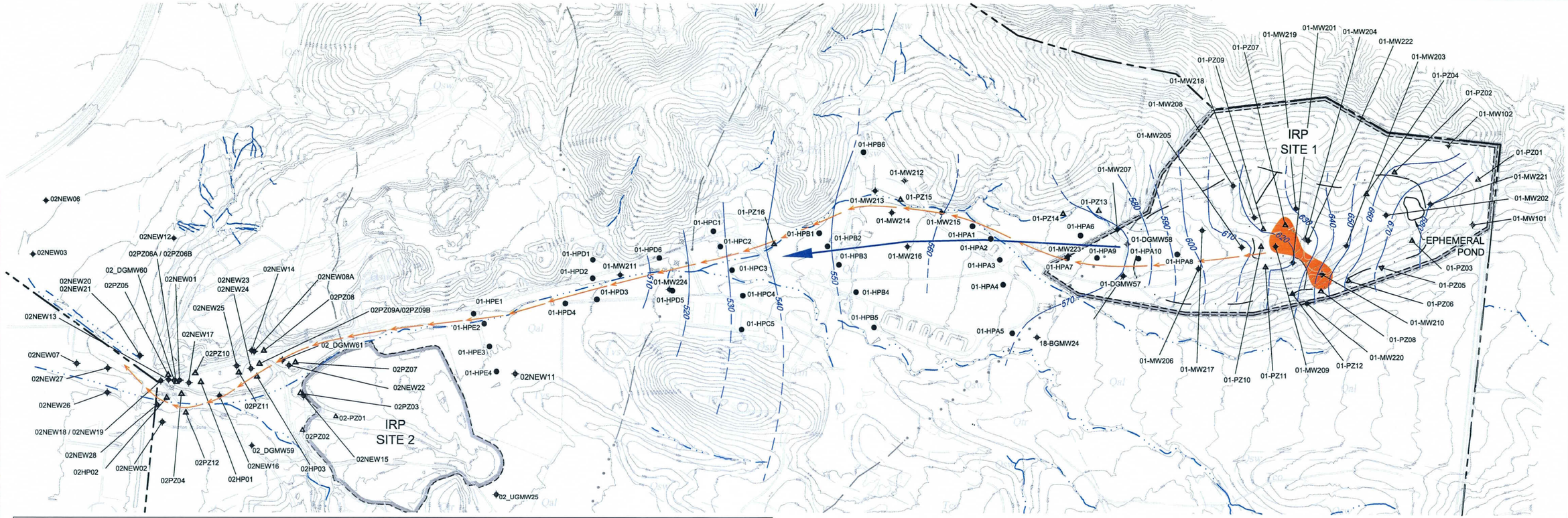
5.1.4 Perchlorate Migration in Groundwater

Perchlorate is primarily present in the bedrock unit of the aquifer between the central portion of IRP Site 1 and the area upgradient of 01-HPA9. Downgradient of 01-HPA9, perchlorate is present both in the saturated bedrock and the saturated alluvium, which had been deposited in a paleochannel cut into the bedrock. Therefore, the presentation of fate and transport of perchlorate is divided into two parts – perchlorate fate and transport in the aquifer between the central portion of IRP Site 1 and upgradient of 01-HPA9 (or perchlorate fate and transport at IRP Site 1) and perchlorate fate and transport south of 01-HPA9 in the aquifer (both alluvial and bedrock units) between IRP Site 1 and IRP Site 2.

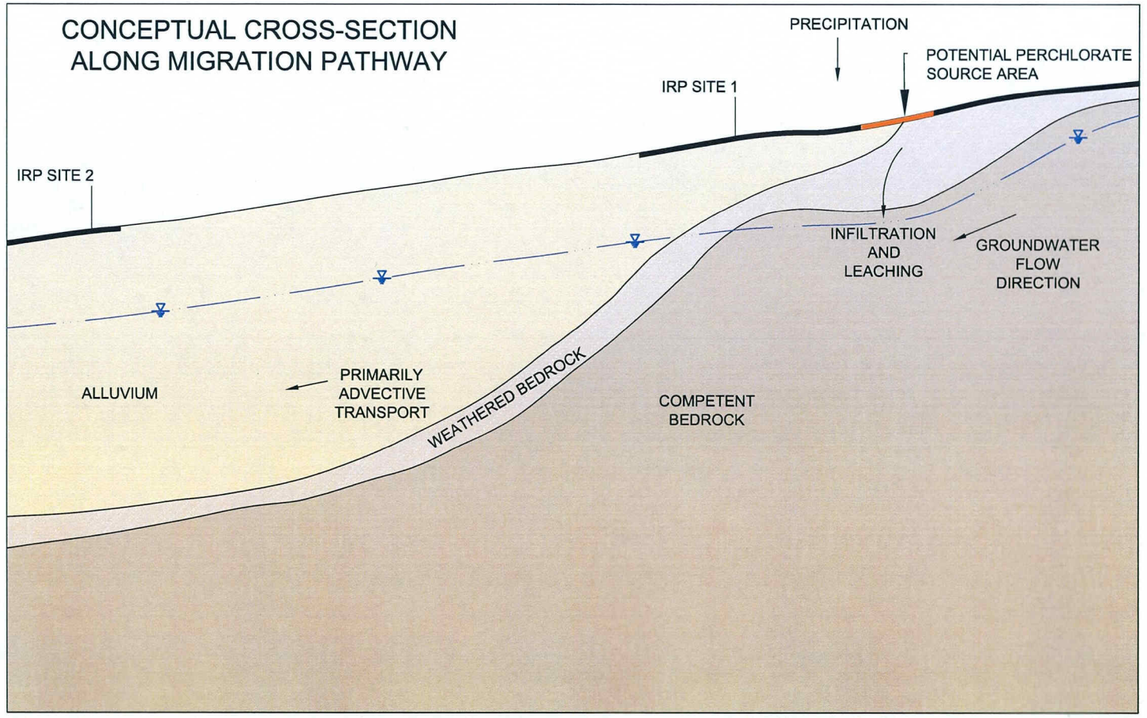
5.1.4.1 PERCHLORATE MIGRATION AT IRP SITE 1

The following mechanisms are proposed for subsurface transport of perchlorate at IRP Site 1 (Figure 5-2):

- The direction of groundwater flow is generally southwest from the central portion of IRP Site 1 to the area in the vicinity of 01-HPA9. Because of the high solubility of perchlorate in water and poor adsorption on the soil matrix, perchlorate released in the central portion of IRP Site 1 may have traveled in the groundwater and migrated toward 01-HPA9. It should be noted that perchlorate was detected at concentrations less than its DWEL of 24.5 µg/L (EPA 2006) in Monitoring Wells 01-MW217, 01-MW206, 01-DGMW57, and 01-DGMW58 located south of the central source area. However, perchlorate was detected at concentrations of 17.6, 15.4, and 7.5 µg/L at locations 01-PZ10, 01-PZ11, and 01-HPA10, respectively (see Figure 4-7). The Piezometers 01-PZ10 and 01-PZ11, and Borehole 01-HPA10 are located along an imaginary line joining 01-MW209 and 01-HPA9 and midway between the locations of 01-MW217 and 01-DGMW58, and 01-MW206 and 01-DGMW57. This indicates that perchlorate is migrating south in this area in a narrow swath bounded by 01-MW217 and 01-DGMW58 on one side and 01-MW206 and 01-DGMW57 on the other side.
- The average linear velocity of groundwater in the bedrock at IRP Site 1 was estimated to be about 0.4 to 0.9-foot per year. At this velocity it would take more than 800 years for groundwater to travel from the central source area to the location of 01-HPA9. Considering the fact that large-scale production of perchlorate in the United States began about 60 years ago, in the mid-1940s (EPA 1999), the extent of migration seems unlikely. However, it should be noted that geological and hydrogeological investigations performed at IRP Site 1 indicated that groundwater is being transported through the feldspathic sandstone primarily within randomly distributed zones of secondary porosity/permeability. It is possible that these zones have created more hydraulically conductive features within a narrow swath connecting the central source area and the area in the vicinity of 01-HPA9. Perchlorate-impacted groundwater from the central portion of the site may be migrating through these features at a velocity higher than the average velocity of 0.4 to 0.9-foot per year. It is also possible that as local recharge occurs, more of the fewer/more pourous zones may be intersected, changing the effective permeability of the aquifer in localized zones and preferentially increasing flow of perchlorate-contaminated groundwater.



CONCEPTUAL CROSS-SECTION ALONG MIGRATION PATHWAY



LEGEND:

01-HPE1 ●	HYDROPUNCH SAMPLING LOCATION
01-MW209 ✦	EXISTING GROUNDWATER MONITORING WELL
01-PZ11 △	EXISTING PIEZOMETER
	MCAS EL TORO BOUNDARY
	EOD TRAINING RANGE BOUNDARY
	IRP SITE BOUNDARY (1 AND 2)
	STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
	GEOLOGIC FAULT, DOTTED WHERE INFERRED
	EXISTING FENCE
	POTENTIAL PERCHLORATE SOURCE AREA
	APPROXIMATE PERCHLORATE MIGRATION PATHWAY
	APPROXIMATE GROUNDWATER ELEVATION
	GENERAL GROUNDWATER GRADIENT DIRECTION

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NOTES:

EOD	EXPLOSIVE ORDNANCE DISPOSAL
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION

NORTH

0 350 700 FEET

SCALE: 1"= 700'

Phase II Remedial Investigation — Final

Fate and Transport of Perchlorate

IRP Site 1 - EOD Training Range

Former MCAS El Toro

Date: 12-06

Project No. 36097

EarthTech — A Tyco International Ltd. Company

Figure 5-2

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 5-2.dwg Time: Dec 21, 2006 - 1:40pm

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- The analysis of the boring logs for monitoring wells and Hydropunch™ data suggests that the alluvium present south of IRP Site 1 thins and then pinches out toward the central portion of IRP Site 1. It is possible that the perchlorate originally in the shallow soil at the source area may have dissolved at or near the surface of the southward thickening alluvial sediment, percolated down to the bedrock surface and followed that surface to the alluvial aquifer surface somewhere between 01-HPA10 and 01-HPA9.

Perchlorate apparently persists in bedrock sandstone in many vertically and laterally discontinuous zones with differential (or secondary) porosities that are caused by either incomplete cementation or differential weathering, or both. Because these many zones are not completely hydraulically connected, perchlorate in groundwater migrates out of this bedrock lithology at variable rates. Evidence for the presence of these discontinuous heterogeneous zones at IRP Site 1 is demonstrated by the following:

- Eighteen separate hydrogeologic zones (primarily within the bedrock) were identified at IRP Site 2 during a hydrogeolgic investigation which included long-term aquifer stress tests; IRP Site 1 has hydrogeologic zones similar to those at IRP Site 2;

- Detailed observations of continuous cores obtained at IRP Site 1 under Tier III-C of the RI supports the presence of zones with incomplete or differential cementation. The apparent random presence of calcite (HCL-reactive) cement, juxtaposed with non-reactive dry, moist, and wet zones throughout these cores demonstrates the incomplete and/or differential nature of cementation and therefore, the resultant variability in hydrologeologic properties within the bedrock lithology; and

- Aquifer stress tests (pumping) conducted in the shallow zone at IRP Site 1 in June 2005 yielded a response in deep observation well 01-MW222 but not in an adjacent shallow observation well 01-MW204. This illustrates the heterogeneous nature of the hydraulic conductivity and the potential for preferential pathways in the subsurface at IRP Site 1.

Considered together, perchlorate probably migrated downward from the surface soil at IRP Site 1 by infiltration of surface recharge (rain water) and leaching to the weathered profile within the bedrock to the less weathered bedrock where it resides in a complex matrix of hydraulically separated zones that are periodically, but only partially, "flushed" by significant recharge events, such as occurred in early 2005.

5.1.4.2 PERCHLORATE MIGRATION IN THE AQUIFER BETWEEN IRP SITE 1 AND IRP SITE 2

The Hydropunch™ data collected at the transition from the saturated feldspathic bedrock to the saturated alluvium (southern part of IRP Site 1) suggest a mechanism for transporting perchlorate from one matrix to another. At Hydropunch™ location 01-HPA8, perchlorate was reported at a concentration of 27 µg/L in a groundwater sample from the weathered sandstone bedrock (groundwater exists only in bedrock at this location). At location 01-HPA10, 273 feet downgradient, perchlorate was reported at a concentration of only 7.5 µg/L in a groundwater sample from the alluvium. Another 292 feet downgradient at location 01-HPA9, perchlorate was reported at a concentration of 219 µg/L in a groundwater sample from the alluvium. At location 01-HPA7, 210 feet father downgradient, perchlorate was found in alluvium at approximately the same concentration (185 µg/L).

Depth to bedrock doubles from 24 feet bgs at 01-HPA8 to 50 feet bgs at 01-HPA10. Bedrock depth is nearly constant from 01-HPA9 to 01-HPA7 at approximately 72 feet bgs (see Figure 3-13). From

01-HPA7 to 01-HPE3, a distance of 4,117 feet, depth to bedrock increases only another 19 feet, which highlights the zone between 01-HPA8 and 01-HPA9 as the location where there is considerable relief on the bedrock in the subsurface. This is also the area where alluvium, the weathered bedrock surface and the present-day water table come into contact together.

Installation of Monitoring Well 01-MW223 adjacent to Hydropunch™ 01-HPA7 was performed to both confirm the perchlorate concentration found in the near surface part of the alluvial aquifer and to allow for collection of groundwater samples deeper in the alluvial aquifer near the southern end of IRP Site 1. The sample from 01-HPA7 was collected from approximately 5 feet below the aquifer surface and was found to contain perchlorate at a concentration of 185 ug/L. The initial sample from 01-MW223 was collected from approximately 30 feet below the aquifer surface and was found to contain 74.6 ug/L of perchlorate. This tends to suggest that perchlorate is entering the saturated alluvium more at the surface than at depth.

Hydropunch™ location 01-HPA6 was located between 01-HPA7 and the western reach of Borrego Canyon Wash, which hugs the western wall of the Wash for most of its traverse between IRP Site 1 and IRP Site 2. Hydropunch™ location 01-HPA6 evinced perchlorate at a concentration of 51.9 ug/L, substantially less than that observed at 01-HPA7 (185 ug/L). Three monitoring wells are located in the near proximity of the western reach of Borrego Canyon Wash near its headwaters (01-MW207 at the southern boundary of IRP Site 1). All three of these wells have yielded very low concentrations of perchlorate, with the most recent results of 5.8 ug/L (01-MW207), 4.1 ug/L (01-PZ13), and 5.3 ug/L (01-PZ14). The overall pattern of perchlorate detections now suggests that although there appears to be an association with the western reach of Borrego Canyon Wash south of 01-PZ14, this may be more related to a preferential flow path within the near-aquifer surface than with the surface drainage.

Monitoring Well 01-MW224 was installed near Hydropunch™ location 01-HPD5. This well was installed to assess perchlorate at deeper levels within the saturated alluvium. The initial sample obtained from this well was withdrawn from a depth of 87 feet from the top of casing, some 50 feet below the aquifer surface and approximately 4 feet above the bedrock surface. Perchlorate was found at a concentration of 1.6 ug/L at this location. Groundwater elevation data are found in Table 3-1.

The system of groundwater flow between IRP Site 1 and IRP Site 2 is initiated in the very small drainage area of IRP Site 1. Precipitation that falls within IRP Site 1 is either absorbed by the soil and percolates downward, or if occurring at a sufficient rate and duration, also contributes to runoff. The flow dynamics within IRP Site 1 therefore consist of saturated flow and surface runoff. Perchlorate can be completely flushed from soil with 5 to 7 pore volumes of water (Roberson 2004), essentially a very large single storm event. In general, proceeding upward from solid bedrock through saprolite to soil (see Figure 3-6), porosity and permeability tend to increase due to dissolution or decomposition of both cement and the rock matrix itself. Therefore, water penetration from precipitation, unless impeded by clays, tends to be greatest near the surface of a weathering profile and decreases with depth.

In the area of the IRP Site 1 perchlorate plume, sufficient time has passed for perchlorate to have been flushed from the surface soil into the weathered bedrock beneath, but does not appear to have penetrated to the depths within the less weathered bedrock as observed in 01-MW222. The depth to groundwater within the IRP Site 1 plume area tends to average approximately 40 feet bgs. Based on the continuous corings obtained during the Tier III-C assessment, the potentiometric surface is predominantly within the less weathered bedrock.

In order to reach the aquifer surface, the leached perchlorate must pass through both the thin surface soil and the deeply weathered saprolitic bedrock. Some of the perchlorate clearly reached the aquifer surface in the IRP Site 1 plume area; however, it also appears to have had some means of migrating out of the plume area south of the main plume. This is believed to have occurred through several possible mechanisms, but owing to the unusual nature of this host matrix (deeply to less weathered partially cemented immature sandstone), the precise mechanism may never be known with certainty.

The contact between alluvium and the weathered bedrock surface was found at a depth of 24 feet bgs at location 01-HPA8. The alluvium grows in thickness to 71.5 feet at location 01-HPA9 (see Figure 3-13 and Appendix B) with intervening locations showing abrupt changes in thickness. It is likely that the alluvium thins and pinches out somewhere near or possibly within the IRP Site 1 plume area. Perchlorate dissolved from surface soil may have penetrated the weathered bedrock matrix as well as moved along the much more transmissive alluvium/bedrock contact to where it has been detected moving in a relatively narrow plume in the saturated alluvium (Figure 5-2). It may also be slowly leaching from both the weathered saprolite bedrock or less weathered bedrock to the alluvium by a difficult-to-detect pathway resulting from the variability of secondary porosity.

Munitions-class perchlorates tend to have very low partition coefficients into soil or sedimentary organic carbon (EPA 2001a; ITRC 2002). This property is known to produce relatively little dispersion in groundwater. This circumstance is demonstrated on each line of Hydropunch™ locations as shown on Figure 4-7. For over 3,000 feet, perchlorate is only detected at elevated concentrations in one, or sometimes two, of the borings per line. These locations tend to be located along the western side of the Wash and predominantly in the near surface part of the alluvial aquifer. This suggests that perchlorate may be entering the alluvial aquifer at the water table surface from IRP Site 1, possibly between 01-HPA9 and 01-HPA10, then following a preferential flowpath within the alluvium at the aquifer surface down to IRP Site 2.

Due to the relatively coarse, heaving, unconsolidated sands encountered during Tier III-D Hydropunch™ investigations while coring south of IRP Site 1, groundwater flow and perchlorate transport in the alluvial aquifer can be expected to be higher than in bedrock and is likely the predominant medium through which the perchlorate has migrated downgradient from IRP Site 1.

5.1.5 Mechanism for Perchlorate Decrease Downgradient

The assessments conducted to date have delineated the connection between perchlorate detections at IRP Site 1 and along the Western Reach of Borrego Canyon Wash to IRP Site 2. The decrease in perchlorate concentrations from IRP Site 1 through IRP Site 2 are likely related to the convergence of IRP Site 1 groundwater with groundwater from the unnamed tributary at the southern end of IRP Site 1, with groundwater from Borrego Canyon Wash at IRP Site 2 and with groundwater in the Irvine Management Zone. Figure 3-1 shows alluvial drainage areas, convergence locations and relative quantity of groundwater flow at each location.

Within IRP Site 1, the maximum concentration of perchlorate has been detected at 459 µg/L within bedrock groundwater. As perchlorate-impacted groundwater converges with the groundwater from the unnamed tributary, it is diluted and dispersed. The result is maximum perchlorate concentrations of approximately 200 ug/l at the convergence point located at 01-HP07 and 01-HP09. As groundwater continues to flow downgradient, perchlorate from IRP Site 1 continues to mix, dilute and disperse with groundwater from the unnamed tributary. Just upgradient of IRP Site 2, a second significant convergence of groundwater occurs between IRP Site 1 and the unnamed tributary groundwater and Borrego Canyon Wash groundwater. The concentrations above the IRP Site 2 landfill (where the convergence first occurs) decrease to the 40 µg/L range and decrease further

down-gradient to approximately 20 µg/L below the IRP Site 2 landfill. Downgradient of IRP Site 2 and the station boundary, groundwater enters into the Irvine Management Zone, where significant groundwater from numerous drainage basins of the Santa Ana Mountains is encountered. As seen by perchlorate concentrations in downgradient wells 02NEW07, 02NEW20, 02NEW21, 02NEW26, and 02NEW27, the concentration of perchlorate decreases to approximately 6 µg/L or less.

From these investigations, two locations appear optimal for focusing on the Feasibility Study activities:

- The upper reaches of the alluvial channel in the vicinity of 01-HP10, and
- The lower reaches of the alluvial channel where it narrows between Monitoring Wells 01-MW211 and 01-MW224.

5.1.6 Perchlorate Transformation Mechanisms in Groundwater

The evaluation of groundwater monitoring results for selected monitoring wells collected over a period of one to three years does not indicate significant reductions of perchlorate in groundwater. This indicates that natural attenuation mechanisms, including biotic and abiotic degradation, are insignificant for reduction of perchlorate concentrations in IRP Site 1 groundwater. The reason for limited biodegradation may be elevated dissolved oxygen concentrations in IRP Site 1 groundwater as perchlorate biodegradation has only been shown to be significant under moderately reducing conditions. Additionally, abiotic degradation of perchlorate does not appear to be occurring for the same reason.

5.2 Fate and Transport of Organic Chemicals and Metals

The primary source of organic contamination (VOCs, SVOCs, explosives residues, hydrocarbons) at IRP Site 1 is EOD activities conducted at the site. These activities have a potential to release contaminants in the soil, which may then serve as a secondary source for environmental contamination by the following transport mechanisms:

- Infiltration of rainwater, which causes leaching of contaminants into groundwater (potentially significant for contaminants with high water solubility)
- Dissolution of contaminants in surface water runoff (potentially significant for contaminants with high water solubility)
- Sediment transport due to surface water runoff (potentially significant for contaminants that adsorb to the surfaces of soil particles)
- Transport to atmosphere due to volatilization (potentially significant for VOCs)
- Transport due to fugitive dust and wind erosion (potentially significant for contaminants that adsorb to the surface of the soil particles)

None of the above-mentioned mechanisms is significant for migration of organic contaminants and/or metals at IRP Site 1. This conclusion was based on the following observations:

- Relatively low concentrations of VOCs, SVOCs, explosives residues, and metals were identified at only a few locations in IRP Site 1 soil.
- Low concentrations of VOCs, SVOCs, and petroleum hydrocarbons were inconsistently reported in samples from only a few monitoring wells. Because none of these

compounds were consistently detected in any of the monitoring wells, suggests that negligible VOC, SVOC, and/or petroleum hydrocarbon contamination exists in IRP Site 1 groundwater. This indicates that high concentrations of organic contaminants have not leached from the vadose zone into IRP Site 1 groundwater.

- Very few metals were detected in IRP Site 1 groundwater at concentrations exceeding their respective MCLs. This indicates that migration of metals from IRP Site 1 soil into groundwater is not significant.
- Low concentrations of one VOC (acetone), one explosive residue (RDX), and petroleum hydrocarbons were detected in surface water samples collected from the Ephemeral Pond and a wash downgradient from the pond at IRP Site 1. This indicates that dissolution of contaminants into surface water runoff is not a significant migration pathway at IRP Site 1.
- Low concentrations of one VOC (toluene) and hydrocarbons, and concentrations of metals generally consistent with background were detected at a few locations in surface sediment samples collected from the Ephemeral Pond. This indicates that sediment transport due to surface water runoff is not a significant migration pathway at IRP Site 1.

6. Screening Risk Assessment – Human Health

6.1 INTRODUCTION

6.1.1 Purpose

This risk assessment is part of the Phase II RI for IRP Site 1 at Former MCAS El Toro, California. Detailed information regarding the RI (e.g., nature and extent of contamination, contaminant transport, and fate) is contained in Sections 4 and 5, and the approved Work Plan, wherein the risk assessment objectives were outlined (Earth Tech 2001a). However, where appropriate, information that is relevant to the interpretation of the risk evaluation has been summarized and included herein to provide all additional facts that were considered prior to completing the risk evaluation. Supporting tables are provided in Appendix G of this document.

A Tier 1 screening risk assessment (SRA) was conducted for IRP Site 1 to help risk managers determine if further action at the site is warranted. The decision for further action will include consideration of the potential for adverse human health effects as a result of exposure to chemicals detected at the site. These chemicals, termed COPCs, were identified and risk was evaluated for receptors that exist now (current conditions) or those that may exist in the future (future conditions). Analytical results from surface soil, subsurface soil, groundwater, surface water, and sediment analyses were used to identify the COPCs for each exposure medium evaluated in the SRA.

6.1.2 Human Health Screening Risk Assessment

This human health SRA quantitatively focused on the potential for human exposure to surface and subsurface soil, groundwater, surface water and sediment that may have been contaminated by past operations. As noted in the approved Work Plan (Earth Tech 2001a), a preliminary determination was made documenting that the potable use of groundwater at the site was negligible, despite its regulatory classification as a potential drinking water source. Although future groundwater use as a drinking water supply is believed to be unlikely, the SRA conservatively evaluates potential exposure to, and risk from, this medium, assuming residential use.

6.1.3 Guidance Documents

The human health SRA is based on a standard approach developed in accordance with guidelines from the following documents and communications:

- DON Human Health Risk Assessment Policy 5090 Ser N453E/1U595168 (DON 2001b)
- Navy Background Chemical Levels Policy 5090 Ser N45C/N4U732212 (DON 2004a)
- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Parts A, B and E) (EPA 1989, 1991a, 2004c)
- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors. (EPA 1991b)
- Exposure Factors Handbook (EPA 1997a)
- Communications between EPA Region 9 Toxicologist Dr. Daniel Stralka and Xuannga Mahini of Ogden Environmental and Energy Services, Inc. (Stralka 1995)

Risk assessments are key components of the Environmental Restoration Program employed by the DON. Pursuant to the DON policy 5090 Ser N453E/1U595168 (DON 2001b), the determination of human health risk at a site of concern is clearly prescribed to ensure sufficient resources are allocated for the protection of human health. The DON policy for conducting human health risk assessments

(HHRAs) identifies a three-tiered approach that may be implemented in its entirety depending on the level and magnitude of incremental risk or hazard that is determined in prior tiers. The tiers that are discussed in the DON policy are listed below.

Tier 1 - Screening Risk Assessment (SRA)

Tier 2 - Baseline Human Health Risk Assessment (BHHRA)

Tier 3 - Evaluation of Remedial Alternatives

The evaluation contained herein is Tier 1, the SRA. As defined by Navy Policy Ser N453E/1U595168 (DON 2001b), the purpose of the Tier 1 SRA is to identify COPCs that may pose excess risks to human health. This SRA incorporates all elements the Navy has identified as necessary for a screening assessment (DON 2001b); additionally, this SRA also includes elements typically of the Tier 2 assessment to satisfy screening requirements of EPA Region 9. Examples of additional elements traditionally included in the Tier 2 assessment include the evaluation of cumulative risks and the evaluation of risks under both a high-end level of exposure (reasonable maximum exposure [RME]) and an average level of exposure (central tendency exposure [CTE]), as well as a detailed qualitative evaluation of the uncertainty associated with this evaluation.

This Tier 1 SRA consists of two parts: Tier 1A, the risk-based screening (RBS) which satisfies the EPA Region 9 requirements of a screening preliminary risk evaluation (PRE), and Tier 1B, a site-specific risk-based evaluation (SSRBE) which satisfies the EPA Region 9 requirements for the site-specific PRE.

In certain instances, a SRA is not required. This can occur when negligible contamination is detected at a site. The SRA is, however, conducted if analytical data from the site investigation indicate that contamination is, or may be, of sufficient magnitude and distribution to warrant continuance of the risk assessment process.

The Tier 1A RBS methodology is consistent with Risk Assessment Guidance for Superfund (RAGS) sites (EPA 1989, and 1991a) and is conducted using risk-based concentration benchmarks (i.e., the EPA Region 9 PRGs (EPA 2004a) for the residential and industrial exposure scenarios) as the basis for comparison with site data. Based on recommendations from EPA Region 9 (Stralka 1995), the Tier 1A RBS (or screening PRE) is performed when:

- The complete or potentially complete exposure pathways of concern at a site are the same as those used to develop EPA Region 9 PRGs (EPA 2004a), and
- Pathway-specific exposure factors are expected to be similar to those used by the EPA for calculation of EPA Region 9 residential and/or industrial PRGs.

If complete or potentially complete exposure pathways for the site are not addressed in the use of the EPA Region 9 PRG tables (e.g., construction/utility worker), or if site conditions warrant the use of exposure factors that differ from those used to develop EPA Region 9 PRGs, a Tier 1B SSRBE is performed. Additionally, if the Tier 1A results indicate potentially significant health risks, the analysis proceeds to Tier 1B to derive more realistic, site-specific measures of risk.

6.2 DATA EVALUATION AND REDUCTION

Section 6.2 presents the details of the data quality assessment process and results. The following text summarizes the methods used to perform the data quality assessment for application to the SRA.

6.2.1 Data Quality Assessment

A data quality assessment was conducted, which included a review of analytical methods; reporting limits; laboratory, field, and method blanks; and quality assurance/quality control (QA/QC) procedures. This section presents the results of the data quality assessment for each element most pertinent to the SRA.

Soil, groundwater, surface water, and sediment data were reviewed in the following manner:

- A minimum of 20 percent of the analytical data were validated according to Navy "Level D" data validation criteria.
- A maximum of 80 percent of the data were validated according to Navy "Level C" (NFESC 1999).

Rejected Data. Data assigned an "R" qualifier (rejected) during data validation were eliminated from the database and not used for the SRA. In soil, a total of 49 analytical results were rejected. Of these results, seven were rejected for 1,2-dichloroethane, one for 2-butanone, and 41 acetone measurements were rejected. The rejected results are summarized in Table G-1, Appendix G. Data was rejected due to failures of laboratory quality control or calibration and corrective action could not be taken to validate the data. The effect of the rejected data on the risk estimates is discussed in Section 6.6.5, Uncertainties in the Screening Risk Assessment. All usable soil data were compared to EPA Region 9 residential and industrial soil PRGs (EPA 2004a). None of the analytical results for groundwater, surface water or sediment was rejected during the validation process, and all results were considered usable for the SRA.

Laboratory Contaminants. All data have been validated and the third-party validators determined that there is no objective evidence to qualify acetone and methylene chloride data based on their association with field or laboratory blanks. The measurements were retained for risk assessment purposes.

Chemicals Analyzed with Multiple Methods. Compounds such as 2,4-dinitrotoluene and 2,6-dinitrotoluene were analyzed using two methods: SVOC (SW8270) analysis and Nitroaromatics (SW8330) analysis. In reviewing the data, the data validators determined which of the two results to retain. In most cases, results by the SVOC method were rejected while those of the Nitroaromatics method were retained. However, in at least one instance (including the maximum reported concentration of 2,4-dinitrotoluene), the result with the Nitroaromatics method was determined to be less reliable (due to matrix interference) and the SVOC method result was retained.

For comparison purposes, soil data were segregated into surface soil data and subsurface soil data. Surface soil is defined as soil collected from 0 to 2 feet bgs. Subsurface soil is defined as soil collected from the 0 to 10-feet bgs.

6.2.2 Sample Reporting Limit Evaluation

The magnitude of the sample reporting limits (RLs) may have a substantial effect on the results of the risk assessment. RLs may be set at levels determined by the analytical method or may become elevated due to sample preparation procedures or during sample analysis. Potential causes of elevated RLs include percent soil moisture, limited sample volume, and matrix interferences where high levels of non-target compounds limit the ability to detect target chemicals, or dilutions required to detect certain target compounds mask the detection of other chemicals. The potential presence of chemicals in environmental media at concentrations below the highest sample reporting limit could result in a potential underestimation of cancer risk or adverse noncarcinogenic health effects if the

concentration were deemed to be negligible and exposure were to occur. However, it is also possible that these chemicals are not present, and therefore, do not contribute to additional risk for human receptors. The assumption that the chemical is present when, in fact it is not, would potentially result in an overestimation of the potential for adverse health effects. For these reasons, a detailed evaluation of the sample reporting limits was performed before cancer risk or noncarcinogenic health effects were assessed to ensure that the risk estimate was as accurate and unbiased as possible.

Table G-2, Appendix G, presents those chemicals with nondetect values (i.e., reporting limits) that exceed a designated screening criterion. These screening criteria were selected as follows:

- For soil samples, the screening criteria were the EPA Region 9 residential soil PRGs (EPA 2004a). However, the PRGs do not have criteria for TPH. The CRWQCB recommends the use of the ASTM standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 (ASTM 1995), to evaluate potential health risk due to TPH (CRWQCB 1996). Because the ASTM standard provides Tier 1 screening levels for indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene [BTEX], and PAHs), reporting limits for petroleum hydrocarbons were evaluated by reviewing those of indicator chemicals in soil.
- Groundwater screening criteria were EPA Region 9 tap water PRGs (EPA 2004a). Because the CRWQCB (1996) recommends the use of the ASTM standard for RBCA to evaluate potential health risk due to petroleum hydrocarbons, the evaluation of indicator chemicals (and not hydrocarbon mixtures) was deemed sufficient to assess reporting limits.
- For surface water, the screening criteria were the EPA Region 9 residential tap water PRGs (EPA 2004a) as they were deemed to be conservative values for the assessment of RLs.
- For sediment, the screening criteria were the EPA Region 9 residential soil PRGs (EPA 2004a) they were deemed to be conservative values for the assessment of RLs.

Table G-2, Appendix G, illustrates the frequency that reporting limits exceed screening criteria. Typically, the reporting limit may be elevated due to sample matrix interferences. For the surface soil samples, 15 VOCs, 26 SVOCs, and two inorganic chemicals had reporting limits that exceeded screening criteria. Except for the following seven chemicals, the frequency of RLs for nondetected chemicals that exceeded screening criteria is less than five percent. Only one chemical, hexachlorobenzene, had a range of reporting limits that were greater than the screening criterion for 100 percent of the samples.

Arsenic

Bis(2-Chloroethyl) ether

Hexachlorobenzene

n-Nitrosodi-n-propylamine

Dibenz(a,h) anthracene

Benzo(a)pyrene

Perchlorate

For the subsurface soil, 16 VOCs, 27 SVOCs, and three inorganic chemicals had reporting limits that exceeded the screening criterion. Except for the following 10 chemicals, the frequency of RLs for nondetected chemicals that exceeded screening criteria is less than five percent. Only one chemical, hexachlorobenzene, had a range of reporting limits that were greater than the screening criterion for all samples.

Arsenic

Bis(2-Chloroethyl) ether

Hexachlorobenzene

n-Nitrosodi-n-propylamine

Dibenz(a,h) anthracene

Benzo(a)anthracene

Benzo(b)fluoranthene

Benzo(a)pyrene

Indeno(1,2,3-c,d)pyrene

Perchlorate

For groundwater, there were numerous nondetected chemicals with RLs for all samples that exceeded screening criteria including three VOCs, 21 SVOCs, three explosives residues, and five inorganic chemicals. These include the following chemicals.

1,1,2,2-Tetrachloroethane	cis-1,3-dichloropropene
trans-1,3-Dichloropropene	2,4,6-Trichlorophenol
3,3'-Dichlorobenzidine	3-Nitroaniline
4-Nitroaniline	Benzo(a)anthracene
Benzo(b)fluoranthene	Benzo(k)fluoranthene
Benzo(a)pyrene	Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether	BEPH
Carbazole	Dibenz(a,h)anthracene
Hexachlorobenzene	Hexachlorobutadiene
Indeno(1,2,3-c,d)pyrene	Nitrobenzene
n-Nitrosodi-n-propylamine	n-Nitrosodimethylamine
Pentachlorophenol	1,2-Dinitrobenzene
2,4,6-Trinotrotoluene	RDX
Perchlorate	Antimony
Arsenic	Lead
Thallium	

When sample reporting limits for nondetected chemicals exceeded the screening criteria, additional uncertainty may be introduced into final risk estimates. Where sample reporting limits appeared to be

inordinately high relative to other samples evaluated, an additional evaluation of the data was performed in the data reduction step (Section 6.2.3.3). The influence of elevated reporting limits on the SRA results is qualitatively discussed in Section 6.6.5, Uncertainties in the Screening Risk Assessment.

6.2.3 Data Reduction

The SRA focuses on data from the impacted area(s) within the study site. Chemicals that have been detected at least once are considered COPCs for the Tier 1A RBS (or screening PRE under the EPA Region 9 terminology). Relevant data sets are identified to facilitate the estimation of chemical exposure point concentrations (EPCs) to which receptors may reasonably be exposed. If environmental samples are analyzed for a chemical using more than one analytical method, then the results that are most reliable (as indicated by data validation qualifiers or laboratory data qualifiers), have the lowest detection limits, and provide the most representative environmental concentrations with respect to exposure are selected.

Conclusions and recommendations of the risk assessment are often based on the reasonable maximum exposure (RME) that a receptor may encounter. Key in determining the RME is a statistical evaluation of the data set, which provides summary statistics such as maximum detected concentration, minimum detected concentration, number of detects, and upper confidence levels on the mean value. Prior to making this summary, the data set was manipulated for input into the risk model. Thus, the data set was "reduced" by (a) averaging original and field duplicate samples to yield one datum per sampling locus, (b) choosing appropriate analytical methods, and (c) eliminating elevated or inordinately high nondetect values. Each of these steps is discussed in the sections that follow.

6.2.3.1 Field Duplicate Samples

For soil samples, field duplicates were treated in the following manner:

Case 1: The original sample and field duplicate results for the COPC were above the reporting limit for the COPC.

Both values were averaged to obtain an average concentration for the sample pair before the statistical summary was performed.

Case 2: One sample of the duplicate pair had a concentration that was nondetect for the COPC, while the other exceeded the reporting limit.

The nondetect value was assigned a value of one-half its reporting limit and was then averaged with the detected concentration. If a qualifier existed on the detected concentration, that qualifier remained with the "averaged" value.

Case 3: Both samples had COPC concentrations that were nondetect.

The two values (i.e., RL) were averaged to obtain an average RL for the sample pair. Prior to summarizing the data statistically for EPC determination (i.e., calculation of the 95th upper confidence limit [UCL] on the arithmetic mean), the average RL of the sample pair was then assigned a value of one-half of that average RL. In so doing, the underestimation of risk due to use of a "biased low" data set (resulting from assigning the surrogate concentration twice during the process) was minimized.

6.2.3.2 Appropriate Analytical Methods

When more than one analytical method was used to determine presence and quantity of a particular chemical, the "best" of the analytical results was used for quantitative evaluation. The best analytical

results were selected in accordance with the data usability guidelines for risk assessment (EPA 1992a) and the analytical method with the more reliable (and sometimes, most conservative) results was selected for quantitation.

6.2.3.3 ELEVATED REPORTING LIMITS FOR NONDETECT VALUES

One or more sample-specific factors (e.g., matrix interferences) may result in RLs for a particular chemical that, in some samples, may be unusually high. As noted above, potential causes of elevated RLs include percent soil moisture, limited sample volume, and matrix interferences (i.e., high levels of non-target compounds that limit the ability to detect target chemicals, or dilutions required to detect certain target compounds mask the detection of other chemicals). Sometimes these elevated RLs greatly exceed the detected results for the same chemical in other samples, suggesting that the elevated RL is not representative of the data set as a whole or site conditions. Inclusion of these data when determining the EPCs (e.g., calculating the 95 percent UCL) could correspondingly result in poorly characterized risk (EPA 1989). Therefore, sample results that were reported as nondetections with RLs that exceed twice the maximum detected concentration were not included in the statistical analysis. The chemicals reported as nondetections with RLs (for a specific chemical) that exceeded twice the maximum detection are summarized below in Table 6-1 according to the medium evaluated.

Table 6-1: Summary of Chemicals Having Reporting Limits Exceeding Twice the Maximum Detected Concentration

Surface Soil		Subsurface Soil	
Chemical	ND > 2 times Max[a]	Chemical	ND > 2 times Max[a]
2,6-Dinitrotoluene	72	2,6-Dinitrotoluene	148
2-Butanone	67	2-Butanone	143
2-Hexanone	8	2-Hexanone	7
4-Methyl-2-Pentanone	83	4-Methyl-2-Pentanone	173
Acetone	64	Acetone	5
Bis(2-Ethylhexyl)Phthalate (BEPH)	2	Bis(2-Ethylhexyl)Phthalate (BEPH)	12
Chloroform	79	Chloroform	160
Diethyl Phthalate	70	Cobalt	1
Fluoranthene	71	Diethyl Phthalate	110
Motor Oils	1	Fluoranthene	146
Phenol	1	Hexachlorobenzene	112
--	--	Motor Oils	5
--	--	Phenol	4
--	--	Selenium	1
--	--	Tetrachloroethene	172
--	--	Thallium	1

Notes:
[a] number of analyses having reporting limits greater than 2 times the maximum detection
> = more than
ND = non-detect

6.2.4 Summary Statistics for Sample Data

Summary statistics (e.g., frequency of detection, maximum values) for the detected chemicals in surface soil, subsurface soil, groundwater, sediment, surface water samples, all of which were evaluated in this RBS, appear in Tables G-3 through Table G-7, Appendix G. One-half the sample RL (U or UJ qualified) was used as a proxy value for nondetects in all statistical calculations. Rejected data and nondetect data with elevated RLs were not used to calculate summary statistics or conduct statistical comparisons. A 95 percent UCL is included based on the method(s) described in Section 6.4.4.

6.3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Analytes expected to be characteristic of releases at IRP Site 1 were used to identify COPCs. The chemical groups included metals, VOCs, SVOCs, dioxins/furans, explosives residues, perchlorate, and petroleum hydrocarbons. As such, the Work Plan proposed a comprehensive list of chemicals for testing (Earth Tech 2002). From all data derived from the analyses, all usable (non-rejected) contaminant chemicals detected at least once in an environmental medium (i.e., soil, groundwater, surface water, or sediment) were considered COPCs for the RBS. The selection of COPCs followed a tiered approach as outlined in the DON Human Health Risk Assessment Policy (DON 2001b).

To determine whether the COPCs should be further evaluated in the Tier 1B SSRBE, maximum detected concentrations are compared to EPA Region 9 residential PRGs. COPCs having maximum detected concentrations greater than the residential screening criteria are retained for further evaluation in the SSRBE to determine the magnitude of exposure associated with incremental cancer risk or noncancer hazard based on hypothetical or planned reuse.

6.3.1 Essential Nutrients

Calcium, magnesium, potassium, and sodium are referred to as essential nutrients. These chemicals do not have toxicity criteria or PRGs, and are generally considered to be of minor, if any, concern in risk assessments performed for hazardous waste site remedial activities. While these essential nutrients were not quantitatively evaluated in this Report, they have been summarized and presented for information purposes in subsequent risk summary tables.

6.3.2 Summary of Chemicals of Potential Concern by Media for Each Site

All chemicals detected in surface soil, subsurface soil, groundwater, surface water, and sediment were retained as COPCs for the human health RBS evaluation. A summary of the COPCs that were evaluated in each environmental medium is provided in the following subsections.

6.3.2.1 SURFACE AND SUBSURFACE SOIL

VOCs, SVOCs, dioxins, explosives residues, TPH, and inorganic chemicals (including perchlorate) were detected in surface soil samples collected at the site. All of the above chemicals or classes were detected in the subsurface soil with the addition of one explosive residue and three metals.

6.3.2.2 GROUNDWATER

Groundwater samples were collected from each of the monitoring wells installed at IRP Site 1. Chemicals detected in groundwater were dominated by inorganic elements. The VOCs detected in groundwater samples included BTEX, cis-1,2-dichloroethene, methylene chloride, and TCE, BEPH was the only SVOC detected in groundwater. Diesel and oil range organics were also detected. All detected chemicals were retained as COPCs for the human health RBS.

6.3.2.3 SEDIMENT

Chemicals detected in sediment samples collected from the Ephemeral Pond were dominated by inorganic elements. Toluene, pyrene, and TPH were also detected.

6.3.2.4 SURFACE WATER

Chemicals detected in surface water samples that were collected from the Ephemeral Pond, or in the outfall from the Ephemeral Pond, as well as in the stream leading downgradient from IRP Site 1, were dominated by inorganic elements. Acetone, RDX, and TPH were also detected.

6.3.3 Chemicals Without Toxicity Values

Several chemicals detected in the various environmental media do not have toxicity values with which to derive PRGs and evaluate chemical-specific risks. The omission of these chemicals from the risk evaluation is addressed qualitatively in Section 6.6.5.3, Uncertainties in the Toxicity Assessment.

6.4 EXPOSURE ASSESSMENT

The exposure assessment section identifies land use and receptors that currently, or in the future, are likely to use the property and, as a result, may contact COPCs identified in the previous sections.

6.4.1 Land Use and Receptors

6.4.1.1 CURRENT LAND USE AND RECEPTORS

IRP Site 1 is located in the northeast portion of Former MCAS El Toro in the foothills of the Santa Ana Mountains. A great portion of the land immediately surrounding Former MCAS El Toro, including areas adjacent to IRP Site 1, has been used for agricultural activities. Continued urbanization, however, has brought housing developments about ½-mile to the northeast of IRP Site 1. The land located farther north and northeast of the site near the foothills of the Santa Ana Mountains remains essentially undeveloped. Areas located to the south, southeast, and southwest have been developed for commercial, light industrial, and residential uses.

According to the Santa Ana Region Basin Plan (CRWQCB 1995), the groundwater beneath Former MCAS El Toro has potential beneficial uses for a municipal water supply, agricultural and industrial supplies, and industrial process supply. Groundwater in the vicinity of Former MCAS El Toro is mostly used for irrigation of agricultural and greenbelt areas (i.e., parkways and parks). Potable water in the area is imported from various sources, and the remainder comes from local resources, including groundwater. The nearest municipal wells used as drinking water sources are associated with the recently installed Irvine Desalter project and are located within approximately 5 miles of IRP Site 1, near the intersection of Irvine Center Drive and Culver Drive. It is anticipated that the new wells will be operational by October 2006. The following current human receptors were identified for potential evaluation in the human health SRA:

- Current offsite residents (adult/child),
- Current offsite workers
- Current onsite industrial workers,
- Current construction/utility workers, and
- Current casual trespassers (restricted to the adult)

6.4.1.2 FUTURE LAND USE AND RECEPTORS

Because unrestricted future development is possible, various types of future potential receptors may occur at the site. Future use could include those supporting residential or industrial activities, or may include other site-specific possibilities such as a wildlife reserve or as a training site for investigative detonations in a manner similar to previous training activities performed by the Orange County Sheriff and the FBI. The receptors identified as those most likely to encounter residual chemical concentrations in the various media at IRP Site 1 include:

- Future onsite residents (adult/child),
- Future offsite residents (adult/child),
- Future offsite workers
- Future onsite industrial workers,
- Future construction/utility workers,
- Future casual trespassers (restricted to the adult),
- Future wildlife reserve workers, and a
- Future EOD Training Range supervisor in charge of detonation operations.

The EOD Training Range supervisor would likely be present for all future detonation operations and is considered the most highly exposed individual for this potential future use.

6.4.2 Conceptual Site Model

The Conceptual Site Model (CSM) is a schematic representation of the chemical source areas, chemical release mechanisms, environmental transport media, potential exposure routes, and potential receptors. It is used to guide the evaluation of potential exposures so that relevant pathways, exposure routes, and ultimately risks can be evaluated in the SRA. The primary purpose of the CSM in this risk evaluation is to represent chemical sources and exposure pathways that may result in human health risks. Only potentially complete exposure pathways are evaluated quantitatively in the risk assessment, consistent with EPA Guidance (EPA 1989).

A complete exposure pathway includes all of the following elements:

- Sources and type of chemicals present
- Affected media
- Chemical release and transport mechanisms
- Known and potential routes of exposure
- Known or potential human and environmental receptors

The absence of any one of these elements results in an incomplete exposure pathway. Thus, for an incomplete pathway with no potential human exposure, the potential for adverse health effects would be deemed negligible and does not warrant further evaluation. Figure 6-1 is the CSM for current and anticipated future receptors potentially exposed to COPCs in surface soil, subsurface soil, and groundwater, as well as surface water and sediment associated with IRP Site 1.

The exposure pathways for each scenario and each receptor shown in the CSM are described in Section 6.4.3.

6.4.3 Exposure Pathways

Exposure pathways are specifically associated with the environmental medium that is being evaluated. In a generic context, soil, water, and air pathways may facilitate exposure; each of these might result in intake by applicable exposure routes, such as ingestion, dermal absorption, or inhalation. In most settings, exposure pathways may be incomplete or complete, as discussed in Section 6.4.2. The rationale for making this determination is presented below.

6.4.3.1 Incomplete Exposure Pathways

Of those exposure pathways that are presented on Figure 6-1, several have been deemed to be incomplete, insignificant, or not applicable to the SRA. Thus, these pathways do not warrant quantitative assessment. The rationale for excluding a pathway from further evaluation follows:

- Ingestion of plants and animals that are grown or raised in site surface soil is considered an incomplete exposure pathway since no current agricultural activities occur onsite and future agricultural activities are deemed unlikely. Future residents are not anticipated to engage in agricultural activities (i.e., gardening) to the extent that exposure to chemicals in the surface soil would result in significant chemical intake.
- Ingestion of plants and animals that are grown or raised with site surface water or in sediment is considered an incomplete exposure pathway for current receptors since no agricultural activities currently occur onsite and future agricultural activities are deemed unlikely. Future residents are not anticipated to engage in agricultural activities (i.e., gardening) to the extent that exposure to chemicals in surface water would result in significant chemical intake.
- Ingestion of chemicals in subsurface soil is considered an incomplete exposure pathway for offsite receptors, current casual trespassers, and current onsite industrial workers as direct contact with this secondary source is unlikely. Additionally, future trespassers, wildlife reserve workers, and an EOD Training Range supervisor are not expected to directly contact subsurface soil.
- Dermal contact with chemicals in subsurface soil is considered an incomplete exposure pathway for the casual trespasser and current onsite industrial workers as direct contact with this secondary source is unlikely. Additionally, future trespassers, wildlife reserve workers, and an EOD Training Range supervisor are not expected to directly contact subsurface soil.
- Inhalation of fugitive particles from contaminated subsurface soil by current offsite receptors, and current onsite industrial workers and current casual trespassers is incomplete since these receptors cannot interface with subsurface soil. Where subsurface soil is excavated, exposure to fugitive particulates is insignificant for future casual trespassers, wildlife reserve workers, or an EOD Training Range supervisor relative to other exposure pathways such as direct contact with surface soil.
- Dermal contact with impacted groundwater is considered an incomplete pathway for current onsite workers and casual trespassers and current offsite residents since impacted groundwater onsite is not currently used nor has it migrated to wells for current offsite receptors. Future trespassers, wildlife reserve workers, or an EOD Training Range supervisor are not expected to contact groundwater. Future potential exposure for construction/utility workers is insignificant relative to other exposure pathways.
- Inhalation of VOCs in ambient air from impacted groundwater by current onsite workers, offsite residents (adults/children), current and future onsite construction/utility workers and casual trespassers, future wildlife reserve workers, or an EOD Training Range supervisor is insignificant as the chemical intake anticipated for these receptors is relatively less as compared to other exposure pathways.

- Ingestion of plants and animals that are grown or raised with impacted groundwater by current or future onsite industrial workers, construction/utility workers, casual trespassers, future wildlife reserve workers, or a future EOD Training Range supervisor is considered an incomplete exposure pathway since no current agricultural activities occur onsite and future agricultural activities are unlikely to lead to exposure for these receptors. This pathway is incomplete for current offsite residents since impacted groundwater has not migrated to offsite wells used by this receptor. For future onsite residents, this exposure pathway is insignificant relative to other exposure pathways such as ingestion and dermal contact with surface soil.
- Ingestion of impacted groundwater as a drinking water source for current offsite residents or onsite industrial workers, construction workers, and casual trespassers is considered an incomplete exposure pathway as impacted groundwater is not currently used onsite nor has it migrated to wells used by offsite receptors. Additionally, future construction workers, casual trespassers, wildlife reserve workers, or a future EOD Training Range supervisor are not expected to use the groundwater onsite as a source for drinking water.
- Ingestion of chemicals in plants/animals grown or raised with impacted groundwater by current offsite residents (adults/children) is incomplete, as impacted groundwater has not migrated to wells used by offsite receptors. For future onsite residents (adults/children), the pathway is considered insignificant relative to other exposure pathway such as ingestion and dermal contact with surface soil.

6.4.3.2 *Potentially Complete Exposure Pathways*

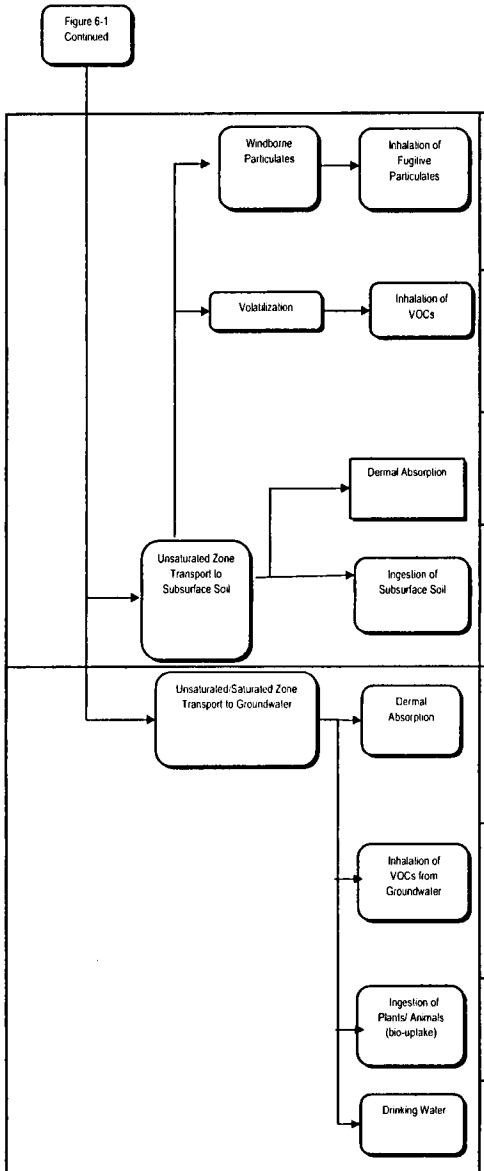
Based on analysis of the CSM, the following exposure pathways were considered for evaluation:

- Incidental ingestion of chemicals in surface soil by future onsite residents (adults/children) and current and future industrial workers, current and future construction/utility workers, current and future casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Dermal adsorption of chemicals from surface soil by future onsite residents (adults/children) and current and future industrial workers, current and future construction/utility workers, and current and future casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Inhalation of fugitive particulates from surface soil by future onsite residents (adults/children) and current and future industrial workers, current and future construction/utility workers, current and future casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Inhalation of VOCs in ambient air from impacted surface soil by future onsite residents (adults/children) and current and future industrial workers, current and future construction/utility workers, current and future casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Incidental ingestion of chemicals in subsurface soil by future onsite residents (adults/children), current and future construction/utility workers, and future industrial workers through excavation or gardening activities.
- Dermal adsorption of chemicals from subsurface soil by future onsite residents (adults/children), current and future construction/utility workers, and future industrial workers through excavation or gardening activities.

FIGURE 6-1: Conceptual Site Model for IRP Site 1

Pathway	Contributing Sources	Transport Mechanisms	Exposure Route	Receptors: Current Land Use: Off-Site Residents (Adult/Child) or Onsite Workers	Current Land Use: Construction/ Utility Workers	Current Land Use: Casual Trespassers (adult)	Future Land Use: Off-Site and On-Site Residents (Adult/Child)	Future Land Use: On-Site Industrial Workers	Future Land Use: Construction/ Utility Workers	Future Land Use: Casual Trespassers (adult)	Future Land Use: Wildlife Reserve Worker	Future Land Use: EOD Range Supervisor	Rationale
Air		Windborne Particulates	Inhalation of Fugitive Particulates	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Inhalation may be a potentially complete pathway for fugutive dust generated during dry, windy conditions, during construction activities or potential future blasting operations.
		Volatilization	Inhalation of VOCs	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	The inhalation of VOCs is a potentially complete exposure pathway for all curren and future onsite receptors. This pathway is insignificant for offsite receptors due to dispersion of airborne chemicals.
Surface Soil	Surface Soil	Direct Contact	Dermal Contact with Soil	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Direct contact with surface soil is a potentially complete pathway for current and future residents, onsite workers, casual trespassers, and future wildlife reserve worker or range supervisor.
			Incidental Ingestion of Soil	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Incidental ingestion of surface soil by future onsite residents and current and future onsite workers, construction/utility workers, casual trespassers wildlife reserve worker or range supervisor is potentially complete.
			Ingestion of Plants/Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	There are no current agricultural activities on-site. Pathway is considered insignificant relative to other potential exposure pathways for future onsite residents as gardening would not likely result in significant chemical intake. Other future onsite receptors are not expected to engage in gardening or other agricultural activities.
		Surface Water Runoff/Discharge and associated Sediments	Dermal Absorption	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Pond adjacent to IRP Site 1 does have standing water upon occasion. Therefore, surface water and associated sediments provide a secondary source for exposure via this pathway.
			Incidental Ingestion	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Pond adjacent to IRP Site 1 does have standing water upon occasion. Therefore, surface water and associated sediments provide a secondary source for exposure via this pathway.
			Inhalation of VOCs	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Surface water and associated sediments provide a secondary source for VOCs that may be emitted into ambient air.
	Continued on Next Page		Inhalation of fugitive particulates	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Inhalation may be a potentially complete pathway for fugutive dust generated during dry, windy conditions or during construction activities.
			Ingestion of Plants/Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	There are no current agricultural activities on-site. Pathway is considered insignificant relative to other potential exposure pathways for future onsite residents as gardening (watered with surface water) would not likely result in significant chemical intake. Other future onsite receptors are not expected to engage in gardening or other agricultural activities.

FIGURE 6-1: Conceptual Site Model for IRP Site 1



Pathway	Contributing Sources	Transport Mechanisms	Exposure Route	Receptors: Current Land Use: Off-Site Residents (Adult/Child) or Onsite Workers	Current Land Use: Construction/ Utility Workers	Current Land Use: Casual Trespassers (adult)	Future Land Use: Off-Site and On-Site Residents (Adult/Child)	Future Land Use: On-Site Industrial Workers	Future Land Use: Construction/ Utility Workers	Future Land Use: Casual Trespassers (adult)	Future Land Use: Wildlife Reserve Worker	Future Land Use: EOD Range Supervisor	Rationale
		Windborne Particulates	Inhalation of Fugitive Particulates	Incomplete	**Potentially Complete**	Incomplete	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Insignificant	Insignificant	Insignificant	Inhalation may be a potentially complete pathway for current construction/utility workers as fugutive dust may be generated during excavation of subsurface soils. Exposure pathway is potentially complete for future construction workers, residents and industrial workers as construction activites may bring subsurface soils to the surface but the pathway is considered insignificant relative to other exposure pathways for the casual trespasser, wildlife reserve worker or range supervisor.
		Volatilization	Inhalation of VOCs	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	The inhalation pathway for VOCs in ambient air is potentially complete for all receptors. For future onsite residents and industrial workers, the inhalation of VOCs in indoor air is also potentially complete.
	Unsaturated Zone Transport to Subsurface Soil		Dermal Absorption	Incomplete	**Potentially Complete**	Incomplete	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Incomplete	Incomplete	Incomplete	Infiltration to subsurface soil is potentially complete. Subsurface soils may be contacted by onsite workers or residents through excavation or gardening activities. Casual trespassers, wildlife preserve worker or range supervisor will not likely come into contact with subsurface soils.
			Ingestion of Subsurface Soil	Incomplete	**Potentially Complete**	Incomplete	**Potentially Complete**	**Potentially Complete**	**Potentially Complete**	Incomplete	Incomplete	Incomplete	Infiltration to subsurface soil is potentially complete. Subsurface soils may be contacted by future onsite workers or residents through excavation or gardening activities. Casual trespassers, wildlife reserve worker or range supervisor will not likely come into contact with subsurface soils.
	Unsaturated/Saturated Zone Transport to Groundwater		Dermal Absorption	Incomplete	**Potentially Complete**	Incomplete	**Potentially Complete**	**Potentially Complete**	Insignificant	Incomplete	Incomplete	Incomplete	Groundwater offsite used for irrigation, but impacted groundwater has not migrated to offsite wells used by these receptors. No other current receptor potentially exposed. Future casual trespassers are not expected to contact groundwater such that exposure is incomplete. Future exposure to groundwater may occur for construction/utility workers, future onsite residents or future onsite workers, but for construction/utility workers, the pathway is insignificant relative to other exposure pathways.
			Inhalation of VOCs from Groundwater	Insignificant	Insignificant	Insignificant	**Potentially Complete**	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Currently, inhalation of VOCs in ambient air resulting from VOCs that migrated from groundwater is insignificant as chemical intake is less relative to other pathways. Future exposure to groundwater may lead to inhalation of VOCs in ambient air by future onsite residents during household use or by construction/utility workers during excavation activities. For the latter, however, exposure is insignificant relative to other pathways.
			Ingestion of Plants/ Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Groundwater may potentially be used for irrigation purposes. While exposure for current offsite residents and future offsite and onsite residents is possible, it is considered insignificant relative to other exposure pathways.
			Drinking Water	Incomplete	Incomplete	Incomplete	**Potentially Complete**	**Potentially Complete**	Incomplete	Incomplete	Incomplete	Incomplete	Groundwater at the site is currently not used, therefore exposure pathways are incomplete. Additionally, future construction workers, casual trespassers, wildlife reserve workers or range supervisor are not expected to come in direct contact with groundwater or use it as a source for drinking water. Future residents could use groundwater as a future source of drinking water.

- Inhalation of fugitive particulates from subsurface soil by future onsite residents (adults/children), current and future construction/utility workers and future industrial workers through excavation or gardening activities.
- Inhalation of VOCs in ambient air from impacted subsurface soil by future onsite residents (adults/children), and current and future industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker and future EOD Training Range supervisor.
- Inhalation of VOCs in indoor air resulting from surface soil or subsurface soil by future onsite and offsite residents and onsite industrial workers.
- Dermal contact with chemicals in groundwater by future potential onsite and offsite residents (adults/children) and onsite industrial workers.
- Ingestion of impacted groundwater as drinking water for future onsite and offsite residents (adults/children) and future onsite industrial workers.
- Inhalation of VOCs in ambient air from impacted groundwater by future potential onsite and offsite residents (adults/children).
- Inhalation of VOCs in indoor air as a result of VOC migration from impacted groundwater by future onsite residents and industrial workers.
- Ingestion of chemicals in surface water by current offsite and future onsite residents (adults/children), current and future onsite industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Dermal contact with chemicals in surface water by current offsite and future onsite residents (adults/children), current and future onsite industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Inhalation of VOCs from surface water by future onsite residents (adults/children) and current and future onsite industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Ingestion of chemicals in sediment by current offsite and future onsite residents (adults/children), current and future onsite industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Dermal contact with chemicals in sediment by current offsite and future onsite residents (adults/children), current and future onsite industrial workers, construction workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Inhalation of VOCs from sediment by future onsite residents (adults/children) and current and future industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.
- Inhalation of fugitive particulates from sediment by current offsite and future onsite residents (adults/children), current and future onsite industrial workers, construction/utility workers, casual trespassers (adults), future wildlife reserve worker, and future EOD Training Range supervisor.

Exposure for offsite residents would most likely be through ingestion of impacted groundwater. Currently, the nearest drinking water well is approximately 10 miles away, thereby minimizing the potential for exposure (and pathway is considered incomplete). In the future, however, the nearest drinking water well could theoretically be as close as the property boundary. Beyond this point, the Navy has no jurisdiction in determining the use of the land. Using this rationale, potential risks to offsite residents were qualitatively evaluated at the property boundary of IRP Site 1 using exposure parameters for future onsite residents and onsite chemical concentrations.

The pathways by which future wildlife reserve workers may become exposed is likely similar to those for future industrial workers; however the degree of exposure (i.e., chemical intake) for the wildlife reserve workers is considered less based on activity patterns. Therefore, the evaluation of the site for potential future industrial exposures is most likely protective of potential wildlife reserve workers, such that the wildlife reserve worker in not evaluated quantitatively in this SRA.

6.4.3.3 SUMMARY OF SOURCES AND EXPOSURE PATHWAYS

A description of exposure pathways reasonably anticipated for each impacted medium at the site is described.

Surface Soil. Significant potential pathways for human exposure at the site include direct contact by dermal absorption and incidental ingestion of COPCs in surface soil. The inhalation of VOCs was conservatively included despite that chemicals of this constituent class are not persistent in the shallow soil environment unless a current VOC source is present at shallow depths. The inhalation of other compounds via particulates is also included, although the presence of vegetation, buildings and pavement currently onsite may limit the amount of dust generation. Exposure to chemicals via the inhalation pathway could become more significant during or after future construction activities when vegetation, buildings or pavement is removed.

Subsurface Soil. Exposure to chemicals in subsurface soil at this site may occur via direct contact with the soil (by dermal adsorption or incidental ingestion), and inhalation of VOCs and particulates during construction activities or while future potential residents are gardening. Future industrial workers may also be potentially exposed if subsurface soil is brought to the surface by future excavation activities. Evidence of limited contamination of VOCs in the subsurface suggests a low potential for chemical vapors in soil gas and possible vapor migration into future buildings.

Some of the chemicals detected in the subsurface could potentially leach into groundwater. With the exception of the VOCs and perchlorate, there is minimal potential for COPCs to leach from soil to groundwater. Most inorganics have limited mobility in soil of neutral pH, particularly soil with high silt and clay content. Dioxins tend to be relatively immobile because of their low solubility and high affinity for soil. Long-chain petroleum hydrocarbons (i.e., diesel and oil range) tend to adsorb strongly to soil. However, VOCs and perchlorate in soil tend to be more mobile and could readily migrate to groundwater.

Groundwater. Exposure to chemicals in groundwater is typically through tap water ingestion or dermal contact and inhalation of VOCs (if present) during household use. Groundwater beneath the site may potentially be used as a source of drinking water or for irrigation purposes. However, exposure to contaminants in food items that have been irrigated or watered with impacted groundwater is considered insignificant relative to exposure through direct use of the impacted groundwater. The migration of VOC vapors from groundwater into future buildings is possible.

Surface Water. Exposure to chemicals in surface water may potentially occur primarily through ingestion and dermal contact by current offsite and future onsite residents, and current and future

onsite workers, construction workers and casual trespassers. While the inhalation of VOCs is a potentially complete exposure pathway, contaminant intake from this pathway is relatively insignificant when compared to ingestion and dermal contact due to dilution of chemicals in ambient air.

Sediment. Exposure to chemicals in sediment may potentially occur primarily through ingestion and dermal contact by current offsite and future onsite residents, and current and future onsite workers, construction workers and casual trespassers. The inhalation of fugitive particulates provides a secondary pathway for exposure.

6.4.4 Estimation of Exposure Point Concentrations

Exposure point concentrations (EPCs) are used in both the RME and average (or CTE) risk characterization; the same EPC is used in both CTE and RME risk characterization based on EPA Guidance (EPA 1992b). When data sets are relatively small (less than or equal to 10 samples), there is great uncertainty in the confidence of the calculating of a 95 percent UCL; therefore, the 95 percent UCL is only generated for data sets with 11 or more detections. In general, when the maximum detected concentration exceeds the 95 percent UCL, the 95 percent UCL is chosen as the EPC. Alternatively, when the maximum value is less than the 95 percent UCL, the maximum value is chosen as the EPC. According to the EPA's most recent guidance for calculating UCLs for EPCs (EPA 2002a), "defaulting to the maximum value of small data sets" may be the best approach to use in evaluating risk at a site." To derive the 95 percent UCL and to minimize uncertainties that may arise with the use and application of various statistical software packages, ProUCL (Version 3, EPA 2004b) was used to calculate the 95 percent UCLs. To simplify, the following rules were applied when choosing the EPC:

1. When the number of detections was fewer than or equal to 10, the maximum detected concentration was used as the EPC.
2. When the number of detections was greater than or equal to 11, the 95 percent UCL on the mean was calculated using the ProUCL software; the 95 percent UCL was selected based on the recommended output of the ProUCL results.
3. When the 95 percent UCL was greater than the maximum detected concentration, the latter was used as the EPC based on EPA Guidance (EPA 2002a).

Dioxins/furans are special case chemicals for which EPCs are calculated based on the potential risks that could occur based on the additive nature of these special case chemicals. A discussion of the toxicity of this chemical class and the necessity of deriving a total EPC for the class is presented in Section 6.5.1.2.

Dioxins/Furans

Dioxins and furans were detected in soil samples collected at IRP Site 1. A residential PRG is only available for 2,3,7,8–TCDD. A provisional but generally accepted method exists that allows conversion of analytical concentrations to toxic equivalents relative to 2,3,7,8–TCDD. Specifically, for each sample, the concentration (or one-half of the reporting limit for nondetects) of each dioxin/furan congener is multiplied by a WHO-based TEF to convert the concentration to an equipotent concentration of TCDD (EPA 2000b). Available TEFs for dioxins and furans along with the TCDD-equivalent concentrations for each sample location are presented in Tables G-8 and G-9, Appendix G, for the surface soil and subsurface soil, respectively. The converted equipotent concentrations were then summed to obtain a toxicity equivalent quotient (TEQ) EPC for each sample. For these calculations, nondetected dioxin and furan results were estimated as one-half the

reporting limits unless the constituent was not detected anywhere else onsite. Then, the constituent results were included in the total. The TEQ approach is described mathematically in EPA Guidance (2000b) as:

$$Total\ \ Toxicity\ \ Equivalence\ \ (TEQ) = \sum_{n=1}^{k} C_n \ \ * \ \ TEF_n$$

Where:

C_n = Concentration of the individual congener in the complex mixture under analysis

TEF = Toxicity equivalency factor of the individual congener

The TCDD equivalents for surface and subsurface soil depths are presented in Tables G-8 and G-9, Appendix G. The uncertainty associated with the TEF method is presented in Section 6.6.5, Uncertainties in the Screening Risk Assessment.

6.5 RISK-BASED SCREENING EVALUATION

The human health RBS included the following steps:

- *Development of a CSM* (Section 6.4.2). Analysis of the CSM identified potentially complete exposure pathways for both current and future land uses.
- *Identification of relevant data sets*. For this risk assessment, surface soil (0 to 2 feet), subsurface soil (0 to 10 feet), surface water, sediment, and groundwater data were evaluated. Any data assigned an "R" qualifier were eliminated from the database and not used in the screening RBS. Nondetected results with RLs exceeding two times the maximum detected concentration were excluded from the data sets. TPH analytical data were screened against non-risk-based criteria but were not included in the quantitative evaluation.
- *Identification of COPCs*. Any detected chemical was considered a COPC.
- *Selection of EPCs*. The process by which the appropriate EPC is derived is summarized in Section 6.4.4.
- *Comparison of COPC EPCs to Screening Criteria.* The EPCs were compared to EPA Region 9 (EPA 2004a) residential and industrial PRGs to provide options for land use considerations.
- *Assessment of Soil Vapor Migration.* EPCs in soil and groundwater were used to model indoor air concentrations, which were compared to EPA Region 9 ambient air PRGs (EPA 2004a).

EPA Region 9 soil PRGs are concentrations of COPCs in soil that are based on standardized equations and exposure factors for residential and industrial land use. Corresponding to the points of departure defined in the NCP (EPA 1990) (i.e., a cancer risk of 10^{-6} or a noncancer hazard quotient [HQ] of 1), PRGs represent COPC concentrations at or below which no substantive adverse health effects are likely to occur from the exposures assumed in the screening RBS.

EPA Region 9 PRGs do not consider all possible exposure pathways. For instance, some of the exposure scenarios for which the PRG use is not intended include exposure to COPCs in indoor air from soil gas; water used for swimming, wading, or bathing; food such as contaminated fish, meat, dairy products, fruit, or vegetables; and groundwater contaminated from leaching processes. Further, and as noted by EPA Region 9, PRGs are not intended as stand-alone decision-making tools or as substitutes for EPA guidance when preparing risk assessments. However, they do suffice to evaluate

the potential for adverse health effects for a relatively wide range of exposure conditions and land uses (i.e., residential and industrial) commonly encountered by the DON. In such applications, risk can be adequately characterized if exposure assumptions inherent in the PRGs are similar to those made in the exposure assessment of the RBS.

The EPA Region 9 PRGs are used to identify COPCs for further evaluation and to illustrate risk/hazard estimates for the default residential and industrial scenarios. For instance, EPCs for chemicals in soil exceeding residential PRGs are identified as COPCs in the SSRBE (or site-specific PRE under the EPA Region 9 terminology). Such a comparison also provides insight into the potential for unrestricted land use for the site, and in cases where the site is industrial, PRGs for industrial land use are potential target cleanup goals protective of industrial workers. The Tier 1A RBS first entailed a comparison of site EPCs to residential PRGs for relevant exposure pathways. This comparison was performed:

- If the complete or potentially complete exposure pathways of concern at a site were identical to those used in the development of PRGs, and
- If the pathway-specific exposure parameters were similar to the EPA Region 9 default assumptions used to develop the PRGs.

As a conservative approach, the screening RBS consisted of a comparison of site EPCs to residential PRGs. EPCs were then compared to industrial PRGs. If the cumulative risk was below the target incremental cancer risk of 10^{-6} or the target noncancer HI of 1.0, the risk evaluation was considered complete. If potential risk exceeded the target risk of 10^{-6} or the target noncancer hazard of 1.0, or if exposure pathways and parameters were identified that were not consistent with those used to develop the PRGs (such as the casual trespasser and construction/utility worker), a SSRBE was completed. In this case, only those chemicals that exceeded the residential PRG screening process were carried forward.

For PRGs to be relevant in the evaluation, exposure pathways and exposure parameters in the CSM should be similar to those used to develop the PRGs used for comparison. The industrial exposure pathways and default exposure parameters are assumed to be the same as those used to develop industrial PRGs. However, there are no available Region 9 PRGs for receptors equivalent to the construction/utility worker, casual trespasser (adult) or EOD Training Range supervisor. Therefore, the risk evaluation for these receptors was conducted in the SSRBE if concentrations exceeded residential PRGs.

In addition to the PRG comparisons, EPCs in soil and groundwater were used to model potential VOC concentrations in indoor air using the EPA Johnson & Ettinger (J&E) model (EPA 2004e), using the California EPA-recommended indoor air exchange values (Cal-EPA 2004). This additional evaluation is necessary because a) the inhalation of VOCs in indoor air is considered potentially complete for future onsite residents and industrial workers, and b) EPA Region 9 does not consider this exposure pathway in the development of its PRGs.

Evaluation of risks for each of the receptors identified for IRP Site 1 considers the various behaviors and levels of activity by which potential exposure may occur. Risks are determined assuming two levels of exposure: a high-end level or RME; and an average or CTE. PRGs were therefore calculated assuming both RME and CTE scenarios. The purpose for providing risk estimates under both exposure scenarios is to give a sense of the variability surrounding a risk estimate; the two comparisons provide a bounded risk estimate for typical exposures.

6.5.1 Selection of Screening Criteria

As noted above, the general approach for the human health RBS is to conduct a risk screening using EPA Region 9 PRGs. Chemical-specific toxicity values are integrated with the exposure parameters to derive the PRGs. A summary of the approach used to obtain toxicity values follows.

6.5.1.1 TOXICITY VALUES

Because PRGs are based on the toxicity of chemicals that may be ingested, inhaled, or dermally absorbed, it is helpful to understand the derivation of toxicity values used in a toxicity assessment. The purpose of the toxicity assessment is to weigh the available evidence regarding the potential for chemicals to cause adverse health effects and to provide a quantitative estimate of the relationship between the magnitude of exposure and the likelihood or severity of adverse health effects (i.e., dose-response assessment; EPA 1989). Toxicity values are used to provide a quantitative estimate of the relationship between the magnitude of exposure and the potential for adverse health effects.

Per United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (EPA 2003a), the current hierarchy for human toxicity values is:

- Tier 1 – EPA's Integrated Risk Information System (IRIS)
- Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values

The primary source of toxicity information is EPA IRIS. When a toxicity value is not available in IRIS, other sources of toxicity information can be considered in accordance with EPA Guidance (EPA 2003a); these additional sources are often considered "provisional." In this assessment, any chemical for which a Region 9 PRG was predicated on a provisional toxicity value will be listed in the uncertainty section (6.6.5) and the effect on the risk estimates will be discussed in terms of a bias high or bias low based on available toxicity information.

Toxicity Values for Noncarcinogens. Toxicity values are presented as RfDs for noncarcinogens. The EPA Region 9 PRG tables provided virtually all the RfDs and sources of those PRGs used in the current SRA (EPA 2004a). Many of the RfDs used by EPA Region 9 in deriving PRGs were obtained from the IRIS database (EPA 2003b), but the RfD for perchlorate has since been revised (EPA 2005). The RfD for 2-methylnaphthalene was added to the IRIS database soon after the database search used in the development of Region 9 PRGs. The revised value for perchlorate and the new value for 2-methylnaphthalene are used to calculate PRGs using equations as presented by EPA Region 9. Noncarcinogenic chemicals with provisional values are listed and discussed in the uncertainty section 6.6.5.

Oral RfDs (expressed in units of milligrams per kilogram per day [mg/kg-day]) have been developed to evaluate the potential for adverse noncancer health effects from ingestion of chemicals. Chronic RfDs are specifically developed to be protective for long-term exposure to a chemical and are generally used to evaluate the potential noncancer effects associated with exposure periods between seven years and a lifetime (EPA 1989). The RfD is derived from a no-observed-adverse-effect-level (NOAEL) or a lowest-observed-adverse-effect-level (LOAEL). For the risk assessment, a NOAEL is the key datum obtained from a study of a dose-response relationship. It is the highest level tested at which no adverse effects were demonstrated. In some studies, only a LOAEL rather than a NOAEL is available. However, the use of a LOAEL requires additional uncertainty factors (UFs) and modifying factors (MFs) to ensure that a health-protective toxicity value is used (EPA 2003b).

UFs are typically 10 fold factors used for estimating RfDs from laboratory to account for the (1) variation in sensitivity among the members of the human population (i.e., inter-human or intra-species variability); (2) uncertainty in extrapolating animal data to humans (i.e., interspecies variability); (3) uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure to lifetime exposure (i.e., extrapolating from sub-chronic to chronic exposure); (4) uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) uncertainty associated with extrapolation from animal data when the database is incomplete.

MFs are included to reflect the scientific uncertainties not explicitly addressed using UFs, and range from 1 to 10. The default value for a MF is 1.

Methods used to derive inhalation RfDs are conceptually similar to those used to derive oral RfDs. However, the actual analysis of inhalation exposures is more complex than that for oral exposures because of the dynamics and differential structures of the respiratory system and the ability to account for the inhaled dose in the experiment design of laboratory studies. The reference values from inhalation studies are generally reported as a reference concentration (RfC) in air (milligrams per cubic meter [mg/m^3]). However, these values are converted to RfDs for use in risk assessments. As noted in its documentation, EPA Region 9 has converted inhalation RfCs to RfDs using a human body weight of 70 kilograms (kg) and inhalation rate of 20 cubic meters per day (m^3/day).

All noncancer HIs presented in this SRA, except that for perchlorate and 2-methylnaphthalene, are based on noncarcinogenic toxicity values recommended by EPA Region 9. Since the October 2004 presentation of the Region 9 PRG table, the RfD for perchlorate has been revised to 0.007 mg/kg-day (EPA 2005). This value represents a seven-fold increase over the RfD presented in the EPA Region 9 PRG table. Additionally, an oral RfD of 0.004 mg/kg-day for 2-methylnaphthalene from the IRIS database is included.

Toxicity Values for Carcinogens. The predominant theory behind cancer development as it relates to risk assessment is that a small number of molecular events can evoke changes in a single cell, which can lead to uncontrolled cellular proliferation and, eventually, to cancer. In this model (i.e., the linear low dose model), it is assumed that there is no level of exposure to a chemical that does not pose "a finite probability, however small, of generating a carcinogenic response" (EPA 1989). Recent insight into the cancer processes does, however, suggest that theoretically, a threshold mechanism may be operative, especially if the cancer is a "...secondary effect of toxicity or of an induced physiological change that is itself a threshold" (EPA 2003c). Data are not yet sufficient to apply the "threshold" concept in the development of risk assessments for carcinogens that are intended to be protective of the potentially exposed receptor group. Thus, the linear low-dose model is still considered applicable.

The evaluation of the chemical carcinogenicity is a complex process that can be summarized by two primary steps. Initially, the toxicity database for a substance is evaluated for its potential utility in assessing carcinogenic potential. In this step, a weight-of-evidence (WOE) classification is assigned to the chemical. The WOE classification scheme is designed to present the likelihood that a chemical will cause cancer in humans based on the strength of supporting human and/or animal data.

Currently, there are two WOE classifications available for use in conjunction with human health risk assessments. The most recent WOE classification is defined in the latest EPA cancer risk assessment guidelines (EPA 2005a) and is designed to revise and replace the *Guidelines for Carcinogen Risk Assessment* published in September 1986 (EPA 1986b). While the IRIS program will incorporate the new WOE discussion/criteria into revised or new IRIS chemical profiles, existing chemical profiles are still based on the 1986 EPA guidelines.

The WOE descriptors based on the 2005 Revised Guidelines are summarized as:

"Likely to Be Carcinogenic to Humans" – this descriptor reflects strong evidence of carcinogenicity.

"Suggestive Evidence of Carcinogenic Potential" – this descriptor is used when there is sufficient evidence to demonstrate potential carcinogenicity to humans.

"Inadequate Information to Assess Carcinogenic Potential" – this descriptor is used when there is sufficient evidence to suggest a concern for potential carcinogenic effects in humans, but data are not sufficient for a strong conclusion.

"Not Likely to Be Carcinogenic to Humans" – this descriptor is used when data are determined to be inadequate for applying one of the other three descriptors.

Because the revised cancer guidelines are not yet incorporated into many of the IRIS chemicals profiles at the time of this evaluation, the WOE classifications defined by the EPA (EPA 1989, 1986) and shown in the toxicity profiles on the IRIS system are still used when interpreting toxicity of COPCs at IRP Site 1. This WOE classification used in this risk assessment is defined as follows:

Group A:	Known human carcinogen
Group B:	Probable human carcinogen
Group B1:	Limited evidence of carcinogenicity in humans
Group B2:	Sufficient evidence in animals, but inadequate evidence in humans
Group C:	Possible human carcinogen (limited evidence of carcinogenicity in animals in the absence of human data)
Group D:	Human carcinogenicity not classifiable because of lack of data
Group E:	Evidence of noncarcinogenicity in humans (no evidence in at least two adequate animal tests in different species or in both epidemiological and animal studies)

Oral cancer slope factors (CSFos), are expressed as the proportion of a population affected per mg/kg-day dose and are typically reported in units of $(mg/kg\text{-}day)^{-1}$. Currently, CSFos are derived for chemicals with WOE classifications of A, B1, or B2, and occasionally C (noted above). Inhalation cancer toxicity data are presented as a unit risk (expressed as $[mg/m^3]^{-1}$ or micrograms per cubic meter $[\mu g/m^3]^{-1}$) and can be interpreted as "...the increase in the lifetime risk of an individual who is exposed for a lifetime to either 1 mg/m^3 or $\mu g/m^3$ of the cancer agent" (EPA 1986). EPA Region 9 converted unit risks to CSFo by multiplying by the inhalation rate of 20 m^3/day and dividing by a body weight of 70 kg. All PRGs for carcinogenic chemicals evaluated in this SRA are based on the CSFs recommended and used by Region 9 (EPA 2004a).

6.5.1.2 *Availability of Toxicity Values*

Some chemicals may exhibit both carcinogenic and noncarcinogenic health effects. Toxicity values are generally available for the oral route of exposure. Inhalation toxicity values have also been developed for some constituents. However, route-to-route extrapolations are frequently used when there are no toxicity values available for a given route of exposure. Oral CSFos and RfDos were used for both oral and inhalation routes of exposures for organic chemicals lacking inhalation values (EPA 2004a).

Chemical disposition in the body may determine the dose of toxicant that reaches the target organ, confounding the interpretation of toxicity values. For instance, dermal exposures rarely result in the entire applied dose entering systemic circulation. However, because this phenomenon is poorly quantified, toxicity values for evaluating risk from dermal exposure may employ route-to-route (oral to dermal) extrapolations that do not consider the fraction absorbed. Similarly, for the oral route, the orally administered dose is often not entirely absorbed from the gastrointestinal (GI) tract into systemic circulation. Because of incomplete absorption from the GI tract, correcting the administered dose by the fraction absorbed might be preferred to better determine a toxicity value that reflects the actual dose to the target organ.

However, this is not possible for many chemicals because sufficiently credible database does not exist to allow such refinements. Therefore, EPA Region 9 did not adjust toxicity values to correct for the fraction absorbed for any of the COPCs identified in the SRA (EPA 2004a).

Of all the toxicity data that are available, some chemicals do have data to enable quantitative development of toxicity values. In these instances, the toxicity of these chemicals is evaluated qualitatively in Section 6.6.5, Uncertainties in the Screening Risk Assessment. In some instances, because "groups" of chemicals may have similar toxicity (and therefore additive toxicity), it is important to consider the potential additive toxicity of these special case chemicals; these special case chemicals are discussed below.

Special Case Chemicals—Dioxins/Furans

When groups of structurally similar chemicals are present in the environment, it is important to adequately characterize the potential risks that could occur from exposure to such chemicals based on their additive nature. For the dioxins/furans, the TEFs derived by the WHO (WHO 1997) are sometimes used to estimate a total 2,3,7,8-TCDD TEQ concentration for comparison to the 2,3,7,8-TCDD PRG. The uncertainty associated with deriving the 2,3,7,8-TCDD TEQ concentration is presented in Section 6.6.5, Uncertainties in the Screening Risk Assessment. The procedure for deriving the 2,3,7,8-TCDD TEQ is provided in Section 6.4.4 with the TEQ results for soil being presented in Tables G-8 and G-9, Appendix G.

California-Approved Toxicity Values

The California Department of Toxic Substances Control, Human and Ecological Risk Division has established different toxicity values for several chemicals identified at IRP Site 1 than used by EPA Region 9. Chemicals include arsenic, chloroform, lead, naphthalene, and trichloroethylene. Cancer risk and noncancer hazard estimates were also calculated using these California-modified toxicity values (refer to Appendix G, Attachment A). A summary of these estimates are provided in Section 6.5.5.3.

6.5.1.3 SCREENING CRITERIA—EPA REGION 9 PRELIMINARY REMEDIATION GOALS FOR SOIL

The screening criteria for use in the RBS are based on those PRGs that have been developed by EPA Region 9 for the reasonable maximum exposure or RME scenario. Their development assumes that exposure to chemicals at or below PRG concentrations represent a minimal risk to human health. For soil, two sets of exposure criteria exist:

Residential PRGs for Soil: A conservative set of PRGs are applicable to sites 1) that currently or are anticipated to be used for residential purposes, or 2) for which the DON wishes to determine the potential for unrestricted transfer of property.

Industrial PRGs for Soil: One set is used for sites currently or anticipating industrial land use.

Groundwater: For groundwater, a single set of criteria are used.

Residential PRGs for Tap Water: A conservative set of PRGs used to evaluate consumption of water at the tap under the residential scenario.

The PRGs provided by EPA Region 9 are derived using standard equations and exposure factors for the RME scenario. The substitution of exposure factors under an average or CTE scenario produces another set of PRGs that is based on the CTE scenario. The exposure factors used in deriving residential and industrial PRGs under the CTE assumption are presented in Table G-10, Appendix G. By including PRGs for both RME and CTE scenarios, cumulative risk estimates for each receptor and exposure medium are presented for an average and high-end level of exposure. The presentation of both estimates provides a measure of the variability surrounding the risk estimate.

Some chemicals (e.g., TPH) do not have accepted toxicity values from which PRGs can be estimated based on potential health effects, but do have levels that are suggested for use by state governments and/or local municipalities. These levels are often based on aesthetic criteria or the toxicity of specific petroleum hydrocarbon fractions. In such instances, indicator chemicals (Section 6.2.2) accounted for the assessment of petroleum hydrocarbon toxicity while a non-health-based screening level was used for qualitative comparisons of petroleum hydrocarbon data. In other instances (i.e., lead), values deemed to be protective of the potential receptor groups are based on the potential for adverse health effects, but are not amenable to the evaluation of risk in the context of slope factors or RfDs. In this instance, screening levels for lead are included in the RBS tables for comparison purposes, but are not used in the calculation of cumulative incremental cancer risk or HI. Such comparisons for chemicals with non-risk-based screening levels are discussed in Section 6.5.5.

In summary, EPA Region 9 PRGs were used to derive estimates of carcinogenic risk and noncarcinogenic health effects in the RBS under the RME scenario. Calculated site-specific PRGs were used to evaluate risks and hazards under the CTE scenario. Incremental cancer risk and HQs were not estimated for COPCs without available PRGs. Comparisons of the EPCs to non-risk-based screening levels were not included in the cumulative incremental risk or the HI. Rather, these comparisons are presented qualitatively because the screening criteria are not risk-based.

6.5.2 Background Comparisons

IRP Site 1 is located in an area of California that characteristically has elevated levels of various elements (i.e., arsenic and chromium) in soil. Methods do exist to differentiate between concentrations of naturally occurring elements and those that may be associated with site related activities. This method (i.e., the onsite method) is a probabilistic methodology that has the potential to identify background concentrations thus allowing their exclusion from the risk assessment process pursuant to the EPA (EPA 1989). Derivation of the soil background concentrations for Former MCAS El Toro is presented in the *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations, Marine Corps Air Station, El Toro, California* (BNI 1996).

However, rather than eliminate elements detected at concentrations equal to or below their background concentrations before risk is characterized, (DON 2004a) all data, regardless of source origin, have been included in the determination of cancer risk and noncancer hazard, per EPA Region 9 recommendations (Stralka 1995). Thus, incremental, or excess, risk is presented as the sum of estimated potential risks associated with all COPCs with EPA Region 9 PRGs (EPA 2004a), irrespective of elevated chemical concentration that may not be related to facility activity. However, to better ascertain the risks associated with site-related activities, cancer risks and noncancer hazards

are also presented without the contribution of background levels of metals. A single detection (i.e., the maximum detected concentration) above the background level was used to define a chemical that is considered site-related. The uncertainty associated with this definition is presented in Section 6.6.5, Uncertainties in the Screening Risk Assessment.

6.5.3 Estimation of Cumulative Health Risks

To evaluate risk from exposure to COPCs in soil, EPCs were compared to residential soil PRGs under either the RME or CTE scenario. The following soil and air pathways are considered in the development of soil PRGs:

- Incidental ingestion of chemicals in soil
- Dermal contact with chemicals in soil
- Inhalation of chemicals in fugitive dust
- Inhalation of VOCs

In accordance with EPA Region 9 PRG Guidance (EPA 2004a), exposure parameters for children aged zero to six years were used to estimate noncarcinogenic residential PRGs. Age-adjusted exposure parameters were used to estimate carcinogenic residential PRGs for individuals from zero to 30 years old (i.e., 30-year residents).

Excess (incremental) cancer risk associated with a COPC, using its EPC and carcinogenic PRG, was estimated using the following formula:

$$Excess\ Cancer\ Risk = TR \times \frac{EPC_i}{PRG_i}$$

Where:

TR = The target incremental lifetime cancer risk of $1x10^{-6}$

EPC_i = Exposure point concentration of $COPC_i$ detected in soil (µg/kg or mg/kg)

PRG_i = PRG for $COPC_i$ in soil (µg/kg or mg/kg) based on carcinogenic effects

A HQ for each COPC, using an EPC and its respective noncarcinogenic PRG, was estimated using the following formula:

$$Hazard\ Quotient(HQ) = THQ \times \frac{EPC_i}{PRG_i}$$

Where:

THQ = The target HQ of 1

The cumulative incremental cancer risk (or incremental lifetime cancer risk [ILCR]) is also estimated to evaluate potential exposure to multiple COPCs using the following equation:

$$\textit{Incremental Lifetime Cancer Risk} = \sum_{i=1}^{i=n}\left[TR \times \frac{EPC_i}{PRG_i}\right]$$

The cumulative noncarcinogenic HI for exposure to multiple COPCs was estimated as follows:

If the cumulative incremental cancer risk and noncancer HIs exceeded $1x10^{-6}$ and 1.0, respectively, and/or the lead EPC exceeded the residential PRG of 400 mg/kg, then EPCs were compared to industrial soil PRGs.

$$\textit{Cumulative Noncarcinogenic Hazard Index} = \sum_{i=1}^{i=n}\left[THQ \times \frac{EPC_i}{PRG_i}\right]$$

6.5.4 Indoor Air Evaluation

Certain volatile chemicals in soil and groundwater have the potential, through vaporization and soil gas migration, to enter into buildings, where persons may become exposed through inhalation. To evaluate whether this potentially complete exposure pathway is significant at IRP Site 1 and could potentially pose adverse health effects, concentrations of chemicals in indoor air were estimated using the Advanced J&E Model (EPA 2004e) and were compared to EPA Region 9 ambient air PRGs. Residential and industrial exposure scenarios were evaluated for soil at IRP Site 1 under the RME and CTE scenarios. A residential exposure scenario was evaluated for groundwater.

6.5.4.1 Model Theory

The Advanced J&E Model (EPA 2004e) is a screening-level tool that incorporates both convective and diffusive mechanisms for estimating the transport of certain volatile chemical vapors emanating from either contaminated soil or groundwater into an indoor space located directly above the source of contamination. By applying the Advanced J&E Model, the user is able to estimate volatile chemical concentrations (and incremental risk due to the volatile chemicals) in the indoor space. In the case of IRP Site 1, this indoor space is a hypothetical future building.

EPA Region 9 ambient air PRGs were used to compare against the resulting concentrations in indoor air for screening purposes because:

1) Values are risk-based and incorporate inhalation toxicity values (RfDs or slope factors) accepted by EPA Region 9;
2) The ambient air PRGs incorporate a daily inhalation rate that is based on a 24-hour exposure (an entire day) and is therefore conservative;
3) The carcinogenic screening values are based on an age-adjusted residential exposure duration of 30 years to account for exposure as both a child and adult;
4) The noncarcinogenic screening values conservatively assume an adult exposure over the entire 30 years which results in a greater chemical dose than (and therefore is protective of) a child's six years of exposure.

6.5.4.2 VAPOR EMISSION AND MIGRATION FROM SOIL

At IRP Site 1, chemicals detected in soil at depths from 0 to 10 feet included 10 volatile organic compounds, nine SVOCs, 23 metals, two additional inorganic compounds, eight explosives residues, dioxins, and hydrocarbons. Of these chemicals, only 12 are sufficiently volatile to migrate in soil gas and enter buildings via vapor intrusion: acetone, BTEX, chloroform, hexachlorobenzene, methylethyl ketone, methylisobutyl ketone, 2-methylnaphthalene, naphthalene, and PCE.

6.5.4.2.1 Residential Scenario

Using the exposure point concentrations identified in the SRA at IRP Site 1 for each of these 12 chemicals in soil, the Advanced J&E Model (EPA 2004e) was utilized with the following assumptions:

- The hypothetical building was assumed to be a slab-on-grade construction with a depth of 15 centimeters (cm) since basements are uncommon in the vicinity of the site;
- Shallow soil onsite was determined to be mostly loamy sand (Earth Tech 2005);
- Depth to contamination was assumed to equal the depth of the maximum detected concentration;
- Soil parameters were measured to include fraction of organic carbon (0.005), total porosity (38.37 percent) and water-filled porosity (12.30 percent) (Earth Tech 2005);
- The residential indoor air exchange rate was set at 0.5 per hour (Cal-EPA 2004c). Although the default for J & E is 0.25 per hour, Cal-EPA recommends the use of 0.5 per hour for sites in California;
- The model was used to estimate the average vapor flow rate into buildings.

Using the above assumptions, indoor air VOC concentrations were estimated from soil exposure point concentrations and compared against ambient air PRGs to estimate incremental lifetime cancer risks and cumulative noncancer hazards under the RME scenario. To evaluate risks/hazards under the CTE scenario, modeled indoor air concentrations were compared to PRGs that were specifically calculated using equations of EPA Region 9 (2004a) and the exposure factors for the CTE scenario that are identified in Table G-10, Appendix G.

6.5.4.2.2 Industrial Scenario

To evaluate indoor air under an industrial use scenario, indoor air VOC concentrations were compared to PRGs that were calculated for an industrial worker. Using the same equations as EPA Region 9, values for exposure frequency (250 days/year) and exposure duration (25 years) were used for the industrial scenario. Additionally, the adult daily inhalation rate (20 m^3/day) was adjusted downward by a factor of 3 to account for an eight-hour work day. Indoor air VOC concentrations were estimated using the same J&E assumptions except that a commercial air exchange rate of one per hour was used, which is recommended by Cal-EPA for sites in California (Cal-EPA 2004c). The resulting PRGs and comparisons with estimated indoor air VOC concentrations are used to estimate incremental lifetime cancer risks and cumulative noncancer hazards.

6.5.5 Results of the Risk-Based Screening

If the maximum detected concentration was below the residential PRG for a particular chemical and the cumulative incremental cancer risks were below $1x10^{-6}$, and/or the HI was less than 1.0, then no further action was recommended for the site and the evaluation of risk was completed. If any of these criteria were exceeded, then an SSRBE was prepared. In the case of lead, if its EPC was less than the EPA Region 9 residential criterion of 400 mg/kg, no further action was recommended with respect to lead. Additionally, site-specific risk-based evaluations were prepared for the construction/utility worker, casual trespasser (adult), and EOD Training Range supervisor because exposure parameters for these receptors are different from those used to develop residential and industrial PRGs.

EPCs for chemicals detected in surface soil, subsurface soil, sediment, groundwater, and surface water collected from IRP Site 1 are compared to EPA Region 9 (2004a) residential and industrial PRGs for the appropriate medium (refer to Tables G-11 through G-22, Appendix G). The following text summarizes the carcinogenic risk and noncancer hazard estimated for these media under the residential and industrial land use scenarios.

6.5.5.1 Residential Land Use Evaluation

Because the site is located in a suburban and relatively undeveloped area of various uses, evaluation of the residential land use provides information for the unrestricted transfer of the property. This section summarizes the results of the residential evaluation of surface and subsurface soil, sediment, groundwater, and surface water. Potential risks associated with the EPC are estimated using comparisons between the EPC and either the Region 9 PRGs (under the RME scenario) or PRGs that were calculated for the CTE scenario (refer to Tables G-11 through G-18, Appendix G). To identify those COPCs in soil and sediment that require further evaluation in the SSRBE, maximum detections are compared to EPA Region 9 soil PRGs for residential and industrial exposure scenarios. For evaluating groundwater, EPCs are compared to tap water PRGs provided by EPA Region 9 (2004a). Results for the evaluation of each medium under a residential land use assumption follows.

Surface Soil. EPCs for surface soil data collected from IRP Site 1 were compared to EPA Region 9 residential soil PRGs under the RME scenario and site-specific PRGs under the CTE scenario (refer to Table G-11, Appendix G). The following paragraphs summarize the carcinogenic risk and noncancer hazard estimated for surface soil under the residential land use scenario.

Carcinogenic Risk. The incremental lifetime carcinogenic risk for surface soil exposure under an assumed residential land use is $8x10^{-6}$ for the RME scenario and $1x10^{-6}$ for the CTE scenario. Excluding the contribution of metals at background levels, these risk estimates remain the same. Only the risk estimate under the RME scenario is within the risk management range of 10^{-6} to 10^{-4} (as defined by the EPA). Under the RME scenario, arsenic (at 2.12 mg/kg) accounts for 70 percent of the risk with less contribution from n-nitrosodiphenylamine (nine percent), dioxin as represented by TCDD TEQ (nine percent), benzene (six percent), and RDX (6 percent). Only the maximum detected concentration for arsenic (8.6 mg/kg) exceeded its residential PRG; however, this maximum detection was the only surface soil sample result that exceeded the background value of 6.86 mg/kg for MCAS El Toro. The detected arsenic concentration range for other surface soil samples was 0.28 mg/kg to 4.3 mg/kg. Arsenic was retained for further evaluation in the SSRBE.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential exposure to the EPCs are expressed as HIs of 5 and 1 under the RME and CTE scenarios, respectively (refer to Table G-11, Appendix G). Excluding the contribution of metals at background levels, HIs remain the same. Only the RME HI exceeds the target HI of 1.0. Under the RME scenario, naphthalene (42 percent) and 2-methylnaphthalene (30 percent) represent much of the risk, while xylenes (7 percent), other organic compounds, perchlorate and metals (four percent or less) contribute less. As the

maximum detected concentrations for naphthalene and 2-methylnaphthalene exceeded RME PRGs, target organ segregation was considered unnecessary since the resulting HIs would not significantly change and would remain above the target hazard of 1 for certain target organs. Only the maximum detection of naphthalene and 2-methylnaphthalene exceeded residential noncarcinogenic PRGs; therefore, naphthalene and 2-methylnaphthalene were carried forward to the SSRBE. The maximum detected concentration and EPC for lead (88.5 and 16.5 mg/kg, respectively) are both below the EPA Region 9 Residential PRG of 400 mg/kg and the Cal-Modified PRG of 150 mg/kg.

Subsurface Soil. EPCs for chemical data for subsurface soil collected from IRP Site 1 are compared to EPA Region 9 residential soil PRGs and site-specific PRGs under the CTE scenario (refer to Table G-12, Appendix G). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for subsurface soil under the residential land use scenario.

Carcinogenic Risk. The cumulative carcinogenic risk for exposure to subsurface soil in the area of IRP Site 1 under an assumed residential land use is $1x10^{-5}$ for the RME scenario and $2x10^{-6}$ for an average or CTE scenario (refer to Table G-12, Appendix G). Both of these risk estimates are within the risk management range of 10^{-6} to 10^{-4}. Excluding the contribution of metals at background levels, these risk estimates remain the same. Arsenic accounts for approximately one-half of the risk under the RME scenario, with less contribution from RDX (22 percent), TCDD TEQ (11 percent), benzene, hexachlorobenzene, n-Nitrosodiphenylamine, and 2,4,6-trinitrotoluene (all five percent or less). While the cumulative risks under the RME and CTE scenarios are within the risk management range of 10^{-6} to 10^{-4}, only the maximum detected concentrations for arsenic, TCDD TEQ, and RDX exceeded the residential PRGs in subsurface soil. These three compounds were further evaluated in the SSRBE.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential residential exposure are expressed as HIs of 10 and 3, respectively, for the RME and CTE scenarios (refer to Table G-12, Appendix G). Both estimates exceed the EPA target HI of 1.0. Excluding the contribution of metals at background levels, HI estimates remain the same. The chemicals contributing most to the HI under the RME scenario include antimony (26 percent), thallium (23 percent), naphthalene (18 percent), and 2-methylnaphthalene (13 percent). These four COPCs were detected in fewer than five percent of the subsurface soil samples. No other constituent contributes over three percent of the cumulative hazard. The maximum detected concentration for several chemicals exceed their residential PRGs and were further evaluated in the SSRBE. These chemicals include naphthalene, 2-methylnaphthalene, aluminum, antimony, cadmium, copper, thallium, and zinc. The maximum detection for lead is 1,580 mg/kg, which is above the residential PRG of 400 mg/kg; however, the EPC for lead (93.4 mg/kg) was below the residential screening level, including the Cal-Modified PRG of 150 mg/kg. Lead was not carried forward to subsequent risk calculations in the SSRBE as its PRG is based on blood-lead levels and not a RfD.

Soil Vapor Migration. The evaluation of potential soil vapor migration into indoor air resulted in estimated incremental lifetime cancer risk under the assumed residential land use of $2x10^{-5}$ for the RME scenario and $5x10^{-6}$ for the CTE scenario (refer to Table G-13, Appendix G). Most of the potential carcinogenic risk (89 percent) is due to benzene, which was detected in only two percent of the subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are 20 under the RME scenario and 4 under the CTE scenario. Approximately two-thirds of this hazard is due to naphthalene, which was detected in four percent of the subsurface soil samples.

Sediment. Sediment at IRP Site 1 was evaluated by comparing EPCs to residential PRGs (refer to Table G-14, Appendix G). Potential cumulative carcinogenic risk and noncarcinogenic hazard are presented below.

Carcinogenic Risk. The cumulative incremental carcinogenic risk for exposure to sediment in the area of IRP Site 1 under an assumed RME scenario of a residential land use ($2x10^{-6}$) is within the risk management range of 10^{-6} to 10^{-4}, but under a CTE scenario ($3x10^{-7}$) is below this range. Virtually all of the incremental cancer risk is due to arsenic, which was retained for further evaluation in the SSRBE. Each of the other constituents had a maximum detected concentration that was below its residential PRG.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential residential exposure to the EPCs in sediment at IRP Site 1 under the RME and CTE scenarios are expressed as HIs of 0.6 and 0.04, respectively. Both HIs are below the target HI of 1. The maximum detected concentrations for all noncarcinogens (including lead) are below the residential PRG; none of these chemicals were retained for further evaluation in the SSRBE.

Groundwater. Groundwater is evaluated as a source for drinking water with tap water PRGs being developed only under a residential land use scenario. Carcinogenic and noncarcinogenic risk evaluation was performed for unfiltered groundwater at IRP Site 1 under the residential land use scenario (refer to Table G-15, Appendix G). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for groundwater under the residential land use scenario.

Carcinogenic Risk. Under a RME scenario, the estimated cumulative carcinogenic risk associated with potential exposure to the EPC in unfiltered groundwater is $1x10^{-3}$, which exceeds the action level (10^{-4}) typically associated with remediation requirements. The incremental cancer risk under an average or CTE scenario is $5x10^{-5}$. TCE (88 percent under RME scenario) contributed most to the cumulative cancer risk with lesser contribution from arsenic, methylene chloride, BEPH and benzene. The maximum detected concentration for all five of these chemicals exceeded their respective tap water PRG. Because other site-specific receptors are not expected to contact groundwater at all or to a significant degree, these constituents were not further evaluated in the SSRBE. The potential risk associated with TCE is based on a maximum detected concentration of 27 µg/L during the initial round of sampling at IRP Site 1 monitoring wells in January 2002. Subsequent rounds of sampling during February 2002 and June 2002 have not confirmed the presence of TCE in these monitoring wells. Without consideration of TCE, the cumulative incremental cancer risk associated with exposure to groundwater under the RME and CTE exposure scenarios are $1x10^{-4}$ and $4x10^{-5}$, respectively.

Noncarcinogenic Hazard. The cumulative noncancer hazard associated with potential exposure to the EPC in groundwater is expressed as HIs of 10 and 5 under the RME and CTE scenarios, respectively. Perchlorate contributes approximately one-third of the total noncancer hazard with less contribution from TCE, chromium, nickel, and thallium. As the maximum detected concentrations and EPCs for each of these COPCs exceeded RME PRGs, target organ segregation was considered unnecessary since the resulting HIs would not significantly change and would remain above the target hazard of 1 for certain target organs. In the absence of an EPA Region 9 PRG for inorganic lead, the maximum concentration of lead (9.2 µg/L) is below the EPA Action Level of 15 µg/L.

BEHP and nitrate both exceeded their respective MCL. BEPH contributes only one percent to two percent of the total cancer risk estimate from potential exposure to groundwater and was detected in only one sample. Thus, the exceedance of the MCL by BEHP is less significant to the overall management decision for groundwater at the site. Nitrate was detected above the MCL of 10 mg/L in only two of 16 groundwater samples (Monitoring Wells 01-MW201 and 01-MW203). The 95 percent UCL of the onsite nitrate concentration was calculated to be 10.2 mg/L. Based on their relative contribution to risk and low occurrence, these constituents are not expected to trigger any response action.

Vapor Migration From Groundwater. The evaluation of potential vapor migration from groundwater through the soil column and into indoor air resulted in estimated incremental lifetime cancer risk

under the assumed residential land use of $3x10^{-5}$ for the RME scenario and $7x10^{-6}$ for the CTE scenario (refer to Table G-16, Appendix G). Virtually all of the potential carcinogenic risk is due to trichloroethylene, which was detected in only the January 2002 round of sampling. Confirmation sampling the following month and subsequent sampling events failed to confirm its presence. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are less than 1 for both the RME and CTE scenarios.

Surface Water. Surface water at IRP Site 1 infrequently occurs in the Ephemeral Pond. The evaluation of surface water compares EPCs to tap water PRGs (refer to Table G-17, Appendix G). The uncertainty associated with the use of tap water PRGs is further examined in Section 6.6.5, Uncertainties in the Screening Risk Assessment.

Carcinogenic Risk. The cumulative carcinogenic risk for exposure to surface water in the area of IRP Site 1 under an assumed RME scenario of a residential land use is $3x10^{-5}$, while under the CTE scenario is $5x10^{-6}$. Both risk estimates are within the risk management range of 10^{-6} to 10^{-4}. These risk estimates are based on maximum detected concentrations. Arsenic (1.2 μg/L) and RDX (1 μg/L) account for 94 and six percent of the risk, respectively. The maximum detected concentrations in surface water for these two chemicals exceed the residential tap water PRGs. The use of dissolved metal analyses provides a similar conclusion (refer to Table G-18, Appendix G) with arsenic accounting for all of the cumulative cancer risk of $2x10^{-5}$ under the RME scenario.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential residential exposure to the EPCs in surface water at IRP Site 1 are expressed as an HI of 1 and 0.4, respectively, for the RME and CTE scenarios (refer to Table G-17, Appendix G). Neither of these hazard estimates exceeds the target HI of 1.0. While antimony accounts for the highest percentage of the cumulative noncancer hazard, the maximum detected concentration for antimony (and all other COPCs) was below their respective PRGs. The use of dissolved metal analyses results in a similar conclusion as the cumulative noncancer hazard is below 1 for both the RME and CTE scenarios (refer to Table G-18, Appendix G).

6.5.5.2 INDUSTRIAL LAND USE EVALUATION

As indicated in Section 6.5, the Tier 1A RBS includes the evaluation of the default industrial scenario in addition to the default residential scenario. Therefore, exposure to surface and subsurface soil for the industrial scenario was evaluated. Groundwater is evaluated only for its maximum beneficial (residential) use and not included in evaluation of the industrial land use. Tables G-19 and G-20, Appendix G, present the comparisons between EPCs and the EPA Region 9 industrial PRGs for surface and subsurface soil, respectively. Additionally, the potential risk associated with soil vapor migration into buildings is presented in Table G-21, Appendix G. The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for surface and subsurface soil under the industrial land use scenario. These tables indicate that certain COPCs contribute to an incremental carcinogenic risk above EPA benchmark levels.

Surface Soil. EPCs for chemical data for surface soil collected from IRP Site 1 are compared to EPA Region 9 industrial soil PRGs and calculated PRGs for evaluating RME and CTE scenarios (refer to Table G-19, Appendix G). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for surface soil under the industrial land use scenario.

Carcinogenic Risk. The cumulative carcinogenic risk for the surface soil under an assumed RME scenario of an industrial land use is $2x10^{-6}$, which is within the risk management range of 10^{-6} to 10^{-4}. The cumulative risk under the CTE scenario is $3x10^{-7}$, which is below this range. Arsenic accounts for 62 percent of the cumulative RME carcinogenic risk, with benzene, n-nitrosodiphenylamine, TCDD TEQ, and RDX contributing less (14 percent, nine percent, eight percent, and six percent, respectively). Excluding the contribution of metals at background levels, carcinogenic risk estimates remain the same. Only the EPC for arsenic exceeded the industrial PRG.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential exposure to EPCs under the RME and CTE scenarios are expressed as HIs of 0.8 and 0.01, respectively, which are below the EPA target HI of 1. None of the maximum detected concentrations for COPCs exceeded the individual noncarcinogenic industrial PRGs.

Subsurface Soil. EPCs for chemical data for subsurface soil collected from IRP Site 1 are compared to EPA Region 9 industrial soil PRGs and calculated PRGs for evaluating RME and CTE scenarios (refer to Table G-20, Appendix G). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for subsurface soil under the industrial land use scenario.

Carcinogenic Risk. The cumulative carcinogenic risk from exposure to the COPCs in subsurface soil at IRP Site 1 under an assumed RME scenario of an industrial land use is $4x10^{-6}$, which is within the risk management range of 10^{-6} to 10^{-4}. Arsenic (43 percent) and RDX (22 percent) contribute most of the risk. Under an average or CTE scenario, the cumulative incremental cancer risk is $2x10^{-7}$, which is below the risk management range. Excluding the contribution of metals at background levels, carcinogenic risk estimates remain the same. Only the EPC for arsenic (2.79 mg/kg) exceeded its industrial PRG.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential industrial exposure to the EPCs in the subsurface soil at IRP Site 1 under the RME and CTE scenarios are expressed as HIs of 1 and 0.1, respectively. Except for lead, none of the maximum detected concentrations exceeded the noncarcinogenic industrial PRGs.

Soil Vapor Migration. The evaluation of potential soil vapor migration into indoor air resulted in estimated incremental lifetime cancer risk (ILCR) under the assumed industrial land use of $2x10^{-6}$ for the RME scenario and $3x10^{-7}$ for the CTE scenario (refer to Table G-21, Appendix G). Most of the potential carcinogenic risk (89 percent) is due to benzene, which was detected in only two percent of the subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are 2 under the RME scenario and 0.4 under the CTE scenario. Approximately two-thirds of this hazard is due to naphthalene, which was detected in four percent of the subsurface soil samples.

Sediment. Sediment within the Ephemeral Pond at IRP Site 1 was evaluated by comparing EPCs to industrial PRGs for both the RME and CTE scenarios (refer to Table G-22, Appendix G). Potential cumulative carcinogenic risk and noncarcinogenic hazard are presented below.

Carcinogenic Risk. The ILCR for exposure to sediment in the area of IRP Site 1 under an industrial land use is below the risk management range of 10^{-6} to 10^{-4} for both the RME scenario (ILCR = $6x10^{-7}$) and the CTE scenario (ILCR = $3x10^{-8}$). Each constituent had a maximum detected concentration that was below its industrial PRG.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential industrial exposure to the EPCs in sediment at IRP Site 1 under the RME and CTE scenarios are expressed as HIs of 0.02 and 0.004, respectively. Both HIs are below the target HI of 1. The maximum detected concentrations for all noncarcinogens (including lead) are below the industrial PRGs.

6.5.5.3 RISK-BASED SCREENING SUMMARY

Table 6-2 summarizes the results of the screening risk evaluation. Risks are presented with and without the contribution from naturally occurring inorganic constituents.

The evaluation of surface soil exposure under the RME scenario resulted in potential incremental cancer risks that exceeded the target incremental cancer risk level of 10^{-6} for both the future resident (ILCR = $8x10^{-6}$) and industrial worker (ILCR = $2x10^{-6}$). Under the CTE assumption, these risk estimates decrease to $1x10^{-6}$ for the resident and $3x10^{-7}$ for the industrial worker. The incremental cancer risk estimates for subsurface soil increases for each of these receptors, as the incremental

cancer risks for exposure to subsurface soil by future residents and industrial workers under the RME scenario are $1x10^{-5}$ and $2x10^{-6}$, respectively. Regardless of the soil interval or receptor, arsenic contributes most to these risk estimates.

Estimated noncancer HI for the resident exposed to surface soil under the RME scenario is approximately 5, with naphthalene and 2-methylnaphthalene contributing 42 percent and 30 percent of the hazard, respectively. Naphthalene and 2-methylnaphthalene were detected in a single surface soil sample. Using the CTE assumption, the HI is reduced to approximately 1. As the maximum detected concentrations for naphthalene and 2-methylnaphthalene exceeded RME PRGs, target organ segregation was considered unnecessary since the resulting HIs would not significantly change and would remain above the target hazard of 1 for certain target organs. The HI for exposure to the subsurface by future potential residents under the RME scenario increased to 10 and was driven by the presence of antimony, thallium, naphthalene, and 2-methylnaphthalene. All four of these COPCs were detects in fewer than five percent of the subsurface soil samples. Under the CTE scenario, this HI is reduced to the target hazard of 3. For the industrial worker, hazard estimates are below or near 1.0 for both surface and subsurface soil. The incremental cancer risk estimates for exposure to sediment by residents under the RME scenario is $2x10^{-6}$, which is within the risk management range of 10^{-6} to 10^{-4}. Virtually all of the risk is due to arsenic. This risk estimate is reduced to less than 10^{-6} under the CTE scenario. The risk estimate for the industrial worker is below this risk management range. Cumulative noncancer HIs for the resident and industrial worker are less than the EPA target hazard of 1 for both RME and CTE scenarios. Arsenic in sediment (the only COPC) is at background levels.

Risks/hazards associated with potential soil vapor migration into indoor air from subsurface soil were evaluated for both the residential and industrial land uses. Assuming the RME scenario, the incremental lifetime cancer risk is estimated as $2x10^{-5}$ for the residential land use and $2x10^{-6}$ for the industrial land use. Under the CTE scenario, these estimates decrease to $5x10^{-6}$ and $3x10^{-7}$, respectively. Most of the potential carcinogenic risk (89 percent) is due to benzene, which was detected in only two percent of the subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are 20 for the residential land use and 2 for the industrial land use under the RME scenario. Assuming the CTE scenario, these estimates decrease to 4 and 0.4, respectively. Approximately two-thirds of this hazard is due to naphthalene, which was detected in four percent of the subsurface soil samples. That the carcinogenic risk and noncancer hazard are driven by chemicals with infrequent detections belies the likelihood that a receptor would be expected to encounter these chemicals in indoor air.

The evaluation of groundwater resulted in a potential incremental cancer risk for the future onsite resident under the RME scenario (ILCR = $1x10^{-3}$) that exceeds the risk management range of 10^{-6} to 10^{-4}. Most of this risk is due to TCE, which has not been detected since the initial groundwater monitoring event. Under the CTE scenario, this risk estimate is reduced to $5x10^{-5}$. Attenuation processes including groundwater mixing and biodegradation reduce chemical concentrations in groundwater as it moves away from the IRP Site 1 plume, beyond the IRP Site 1 boundary. Where chemical concentrations are lower in groundwater moving away from the source area, risks associated with exposure to groundwater for potential future offsite residents are less. The likelihood of groundwater in the vicinity to be used for residential drinking water is unknown but expected to be low.

Evaluation of noncancer hazards associated with onsite exposure to groundwater resulted in an estimated HI of 10, which was due to the presence of perchlorate, TCE, and several metals. This HI is reduced to 5 under the CTE scenario. As the maximum detected concentrations and EPCs for each of these COPCs exceeded RME PRGs, target organ segregation was considered unnecessary since the resulting HIs would not significantly change and would remain above the target hazard of 1 for certain target organs. Because groundwater is evaluated for its most beneficial use (i.e., residential use as a drinking water source), it was not further evaluated for industrial use.

Potential cancer risks associated with potential vapor emission from groundwater into indoor air were evaluated for residential land use. Assuming the RME scenario, the ILCR is estimated as $3x10^{-5}$. Under the CTE scenario, this estimate decreases to $7x10^{-6}$. Most of the potential carcinogenic risk (99 percent) is due to TCE, the presence of which is no longer certain.

The ILCR estimates for exposure to surface water by future onsite residents is $3x10^{-5}$ under the RME scenario and $5x10^{-6}$ under the CTE scenario. Both risk estimates are within the risk management range of 10^{-6} to 10^{-4}. Arsenic is the main contributor to this risk. The HI for exposure to surface water is near 1.0 for the RME scenario, but less than 1 for the CTE scenario.

Risks are also presented using California-modified toxicity values (Table 6-3). The effect of using these State-approved values depends upon the medium evaluated, but generally, cancer risk estimates are altered; and noncancer hazard estimates remain unchanged.

Incorporating California-modified toxicity values, the evaluation of surface soil exposure under the RME scenario resulted in ILCRs of $1x10^{-4}$ for the resident and $4x10^{-5}$ for the industrial worker. ILCR from subsurface soil exposure remains approximately the same as that for surface soil for both the resident and industrial worker. Risk estimates that utilize California-modified toxicity values are approximately an order of magnitude higher than when estimated using EPA Region 9 PRGs. The main reason for this increase is that naphthalene, originally evaluated as a noncarcinogenic chemical by EPA Region 9, is considered a carcinogen by the State of California. Given the infrequency with which naphthalene was detected in soil (one percent in surface soil and four percent in subsurface soil), the higher estimated cancer risk belies the likelihood that a receptor encounters naphthalene at the site. The second reason for the increase in the cancer estimate is that California assigns a higher (i.e., more toxic) slope factor for arsenic.

Using California-modified toxicity values, the evaluation of potential soil vapor migration from subsurface soil into buildings resulted in ILCRs of $9x10^{-4}$ for the resident and $7x10^{-5}$ for the industrial worker. Under the CTE scenario, these estimates decrease to $2x10^{-4}$ and $1x10^{-5}$, respectively. As above, the increase results from the designation of naphthalene as a carcinogen by the State of California.

The evaluation of direct groundwater exposure using California-modified toxicity values resulted in the reduction of estimated cancer risk. A similar reduction in risk is seen from the potential inhalation of VOCs that have migrated from groundwater. This reduction of risk resulted from a lower assigned cancer potency for TCE by the State of California. This difference in toxicity for TCE has little significance since the chemical has not been detected in groundwater since the sampling event in January 2002.

The evaluation of surface water exposure using California-modified toxicity values results in an ILCR of $2x10^{-4}$ for the resident. This eight-fold increase in the estimated cancer risk from that using EPA Region 9 PRGs is due to the higher assigned slope factor for arsenic by the State of California.

6.6 SITE-SPECIFIC RISK-BASED EVALUATION

This section presents the process for conducting site-specific risk-based evaluations (or screening PREs under the EPA Region 9 terminology) for current and future industrial workers exposed to chemicals in surface soil, subsurface soil and sediment, as well as for the current and future construction/utility worker, casual trespasser (adult), and EOD Training Range supervisor potentially exposed to COPCs in surface soil and subsurface soil at IRP Site 1. Potential future residents are also considered site-specific receptors, but because the risks for them and industrial workers as default receptors were previously presented in the RBS, risks are not re-evaluated in the SSRBE to avoid redundancy. In the SSRBE, site-specific RBCs (i.e., PRGs) are developed for site-specific land use and exposure conditions not addressed during PRG development for EPA Region 9.

Table 6-2: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Screening Risk Assessment

Type	Resident		Industrial Worker	
	RME	CTE	RME	CTE
Surface Soil – Including Background				
ILCR	$8x10^{-6}$	$1x10^{-6}$	$2x10^{-6}$	$3x10^{-7}$
Contributors:	70% - arsenic	67% - arsenic	62% - arsenic	67% -n-Nitrosodiphenylamine
	9% - N-nitrosodiphenylamine	8% - N-nitrosodiphenylamine	14% - benzene	24% -arsenic
	9% - TCDD TEQ	8% - TCDD TEQ	9% -n-Nitrosodiphenylamine	3% - benzene
	6% - benzene	10% - benzene	8% - TCDD TEQ	3% - TCDD TEQ
HI	5	1	0.8	0.01
Contributors:	42% - naphthalene	64% - naphthalene		
	30% - 2-methylnaphthalene	26% - 2-methylnaphthalene		
Surface Soil- Excluding Background				
ILCR	$8x10^{-6}$	$1x10^{-6}$	$2x10^{-6}$	$3x10^{-7}$
Contributors:	70% - arsenic	67% - arsenic	62% - arsenic	67% -n-Nitrosodiphenylamine
	9% - N-nitrosodiphenylamine	8% - N-nitrosodiphenylamine	14% - benzene	25% -arsenic
	9% - TCDD TEQ	9% - TCDD TEQ	9% -n-Nitrosodiphenylamine	3% - benzene
	6% - benzene	10% - benzene	8% - TCDD TEQ	3% - TCDD TEQ
HI	5	1	0.7	<0.01
Contributors:	48% - naphthalene	66% - naphthalene		
	33% - 2-methylnaphthalene	27% - 2-methylnaphthalene		
Subsurface Soil– Including Background				
ILCR	$1x10^{-5}$	$2x10^{-6}$	$4x10^{-6}$	$2x10^{-7}$
Contributors:	50% - arsenic	48% - arsenic	43% - arsenic	49% - arsenic
	22% - RDX	20% - RDX	22% - RDX	21% - RDX
HI	10	3	1	0.1
Contributors:	26% - antimony	22% - antimony	52% - naphthalene	
	23% - thallium	20% - thallium	19% - antimony	
	18% - naphthalene	34% - naphthalene	17% - thallium	
	13% - 2-methylnaphthalene	14% - 2-methylnaphthalene		
Subsurface Soil- Excluding Background				
ILCR	$1x10^{-5}$	$2x10^{-6}$	$4x10^{-6}$	$2x10^{-7}$
Contributors:	50% - arsenic	48% - arsenic	44% - arsenic	49% - arsenic
	22% - RDX	20% - RDX	22% - RDX	21% - RDX
HI	10	3	1	0.1
Contributors:	27% - antimony	22% - antimony	53% - naphthalene	
	24% - thallium	20% - thallium	20% - antimony	
	18% - naphthalene	34% - naphthalene	18% - thallium	
	13% - 2-methylnaphthalene	14% - 2-methylnaphthalene		
Indoor Air- Vapor Migration from Soil				
ILCR	$2x10^{-5}$	$5x10^{-6}$	$2x10^{-6}$	$3x10^{-7}$
Contributors:	89% - benzene	89% - benzene	89% - benzene	89% - benzene
	8% - hexachlorobenzene	8% - hexachlorobenzene	9% - hexachlorobenzene	9% - hexachlorobenzene
HI	20	4	2	0.4
Contributors:	66% - naphthalene	66% - naphthalene	65% - naphthalene	
	33% - xylenes	33% - xylenes	34% - xylenes	

Table 6-2: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Screening Risk Assessment

Type	Resident		Industrial Worker	
	RME	CTE	RME	CTE
Sediment – Including Background				
ILCR	$2x10^{-6}$	$3x10^{-7}$	$6x10^{-7}$	$3x10^{-8}$
Contributors:	99% - arsenic	99% - arsenic	99% - arsenic	99% - arsenic
HI	0.6	0.04	0.02	<0.01
Sediment – Excluding Background				
ILCR	$4x10^{-10}$	$7x10^{-11}$	$6x10^{-11}$	$5x10^{-12}$
Contributors:				
HI	0.1	<0.01	<0.01	<0.01
Groundwater				
ILCR	$1x10^{-3}$	$5x10^{-5}$	Not Evaluated	Not Evaluated
Contributors:	88% - TCE	60% - TCE		
	9% - arsenic	34% - arsenic		
HI	10	5	Not Evaluated	Not Evaluated
Contributors:	31% - perchlorate	31% - perchlorate		
	21% - TCE	19% - TCE		
	13% - nickel	13% - nickel		
	13% - thallium	13% - thallium		
	11% - chromium	11% - chromium		
Indoor Air – Vapor Emission from Groundwater				
ILCR	$3x10^{-5}$	$7x10^{-6}$	Not Evaluated	Not Evaluated
Contributors:	99% - trichloroethene	99% - trichloroethene		
HI	<0.01	<0.01	Not Evaluated	Not Evaluated
Surface Water				
ILCR	$3x10^{-5}$	$5x10^{-6}$	Not Evaluated	Not Evaluated
Contributors:	94% - arsenic	94% - arsenic		
HI	1	0.4	Not Evaluated	Not Evaluated
Contributors:	32% - antimony			
	17% - iron			

Notes:
% = percent
< = less than
CTE = central tendency exposure
HI = hazard index
ILCR = incremental lifetime cancer risk
RDX = cyclotrimethylenetrinitramine
RME = reasonable maximum exposure
TCE = trichloroethene
TCDD TEQ = tetrachlorodibenzodioxin toxicity equivalency quotient

Table 6-3: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Screening Risk Assessment Using California-Modified Toxicity Values

Type	Resident		Industrial Worker	
	RME	CTE	RME	CTE
Surface Soil – Including Background				
ILCR	$1x10^{-4}$	$8x10^{-6}$	$4x10^{-5}$	$1x10^{-6}$
Contributors:	67% - naphthalene	56% - arsenic	77% - naphthalene	46% - arsenic
	31% - arsenic	40% - naphthalene	21% - arsenic	32% - naphthalene
HI	5	1	0.8	0.01
Contributors:	42% - naphthalene	64% - naphthalene		
	30% - 2-methylnaphthalene	26% - 2-methylnaphthalene		
Surface Soil – Excluding Background				
ILCR	$1x10^{-4}$	$8x10^{-6}$	$4x10^{-5}$	$1x10^{-6}$
Contributors:	67% - naphthalene	56% - arsenic	77% - naphthalene	46% - arsenic
	31% - arsenic	40% - naphthalene	21% - arsenic	32% - naphthalene
HI	5	1	0.7	<0.01
Contributors:	46% - naphthalene	66% - naphthalene		
	33% - 2-methylnaphthalene	27% - 2-methylnaphthalene		
Subsurface Soil– Including Background				
ILCR	$1x10^{-4}$	$1x10^{-5}$	$4x10^{-5}$	$1x10^{-6}$
Contributors:	59% -naphthalene	32% - naphthalene	70% - naphthalene	59% - arsenic
	35% - arsenic	58% - arsenic	25% - arsenic	32% - naphthalene
HI	10	3	1	0.1
Contributors:	26% - antimony	22% - antimony	52% - naphthalene	
	23% - thallium	20% - thallium	19% - antimony	
	18% - naphthalene	34% - naphthalene	17% - thallium	
	13% - 2-methylnaphthalene	14% - 2-methylnaphthalene		
Subsurface Soil– Excluding Background				
ILCR	$1x10^{-4}$	$1x10^{-5}$	$2x10^{-5}$	$1x10^{-6}$
Contributors:	59% -naphthalene	32% - naphthalene	45% - arsenic	59% - arsenic
	35% - arsenic	58% - arsenic	45% - naphthalene	32% - naphthalene
HI	10	3	1	0.1
Contributors:	27% - antimony	22% - antimony	53% - naphthalene	
	24% - thallium	20% - thallium	20% - antimony	
	18% - naphthalene	34% - naphthalene	18% - thallium	
	13% - 2-methylnaphthalene	14% - 2-methylnaphthalene		
Indoor Air- Vapor Migration from Soil				
ILCR	$9x10^{-4}$	$2x10^{-4}$	$7x10^{-5}$	$1x10^{-5}$
Contributors:	98% - naphthalene	98% - naphthalene	97% - naphthalene	97% - naphthalene
HI	20	4	2	0.4
	66% - naphthalene	66% - naphthalene	65% - naphthalene	
	33% - xylenes	33% - xylenes	34% - xylenes	

Table 6-3: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Screening Risk Assessment Using California-Modified Toxicity Values

Type	Resident		Industrial Worker	
	RME	CTE	RME	CTE
Sediment- Including Background				
ILCR	$2x10^{-5}$	$2x10^{-8}$	$4x10^{-6}$	$2x10^{-7}$
Contributors:	100% - arsenic	82% - arsenic 16% chromium	100% - arsenic	100% - arsenic
HI	0.6	0.04	0.02	<0.01
Sediment- Excluding Background				
ILCR	$4x10^{-10}$	$7x10^{-11}$	$6x10^{-11}$	$5x10^{-12}$
HI	0.1	<0.01	<0.01	<0.01
Groundwater				
ILCR	$7x10^{-4}$	$1x10^{-4}$	Not Evaluated	Not Evaluated
Contributors:	92% - arsenic	96% - arsenic		
HI	10	5	Not Evaluated	Not Evaluated
Contributors:	31% - perchlorate 21% - TCE 13% - nickel 13% - thallium 11% - chromium	30% - perchlorate 18% - TCE 13% - nickel 13% - thallium 11% - chromium		
Indoor Air-Vapor Emission from Groundwater				
ILCR	$7x10^{-7}$	$2x10^{-7}$	Not Evaluated	Not Evaluated
Contributors:	77% - TCE 21% - methylene chloride	77% - TCE 21% - methylene chloride	Not Evaluated	Not Evaluated
HI	0.008	0.001		
Surface Water				
ILCR	$2x10^{-4}$	$3x10^{-5}$	Not Evaluated	Not Evaluated
Contributors:	99% - arsenic	99% - arsenic		
HI	1	0.4	Not Evaluated	Not Evaluated
Contributors:	32% - antimony 17% - iron			

Notes:
% = percent
< = less than
RME = reasonable maximum exposure
CTE = central tendency exposure
ILCR = incremental lifetime cancer risk
HI = hazard index
TCE = trichloroethene

6.6.1 Selection of Chemicals of Potential Concern

For the SSRBE, COPCs were identified as those chemicals in the RBS evaluation with maximum detected concentrations in surface soil, subsurface soil, or sediment that exceeded its respective soil PRG. Because the SSRBE focuses on construction workers, casual trespassers, and the EOD Training Range supervisor, all of whom do not use groundwater or surface water for drinking purposes, COPCs in these two media were not further evaluated in the SSRBE. The COPCs

associated with surface soil are arsenic, naphthalene, and 2-methylnaphthalene while those for the subsurface soil are naphthalene, 2-methylnaphthalene, RDX, TCDD TEQ, aluminum, antimony arsenic, cadmium, copper, lead, thallium, and zinc. Arsenic is the only COPC in sediment.

Where the maximum EPC for an inorganic constituent was equal to or less than background levels, then the presence of this inorganic COPC was not considered attributable to site-related activities. Total cumulative incremental risk and HI were estimated both with and without contribution from naturally occurring inorganic constituents. Derivation of the soil background concentrations is presented in the *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations, Marine Corps Air Station, El Toro, California* (BNI 1996).

6.6.2 Receptor Selection

IRP Site 1 is located in a semi-urban setting and corresponding mix of land uses. Such uses include residential, industrial, and agricultural use. It is anticipated that IRP Site 1 will be transferred to the FAA and EOD training by local and Federal law enforcement agencies will be performed. However, since reuse has not been finalized, several receptors other than residents and industrial workers (previously evaluated in the RBS) are evaluated to provide risk managers with risk estimates for alternate receptor scenarios. These receptors consist of construction/utility workers, casual trespassers and an EOD Training Range supervisor. Agricultural use is not anticipated at IRP Site 1. Activities that receptors may engage in are discussed below and a summary of the exposure factors used in deriving the site-specific, receptor PRGs is presented in Table 6-4.

Construction/Utility Workers. Exposure-relevant activities in which construction/utility workers may be engaged will typically include limited manual digging (substantial digging is typically done using mechanical equipment, which is likely to reduce the potential for exposure to soil), shoring excavation sidewalls, and removing and installing footings or utilities. In most instances, excavations are anticipated to be relatively shallow (i.e., 3 to 5 feet below grade). However, in situations that may require deeper excavations, such as the construction of additional buildings, excavation may be as deep as 10 feet. Due to the nature of the work, these receptors could be exposed to surface and subsurface soil during excavation work. Construction or utility work is generally a relatively short-term periodic nature. However, for purposes of evaluating this receptor group, it is conservatively assumed that the construction/utility workers may work at the site daily for three years under the RME scenario and six months under the CTE scenario. All exposure factors for the assessment of this receptor group are provided in Section 6.6.3.2

Casual Trespassers. Casual trespassers have been identified in the CSM as receptors to be evaluated in the SSRBE. Workers from other buildings in the vicinity could be exposed to COPCs while trespassing on the site or taking cigarette breaks. Therefore, casual trespassers are restricted to adults and are exposed only to surface soil. They are conservatively assumed to be exposed daily during the course of work over a period of employment. Their soil-contacting activities were assumed to be no greater than that of residents as opposed to occupational workers. All exposure factors for the assessment of the casual trespasser are presented in Section 6.6.3.2.

EOD Training Range Supervisor. The EOD Training Range supervisor was identified in the CSM as the most likely individual with the greatest potential exposure during possible detonation operations. While other workers involved with testing may come to IRP Site 1 during specific testing events, the EOD Training Range supervisor would likely be present for all testing occurrences. Detonations were conservatively assumed to occur once each week for 50 weeks per year under a RME scenario. Detonations were assumed to last only three minutes, but the exposure time for all pathways is assumed to be 30 minutes per day. All other inhalation factors and soil-contacting

factors were assumed to be equal to that of industrial worker. All exposure factors for the assessment of the EOD Training Range supervisor are presented in Section 6.6.3.1.

Chemical intake for the EOD Training Range supervisor is an integration of exposures from incidental ingestion, dermal absorption and inhalation. While intake through inhalation is typically estimated using either a default or site-specific particulate emission factor as recommended by the EPA Soil Screening Guidance (EPA 2004d), none of the recommended default values or algorithms are well suited for estimating airborne concentrations of COPCs during detonation events. To derive a more relevant particulate emission factor (PEF) estimate for the EOD Training Range supervisor, a site-specific PEF was calculated using the maximum PM10 concentration measured during a series of bomb tests at a distant site (ATSDR 2003) and the maximum arsenic concentration measured in surface soil at IRP Site 1.

Bombing operations in Vieques, Puerto Rico, resulted in a 60 percent increase in the average PM10 concentrations (i.e., 34.7 ug/m^3 versus 21.6 ug/m^3) in the closest town, 6 miles predominantly downwind from the testing facility (ATSDR 2003, Table 6). Applying this percent increase to the PM10 readings near IRP Site 1 results can be used in deriving a site-specific PEF value for the EOD Training Range supervisor.

The California EPA has a PM10 database (available at http://www.arb.ca.gov/aqd/oldpm10/pmgeosel.htm) that includes a Station called El Toro. PM10 data are available for years 1993 to 1997 and include the maximum 24-hour reading, maximum geometric and arithmetic means, the expected peak day concentration, and the 99th percentile of PM10 readings for each year. Given the few number of readings per year (12 or fewer), the maximum 24-hour reading and the 99th percentile are the same. The highest 24-hour PM10 reading of 122 ug/m^3 occurred in 1995. Using this highest reading and the estimated 60 percent increase due to detonation operations, one can derive a maximum PM10 concentration of 195 ug/m^3 under the RME scenario. Using this maximum PM10 value, a site-specific PEF of 5.1x10^6 was derived using the following equation:

$$\text{PEF } (m^3/kg) = \frac{1}{PM10\ (\mu g/\ m^3)} \times 10^9\ \mu g/kg$$

The calculated PEF value was applied to COPCs in surface soil and sediment. The calculated PEF value was included with other RME exposure factors and the EPCs of various chemicals in surface soil and sediment in developing the PRGs for the EOD Training Range supervisor (Section 6.6.3). PRGs under the CTE scenario were similarly calculated using the highest geometric mean PM10 value of 32.5 ug/m3. The estimated PEF value under the CTE scenario is 1.9x10^7 m^3/kg.

6.6.3 Estimation of Site-Specific PRGs for Construction/Utility Worker, Casual Trespasser and EOD Training Range Supervisor

Cancer risks and HIs for the SSRBE were calculated in the same manner as described for the screening assessment. In the SSRBE, however, only those chemicals carried over from the RBS are evaluated in a site-specific (e.g., construction/utility worker, casual trespasser, or EOD Training Range supervisor) context. Because the exposure parameters for the receptor groups differ from those used by EPA Region 9 to develop residential or industrial PRGs, site-specific PRGs were developed according to the model below.

6.6.3.1 MODEL DEVELOPMENT

The model used for estimating the site-specific PRGs for COPCs at IRP Site 1 via ingestion of soil, dermal contact with soil, and inhalation of particulates is shown below. This model is based on the model used by EPA Region 9 for the development of PRGs.

$$PRG = \frac{TCR \times BW \times AT}{ED \times EF \times \left[(CSF_o \times IRS \times FI \times CF) + (CSF_o \times SA \times ABS \times AF \times EV \times CF) + \left(CSF_i \times IRA \times ET \times \left(\frac{1}{PEF} \right) \right) \right]}$$

Where:

PRG = Site-specific preliminary remediation goal for specific receptors (mg/kg)
TCR = Target cancer risk for exposure to carcinogenic chemicals (unitless)
BW = Body weight (kg)
AT = Carcinogenic averaging time (days)
ED = Exposure duration (years)
EF = Exposure frequency (days per year)
CSFo = Oral cancer slope factor for carcinogenic chemicals (mg/kg-day^{-1})
IRS = Ingestion rate of soil (mg/day)
FI = Fraction ingestion from source (unitless)
CF = Conversion factor (kg/mg)
SA = Exposed skin surface area (square centimeters [cm^2]/event)
ABS = Dermal absorption factor (unitless)
AF = Adherence factor (milligrams per square centimeter [mg/cm^2])
EV = Event frequency (events per day)
CSFi = Inhalation cancer slope factor for carcinogenic chemicals [(mg/kg-day)$^{-1}$]
IRA = Inhalation rate (cubic meters [m^3]/hour)
ET = Exposure time (hours/day)
PEF = Particulate emission factor (cubic meters per kilogram [m^3/kg])

A similar model is used to estimate the soil PRGs for noncarcinogenic chemicals. The model shown below was used for estimating the noncarcinogenic PRGs.

$$PRG = \frac{THQ \times BW \times AT}{\frac{IRS \times FI \times EF \times ED \times CF}{RfD_o} + \frac{SA \times AF \times ABS \times EF \times ED \times EVxCF}{RfD_o} + \frac{IRA \times ET \times EF \times ED \times \left(1/VF + 1/PEF \right)}{RfD_i}}$$

Where:

THQ = Target hazard quotient for exposure to noncarcinogenic chemicals (unitless)
RfDo = Oral reference dose for noncarcinogenic chemicals (mg/kg-day)
RfDi = Inhalation reference dose for noncarcinogenic chemicals (mg/kg-day)

6.6.3.2 EXPOSURE PARAMETERS

The exposure parameters used in the soil PRG equations were adapted primarily from the Exposure Factors Handbook (EFH) (EPA 1997a) and Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final Guidance (EPA 2004c). Where applicable, default factors from EPA Region 9 PRGs are used. The exposure parameters are summarized in Table 6-4.

6.6.3.3 INCREMENTAL TOXICITY VALUES (CANCER SLOPE FACTOR AND REFERENCE DOSE)

Toxicity values are chemical-specific values derived by EPA that are health-protective, upper bound estimates of potential toxicity or carcinogenicity of chemicals. Site-specific PRGs are based on the toxicity (i.e., potential for carcinogenic or noncarcinogenic effects) of chemicals that may be ingested, inhaled, or dermally absorbed. RfDs for noncarcinogens and CSFs for carcinogens used in developing PRGs for the construction/utility worker, casual trespasser, and EOD Training Range supervisor are presented in Table G-23, Appendix G.

6.6.3.4 SITE-SPECIFIC PRELIMINARY REMEDIATION GOALS

The exposure parameters discussed in Section 6.6.3.2 and the toxicity values presented in Section 6.6.3.3 were inserted into the equations presented in Section 6.6.3.1. The resulting site-specific PRGs for both site-specific receptors (construction/utility worker, casual trespasser, and EOD Training Range supervisor) are presented in Table G-24, Appendix G. EPCs at IRP Site 1 are compared to the site-specific PRGs for both the RME and CTE scenarios in Tables G-25 through G-31, Appendix G, with results presented below.

6.6.4 Site-Specific Risk-Based Evaluation Results for the Construction/Utility Worker, Casual Trespasser, EOD Training Range Supervisor and Wildlife Reserve Workers Receptors

The EPCs for COPCs in surface and subsurface soil were compared to PRGs developed specifically for the site-specific receptors. Cumulative incremental cancer risks and the HQ (i.e., the HI) were calculated. The results of the SSRBE (refer to Tables G-25 through G-31, Appendix G) are discussed below. Table 6-5 summarizes those results.

6.6.4.1 EVALUATION OF CONSTRUCTION/UTILITY WORKER

Surface Soil. The SSRBE results for surface soil under the construction/utility worker scenario are presented in Table G-25, Appendix G. Based on the maximum detected concentration, arsenic was treated as though it exceeds background levels. The cumulative incremental cancer risks for the RME and CTE scenarios are $5x10^{-7}$ and $2x10^{-8}$, respectively, with arsenic as the only contributor to the risk. Both estimates are below the risk management range of 10^{-6} to 10^{-4}. The RME cumulative incremental cancer risk, excluding background, remains at $5x10^{-7}$ because the reported level of arsenic is considered to be site-related. However, only the maximum detected concentration of arsenic (8.6 mg/kg) is above the background concentration of 6.86 mg/kg (refer to Table G-25, Appendix G). The cumulative noncarcinogenic HI due to exposure to surface soil by construction/utility workers is less than or equal to the target level of 1.0 for both the RME and CTE scenarios.

Table 6-4: Exposure Parameters for Site-Specific Risk-Based Evaluation Receptors

Parameter	Definition	Construction/ Utility Worker RME	Construction/ Utility Worker CTE	Casual Trespasser RME	Casual Trespasser CTE	EOD Training Range Supervisor RME	EOD Training Range Supervisor CTE
IRS	Soil Ingestion Rate (mg/day) [a]	330	165	50	50	100	50
FI	Fraction Ingestion from Source (unitless) [b]	1.0	0.5	1.0	0.5	1.0	0.5
IRA	Inhalation Rate (m^3/hour) [c]	2.5	1.3	1.0	1.0	0.83	0.63
PEF	Particulate Emission Factor (m^3/kg) [d]	1.32E+09	1.32E+09	1.32E+09	1.32E+09	5.1E+06	1.9E+07
SA	Exposed Surface Area (cm^2/event) [J]	3,300	3,300	5,700	3,300	3,300	3,300
AF	Weighted Adherence Factor (mg/cm^2) [e]	0.3	0.14	0.07	0.01	0.2	0.02
ABS	Absorption Factor (unitless) [f]						
	Arsenic; dioxins	0.03	0.03	0.03	0.03	0.03	0.03
	VOCs; inorganics	0	0	0	0	0	0
	SVOCs	0.1	0.1	0.1	0.1	0.1	0.1
	PAHs	0.13	0.13	0.13	0.13	0.13	0.13
ET	Exposure Time (hour/day) [g]	8	8	1	0.5	0.5	0.25
EF	Exposure Frequency (days/year) [h]	250	250	250	219	50	17
ED	Exposure Duration (year) [i]	3	0.5	25	6.6	25	6.6
EV	Event Frequency (events/day)	1	1	1	1	1	1
CF	Conversion Factor (kg/mg)	1.00E–06	1.00E–06	1.00E–06	1.00E–06	1.00E–06	1.00E–06
BW	Body Weight (kg)	70	70	70	70	70	70
AT	Averaging Time (days):						
	Noncarcinogenic	1,095	183	9,125	2,409	9,125	2,409
	Carcinogenic	25,550	25,550	25,550	25,550	25,550	25,550
TCR	Target Cancer Risk	1.00E–06	1.00E–06	1.00E–06	1.00E–06	1.00E–06	1.00E–06
THQ	Target Hazard Quotient	1.0	1.0	1.0	1.0	1.0	1.0

Notes:
CTE = central tendency exposure
EOD = explosive ordnance disposal
PAHs = polynuclear aromatic hydrocarbons
RME = reasonable maximum exposure
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
cm^2/event = square centimeters per event
kg = kilograms
kg/mg = kilograms per milligram
mg/cm^2 = milligrams per square centimeters
mg/day = milligrams per day
m^3/hour = cubic meters per hour
m^3/kg = cubic meters per kilograms

n/a = not applicable; EPA dermal Guidance (2004c) states that there are too few data to extrapolate a reasonable default value for inorganics.

[a] RME value taken from *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, December 2002b, OSWER 9355.4-24. CTE value of 165 mg/day assigned 1/2 the RME value. Ingestion rate for casual trespasser for both RME and CTE assigned the adult value recommended in Table 4-23 of Exposure Factors Handbook (EPA 1997a).*

[b] Assumes 100% of daily intake is from the contaminated source under the RME scenario and only 50 percent under the CTE scenario based on limited hours at the contaminated area.

[c] Table 5-23 of EFH 1997a. RME value for construction worker is based on heavy activities during short-term exposures for outdoor workers whereas the CTE value is the hourly average. RME and CTE value for casual trespasser is the mean inhalation rate for outdoor workers engaged in light activities during short-term exposures.

[d] Default PEF for Region 9 PRGs (2004a) was used except for the EOD Training Range supervisor which is described in section 6.6.2.

[e] *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment [Dermal Guidance])* (EPA 2004c). RME and CTE values for the construction worker taken from Appendix C and represent the 95th percentile and geometric mean of weighted adherence factors for the construction worker. RME and CTE values for the casual trespasser set equal to the recommended residential values (Exhibit 3-5) since soil-contacting activity of the casual trespasser would be no greater than that of a resident. [f] Chemical-specific values as presented in the Dermal Guidance (EPA 2004c)

[g] RME and CTE value for construction worker assumes the entire 8-hour work day is spent at the site. RME value for the casual trespasser is the total lunch time spent by a worker from nearby facility; CTE value assigned ½ of RME or 30 minutes. The 30 minute and 15 minute exposure time for the EOD Training Range supervisor under the RME and CTE scenarios were assumed.

[h] RME and CTE values for the construction worker and the RME value for the casual trespasser taken as the standard default value for industrial worker as presented in Region 9 PRGs (2004a). CTE value for casual trespasser assumed equal to that of an industrial worker and taken from Exhibit 3-5 of the Dermal Guidance (EPA 2004c).

[i] Duration of construction project assumed to be 3 years under the RME scenario and 6 months (0.5 year) under the CTE scenario. For the casual trespasser who is assumed to be a worker from a nearby facility, exposure duration would be similar to an industrial worker. Therefore, the RME value is the EPA Region 9 default value for the occupational worker. The CTE value for casual trespasser is the median tenure of occupational employees as presented in Table 15-158 of the Exposure Factors Handbook (1997a).

[j] Except for the RME value for the casual trespasser (set equal to that of a resident), surface area for all receptors set equal to the recommended value of 3,300 cm2 for industrial workers as presented in Exhibit 3-5 of the Dermal Guidance (EPA 2004c).

Subsurface Soil. The SSRBE results for subsurface soil under the construction/utility worker scenario are presented in Table G-26, Appendix G. These results indicate that concentrations of aluminum, antimony, cadmium, copper, lead, thallium, and zinc in subsurface soil are above background. Based on its maximum detected concentration, arsenic was treated as though it exceeds background. The average concentration of arsenic is consistent with background levels. The cumulative incremental cancer risk under the RME scenario ($1x10^{-6}$) and CTE scenario ($5x10^{-8}$) are near or below the risk management range of 10^{-6} to 10^{-4}. The primary contributors to risk are arsenic and RDX. Only the maximum detected concentration for arsenic exceeds the risk-based construction worker PRG in subsurface soil. The cumulative HIs under the RME and CTE scenarios are 3 and 0.4, respectively. While the HI associated with the RME scenario is above the EPA target HI of 1.0, that for the CTE scenario is below this target level. Antimony and thallium contribute most to the cumulative HI, with less contribution from naphthalene and 2-methylnaphthalene. Aluminum exceeds the maximum permissible conconcentration of 1E+05 mg/kg (refer to Table G-26, Appendix G).

Sediment. Sediment in the Ephemeral Pond at IRP Site 1 was evaluated against construction/utility worker PRGs for both RME and CTE scenarios (refer to Table G-27, Appendix G). Arsenic is the only chemical that is evaluated since it was the only constituent carried forward from the RBS. Cumulative incremental cancer risk including background is $2x10^{-7}$ for the RME scenario and $9x10^{-9}$ for the CTE scenario. Both estimates are below the risk management range of 10^{-6} to 10^{-4}. The maximum detection of arsenic in sediment (1.5 mg/kg) is below (or considered) background. Therefore, if one excludes background constituents, there is no incremental cancer risk associated with exposure to sediment for the construction/utility worker.

Arsenic was also evaluated against its noncarcinogenic PRG. The resulting cumulative HI is below 1.0 under both the RME and CTE scenarios.

6.6.4.2 EVALUATION OF CASUAL TRESPASSER

Surface Soil. The SSRBE results for surface soil under the casual trespasser scenario are presented in Table G-28, Appendix G. Based on the maximum concentration, arsenic is treated as though it exceeds background. The cumulative incremental cancer risks for the RME and CTE scenarios are $6x10^{-7}$ and $6x10^{-8}$, respectively. Both estimates are below the risk management range of 10^{-6} to 10^{-4}. These carcinogenic risk estimates are comprised entirely of arsenic since the non-risk-based PRGs for naphthalene and 2-methylnaphthalene (i.e., PRGs for both chemicals are based on soil saturation) preclude their use in risk estimates. The maximum detected concentration of arsenic in surface soil exceeds the carcinogenic trespasser PRG under the RME scenario but the EPC is below it. Because arsenic is treated as though it is above background, the cumulative incremental cancer risk, excluding background, is also estimated at $6x10^{-7}$ under the RME scenario because the reported level of arsenic is considered to be site-related. However, only the maximum detected concentration of arsenic (8.6 mg/kg) is above the background concentration of 6.86 mg/kg (refer to Table G-28, Appendix G). The cumulative noncarcinogenic HI due to exposure to surface soil by casual trespassers is less than the target level of 1.0 for both the RME and CTE scenarios.

Subsurface Soil. The casual trespasser is not expected to become exposed to subsurface soil, and therefore no risk estimate is provided for this soil interval.

Sediment. Sediment at IRP Site 1 was evaluated against casual trespasser PRGs for both RME and CTE scenarios (refer to Table G-29, Appendix G). Arsenic is the only chemical that is evaluated since it was the only constituent carried forward from the RBS. The cumulative incremental cancer risk including background is $2x10^{-7}$ for the RME scenario and $3x10^{-8}$ for the CTE scenario. These estimates are below the risk management range of 10^{-6} to 10^{-4}. The maximum detection of arsenic in

sediment (1.5 mg/kg) is below (or considered to be) background. Therefore, if one excludes background constituents, there is no incremental cancer risk associated with exposure to sediment for the casual trespasser. The cumulative noncarcinogenic HI due to exposure to sediment by casual trespassers is less than the target level of 1.0 for both the RME and CTE scenarios.

6.6.4.3 EVALUATION OF EXPLOSIVE ORDNANCE DISPOSAL TRAINING RANGE SUPERVISOR

Surface Soil. The SSRBE results for surface soil under the EOD Training Range supervisor scenario are presented in Table G-30, Appendix G. Based on the maximum concentration, arsenic is treated as though it exceeds background. The cumulative incremental cancer risks, including background, are $3x10^{-7}$ for the RME scenario and $3x10^{-9}$ for the CTE scenario. Both estimates are below are within the risk management range of 10^{-6} to 10^{-4}. These carcinogenic risk estimates are comprised entirely of arsenic since the non-risk-based PRGs for naphthalene and 2-methylnaphthalene (i.e., PRGs for both chemicals are based on soil saturation) preclude their use in risk estimates. The maximum detected concentration of arsenic in surface soil slightly exceeds the EOD Training Range supervisor PRG but the EPC is below it. Because arsenic is treated as though it is above background, the cumulative incremental cancer risk, excluding background, is also estimated at $3x10^{-7}$ because the reported level of arsenic is considered to be site-related. However, only the maximum detected concentration of arsenic (8.6 mg/kg) is above the background concentration of 6.86 mg/kg (refer to Table G-30, Appendix G). The cumulative noncarcinogenic HI due to exposure to surface soil by an EOD Training Range supervisor is less than the target level of 1.0 for both the RME and CTE scenarios.

Subsurface Soil. The EOD Training Range supervisor is not expected to become exposed to subsurface soil, and therefore no risk estimate is provided for this soil interval.

Sediment. Sediment at IRP Site 1 was evaluated against the EOD Training Range supervisor PRGs for both RME and CTE scenarios (refer to Table G-31, Appendix G). Arsenic is the only chemical that is evaluated since it was the only constituent carried forward from the RBS assessment. Cumulative incremental cancer risks, including background, are $1x10^{-7}$ under the RME scenario and $1x10^{-9}$ under the CTE scenario. These estimates are below the risk management range of 10^{-6} to 10^{-4}. The maximum detection of arsenic in sediment (1.5 mg/kg) is below (or considered to be) background. Therefore, if one excludes background constituents, there is no incremental cancer risk associated with exposure to sediment for the EOD Training Range supervisor. The cumulative noncarcinogenic HI due to exposure to sediment by the EOD Training Range supervisor is less than the target level of 1.0 for both the RME and CTE scenarios.

6.6.4.4 EVALUATION OF WILDLIFE RESERVE WORKER

Risks for the wildlife reserve worker are anticipated to be less than those for the industrial worker due to differences in activity patterns that reduce the expected chemical intake. Evaluation of the industrial worker is likely to be adequately protective of the wildlife reserve worker. As a result, the wildlife reserve worker was qualitatively evaluated. Exposure to either surface soil or subsurface soil results in estimated cumulative incremental cancer risks that are less than $2 x10^{-6}$ (i.e., less than the ILCR for the industrial worker). Noncancer hazards are less than 1. Exposure to sediment would result in estimated cumulative incremental cancer risks and noncancer hazards that are within acceptable levels.

6.6.4.5 SITE-SPECIFIC RISK-BASED EVALUATION SUMMARY

Table 6-5 summarizes the results of the site-specific risk assessment. Risks for the wildlife reserve worker, which were qualitatively evaluated, are not included.

The evaluation of surface soil scenarios using EPCs resulted in no incremental cancer risks that exceeded the target incremental cancer risk level of 10^{-6} for the construction worker (ILCR = $5x10^{-7}$), casual trespasser (ILCR = $6x10^{-7}$) or EOD Training Range supervisor (ILCR = $3x10^{-7}$). Arsenic is the only carcinogenic COPC. Because the maximum detection of arsenic is greater than the background concentration, arsenic was evaluated as though it exceeded background, even though the only location where arsenic exceeds background is a single trench location. With this assumption, the cumulative incremental cancer risk, excluding background, remains the same for each receptor because the reported level of arsenic is considered to be site-related. Taking all arsenic data collectively, however, the average arsenic concentration in surface soil is consistent with background levels.

The site-specific incremental cancer risk estimates for subsurface soil are at or below the target level of 10^{-6} for the construction worker. The casual trespasser and EOD Training Range supervisor are not exposed to subsurface soil. The site-specific incremental cancer risk estimates for sediment are below the risk management range of 10^{-6} to 10^{-4} and cumulative noncancer HI is less than 1.0. Arsenic in sediment (the only COPC) is at background levels.

Evaluation of noncancer hazards associated with exposure to surface soil for the construction worker resulted in HIs equal to or below the target noncancer hazard of 1 (Table 6-5). Evaluation of noncancer hazards associated with exposure to subsurface soil resulted in HIs for the construction worker that exceeded the target noncancer hazard of 1.0 under the RME scenario (HI = 3) but below this target level under the CTE scenario (HI = 0.4). Antimony and thallium (present at levels above background) contribute most to this hazard. For the casual trespasser or EOD Training Range supervisor, noncarcinogenic HIs are below the target hazard of 1.0.

Risks are also presented using California-modified toxicity values (Table 6-6). The evaluation of surface soil exposure under the RME scenario resulted in cumulative lifetime cancer risks (or ILCRs) of $5x10^{-6}$ for the construction/utility worker, $6x10^{-6}$ for the casual trespasser, and $4x10^{-7}$ for the EOD Training Range supervisor. The estimated ILCR from subsurface soil exposure increases slightly (ILCR = $7x10^{-6}$) for the construction/utility worker. Risk estimates that utilize California-modified toxicity values are approximately an order of magnitude higher than when estimated using EPA Region 9 PRGs. The main reason for this increase is that naphthalene, originally evaluated as a noncarcinogenic chemical by EPA Region 9, is considered a carcinogen by the State of California. Given the infrequency with which naphthalene was detected in soil (one percent in surface soil and four percent in subsurface soil), the higher estimated cancer risk belies the likelihood that a receptor encounters naphthalene at the site. The second reason for the increase in the cancer estimate is that California assigns a higher slope factor (i.e., more toxic) for arsenic.

6.6.5 Uncertainties in the Screening Risk Assessment

Uncertainty is inherent in the risk assessment process. The level of certainty associated with the conclusions of the SRA is conditional upon the quality of data and models used to identify COPCs and estimate EPCs, the assumptions made in estimating exposure conditions, and the methods used to develop toxicity factors. Uncertainties in the risk assessment process could result in an overestimation or underestimation of risk. This risk assessment has been developed to be protective, rather than accurately predictive. As a result, the risk assessment is believed to represent a substantial overestimation of excess or incremental cancer risk and noncancer hazard. This section presents a discussion of some of the uncertainties inherent in the risk assessment with focus on key factors believed to influence the risk assessment process and application to risk management activities. Uncertainties involved in each major step of the risk assessment process (i.e., data assessment, exposure assessment, toxicity assessment, and risk characterization) are discussed separately below.

6.6.5.1 UNCERTAINTIES IN DATA ASSESSMENT

Rejected Results. As presented in Table G-1, Appendix G, some of the analytical results were determined to be unusable (i.e., R-flagged) for the quantitative risk evaluation due to the reasons described in Section 6.2. These results were excluded from the SRA. Specifically, seven of 174 surface and subsurface soil results (four percent) for cis-1,2-dichloroethane were rejected, one of 174 surface and subsurface soil results (< one percent) for 2-butanone were rejected, and 41 of 174 surface and subsurface soil results (24 percent) for acetone were rejected. All groundwater results were determined to be usable. Because some results were excluded from the quantitative evaluation, the results of the Tier 1 SRA may potentially be over- or underestimated.

Chemicals with Minimum Reporting Limits above the Screening Criteria. When a chemical was both detected and not detected in a sample medium, a proxy concentration of one-half the RL was assigned when calculating exposure point concentrations (such as the 95 percent UCL). If an analyte was not detected in the sample medium, then it is not included as a COPC in the risk assessment. Only one chemical not detected in soil had all of its RLs greater than the screening criteria. Numerous nondetected chemicals in groundwater had all of their RLs greater than screening criteria. Because these chemicals were not detected and therefore not evaluated as a COPC, potential risks/hazards would be underestimated if any of these chemicals is truly present at the RL.

Elevated Nondetects. Calculation of the 95 percent UCL does not include nondetect results with reporting limits two times the maximum detected concentration. Such results are excluded from the dataset. This practice is based on the discussion of unusually high sample quantitation limits in Section 5.3.2 of RAGS (EPA 1989). Based on this comparison (sample quantitation limit [SQL] compared with two-times the highest detect), nondetected results were excluded for several COPCs in surface and subsurface soil. The majority of chemicals having such elevated detection limits were VOCs and among those, chemicals often associated with laboratory contamination or found in blanks were evident. Key exceptions to this conclusion include fluoranthene, motor oil, and phenol in surface soil and cobalt, fluoranthene, hexachlorobenzene, motor oils, phenol, selenium, TCE, and thallium in subsurface soil. As a result of these excluded results, the potential risk may be underestimated.

Sample Quantitation Limit Evaluation. Several chemicals in surface soil, subsurface soil and groundwater were not detected in any of the collected samples. These chemicals may not have been detected because they truly are not present or the RL was insufficient to detect their presence. If any of these chemicals is truly present, risk would be underestimated. A comparison of the SQL to residential PRGs identified those chemicals for which the SQL was not low enough to detect concentrations at the defined residential PRG. Chemicals with 100 percent of the RLs exceeding the PRGs would potentially underestimate the reported risks if the chemical were truly present. Table G-2, Appendix G, illustrates those chemicals for which an SQL exceeded the residential PRG. When RLs exceed PRGs and the chemical is not detected in any sample, it is possible that the chemical is present at a concentration that may exceed the risk-based level. In this instance, risk may be potentially underestimated. However, it is also possible that these chemicals are not present in soil or groundwater, thus having no effect on the quantitative risk evaluation.

COPCs were identified based on the comparison of the maximum detected concentration with the residential PRG. When a chemical was never "detected" (where there were no analytical results above the SQL or estimated between the SQL and the Method Detection Limit [MDL]), then the RLs were compared to the residential PRG to ensure that potential COPCs were not overlooked or dismissed without justification.

Table 6-5: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Site-Specific Risk-Based Evaluation

Medium and Type of Evaluation	Construction/Utility Worker		Casual Trespasser		EOD Training Range Supervisor	
	RME	CTE	RME	CTE	RME	CTE
Surface Soil – Including Background						
ILCR	$5x10^{-7}$	$2x10^{-8}$	$6x10^{-7}$	$6x10^{-8}$	$3x10^{-7}$	$3x10^{-9}$
Contributors:	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic
HI	1	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	61% - naphthalene 37% - 2-methylnaphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
Surface Soil – Excluding Background						
ILCR	$5x10^{-7}$	$2x10^{-8}$	$6x10^{-7}$	$6x10^{-8}$	$3x10^{-7}$	$3x10^{-9}$
Contributors:	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic
HI	1	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	61% - naphthalene 37% - 2-methylnaphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
Subsurface Soil – Including Background						
ILCR	$1x10^{-6}$	$5x10^{-8}$	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	60% - arsenic 26% - RDX 13% - TCDD TEQ	58% - arsenic 29% - RDX 13% - TCDD TEQ				
HI	3	0.4	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	29% - antimony 26% - thallium 24% - naphthalene 15% - 2-methylnaphthalene	47% - antimony [a] 42% - thallium [a]				
Subsurface Soil – Excluding Background						
ILCR	$1x10^{-6}$	$5x10^{-8}$	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	60% - arsenic 26% - RDX 13% - TCDD TEQ	58% - arsenic 29% - RDX 13% - TCDD TEQ				
HI	3	0.4	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	29% - antimony 26% - thallium 24% - naphthalene 15% - 2-methylnaphthalene	47% - antimony [a] 42% - thallium [a]				
Sediment – Including Background						
ILCR	$2x10^{-7}$	$9x10^{-9}$	$2x10^{-7}$	$3x10^{-8}$	$1x10^{-7}$	$1x10^{-9}$
Contributors:	100% - arsenic	100% -	100% -	100% -	100% -	100% - arsenic

Table 6-5: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Site-Specific Risk-Based Evaluation

Medium and Type of Evaluation	Construction/Utility Worker		Casual Trespasser		EOD Training Range Supervisor	
	RME	CTE	RME	CTE	RME	CTE
		arsenic	arsenic	arsenic	arsenic	
HI	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic
Sediment – Excluding Background						
ILCR	--	--	--	--	--	--
HI	--	--	--	--	--	--
Groundwater	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Surface Water	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated

Notes:
% = percent
< = less than
CTE = central tendency exposure
EOD = explosive ordnance disposal
HI = hazard index
ILCR = incremental lifetime cancer risk
RDX = cyclotrimethylenetrinitramine
RME = reasonable maximum exposure
TCDD TEQ= tetrachlorodibenzodioxin toxicity equivalency factor
[a] = The non-cancer hazard cannot include naphthalene or 2-methylnaphthalene because soil saturation is the respective PRG.
-- Cancer risk or Hazard index cannot be calculated since the single COPC of arsenic is at background levels.

Table 6-6: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Site-Specific Risk-Based Evaluation Using California-Modified Toxicity Values

Medium and Type of Evaluation	Construction/Utility Worker		Casual Trespasser		EOD Training Range Supervisor	
	RME	CTE	RME	CTE	RME	CTE
Surface Soil – Including Background						
ILCR	$5x10^{-6}$	$1x10^{-7}$	$6x10^{-6}$	$4x10^{-7}$	$4x10^{-7}$	$2x10^{-8}$
Contributors:	59% - arsenic 41% - naphthalene	100% - arsenic [a]	57% - arsenic 43% - naphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
HI	1	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	61% - naphthalene 37% - 2-methylnaphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
Surface Soil – Excluding Background						
ILCR	$5x10^{-6}$	$1x10^{-7}$	$6x10^{-6}$	$4x10^{-7}$	$4x10^{-7}$	$2x10^{-8}$
Contributors:	59% - arsenic 41% - naphthalene	100% - arsenic [a]	57% - arsenic 43% - naphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
HI	1	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	61% - naphthalene 37% - 2-methylnaphthalene	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]	100% - arsenic [a]
Subsurface Soil – Including Background						
ILCR	$7x10^{-6}$	$2x10^{-7}$	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	61% - arsenic 33% - naphthalene	90% - arsenic [a]				
HI	3	0.4	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	29% - antimony 26% - thallium 24% - naphthalene 15% - 2-methylnaphthalene	47% - antimony[a] 42% - thallium[a]				
Subsurface Soil – Excluding Background						
ILCR	$7x10^{-6}$	$2x10^{-7}$	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	61% - arsenic 33% - naphthalene	90% - arsenic [a]				
HI	3	0.4	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Contributors:	29% - antimony 26% - thallium 24% - naphthalene	47% - antimony[a] 42% - thallium[a]				

Table 6-6: Summary of Incremental Lifetime Cancer Risks and Noncancer Hazards for Site-Specific Risk-Based Evaluation Using California-Modified Toxicity Values

Medium and Type of Evaluation	Construction/Utility Worker		Casual Trespasser		EOD Training Range Supervisor	
	RME	CTE	RME	CTE	RME	CTE
	15% - 2-methylnaphthalene					
Sediment – Including Background						
ILCR	$1x10^{-6}$	$6x10^{-8}$	$2x10^{-6}$	$2x10^{-7}$	$2x10^{-7}$	$8x10^{-9}$
Contributors:	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic
HI	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Contributors:	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic	100% - arsenic
Sediment – Excluding Background						
ILCR	–	–	–	–	–	–
HI	–	–	–	–	–	–
Groundwater	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated
Surface Water	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated

Notes:
% = percent
< = less than
COPC = chemical of potential concern
CTE = central tendency exposure
EOD = explosive ordnance disposal
HI = hazard index
ILCR = incremental lifetime cancer risk
PRG = preliminary remediation goal
RME = reasonable maximum exposure
[a] = The cancer risk or non-cancer hazard cannot include naphthalene or 2-methylnaphthalene because soil saturation is the respective PRG.
– Cancer risk or HI cannot be calculated since the single COPC of arsenic is at background levels.

The evaluation of the analytical RL is to ensure that the analytical limit is sufficient to reliably report the presence of a chemical in the medium of concern. MDLs are the lowest levels at which a method can detect a chemical given the reagents, sample matrix, and preparation steps of the analytical method. It does not include factors such as matrix interferences, variabilities in sample to sample results, etc. While, an evaluation of the MDL against the PRGs could have been conducted where MDLs were compared to the residential PRG, such a comparison does not consider the practical aspects of the analyses and could result in misleading the data quality evaluation. Therefore, as recommended by EPA Guidance (EPA 1989) the use of a more reliable value, the SQL, was used to make assessments of sufficiency of the analytical method. Because most of the SQL were deemed to be sufficiently low for the evaluation of risk, the use of the SQL in this context is not thought to add substantially to the uncertainty of the assessment.

6.6.5.2 UNCERTAINTIES IN EXPOSURE ASSESSMENT

Uncertainty in the exposure assessment is a function of several factors. Such factors include but are not limited to: completeness/representativeness of the site data; identification of COPCs; assumptions regarding actual current and/or future site land use; identification of relevant receptor

groups and activities; and even the extent to which certain chemicals are physiologically retained and transferred to target organs of the selected receptors.

Judgmental Sampling. For this site investigation, the data that have been collected are believed to be reasonably representative of current site conditions. COPCs have been selected based on prior knowledge of the site (i.e., areas identified through geophysical means as having been used as detonation pits) and an understanding of conditions that are likely to influence chemical fate and transport. Several samples have been collected in a judgmental (i.e., biased) fashion over a period of three years at different depths in order to characterize the extent of contamination. The biased sampling procedures are likely to overestimate exposure and associated risk because receptors are assumed to contact those areas preferentially.

Land Use Considerations. For this evaluation, assumptions have been made to both ensure conservatism and attempt to realistically characterize current and future site use. Conservativeness is embodied in the RBS that compares EPC to PRGs under the residential land use. This assumption overestimates risk but provides useful information to facilitate reasonable land use considerations. The site-specific risk-based evaluation evaluated alternate receptor scenarios. This evaluation is more likely to identify reasonably realistic risk given assumptions of receptor activities. Overall, therefore, selection and evaluation of the land uses in the risk assessment will tend, in general, to overestimate risks.

Selection of COPCs. Chemicals evaluated in this SRA were identified by a single detection in each of the environmental media. This conservative approach to identifying COPCs conflicts with some EPA Guidance (EPA 1989) in which a minimum of five percent detection is recommended. The use of the single detection to identify COPCs could overestimate the potential risk from exposure to chemicals detected at the site. For example, the noncarcinogenic HI for exposure to surface soil was driven to a large degree by naphthalene and 2-methylnaphthalene; however each of these two compounds were detected in only one of 72 samples. For subsurface soil, the risk drivers naphthalene, 2-methylnaphthalene, and RDX were detected in only four percent of the samples. Inclusion of these chemicals and their maximum detected concentrations as EPCs likely overestimates the true risk to which receptors at the site are exposed.

Receptor Selection and Exposure Factors. Receptor groups have been selected to be consistent with generic and site-specific land uses. Therefore, the risk assessment has assumed that relevant receptor groups consist of residential and industrial receptors. All of the exposure factors that are used to characterize chemical intake for these receptors are conservatively developed to ensure that, if anything, the risk is overestimated. Alternatively, the risk assessment has assumed that construction/utility workers, casual trespassers, and an EOD Training Range supervisor are relevant to a characterization of site-specific risks. Thus, these receptor groups have been evaluated with exposure factors that are somewhat less conservative but more realistic than those used in the RBS assessment. For instance, despite the fact that current construction work activities result in reduced exposures (i.e., direct contact is minimized with the use of machinery), risk to the receptor has been evaluated using many exposure factors that are recommended as default factors by the EPA to ensure protectiveness in the risk assessment. Because many of the exposure factors used in the evaluation have been developed to ensure protectiveness, the tendency for risk to be overestimated is likely.

Exposure Point Concentrations. Because of the inherent variability of sample collection, sample analysis, and chemical distribution in the environment, the determination of an EPC that represents an average exposure with confidence can be difficult. Defined as the lesser of the maximum detected concentration or the 95 percent UCL, the EPC that is chosen is the value that best represents the average exposure. EPA Guidance allows the use of the "lesser" of the two values between the maximum detected concentration and the 95 percent UCL. When samples are collected (and

therefore, define a data set), and when the variability among the observations is great, the 95 percent UCL will likely be greater than the maximum concentration. Defaulting to the lesser of the two concentrations helps to minimize the overestimation of risk, but does not eliminate the potential to overestimate the risk based on the "average" exposure condition, which is the anticipated level of exposure. The EPC could, in fact, yield an over- or underestimate of risk depending on the truly underlying distribution of the data/chemical concentrations.

Many of the higher detections of inorganic COPCs were located in the trench area and may not accurately reflect metal concentrations across the entire site and those which receptors may contact. For example, arsenic was treated as though it exceeded background levels based on a single surface soil sample and a single subsurface soil sample at 6 feet bgs. The high detections are included in the data set for the appropriate soil interval and would likely artificially elevate the surface soil EPC and subsurface soil EPC to which receptors are potentially exposed at the site.

Uncertainty Associated with Secondary Pathways Not Evaluated. Secondary pathways such as ingestion of homegrown produce were not evaluated in this assessment. Because secondary pathways are not quantitatively evaluated and because some of the chemicals detected have the potential to bioaccumulate in plants, potential risks could be underestimated. The inorganic chemicals detected in the soil medium were compared to published bioconcentration factors for soil to plant transfer (BCFp) (Bechtel Jacobs Company 1998). No inorganic chemical detected in the soil medium at IRP Site 1 had a BCFp greater than 1, therefore, bioaccumulation of these inorganic chemicals in plants (i.e., foodstuffs) is unlikely. Any organic chemical with a log Kow of greater than 3 is conventionally assumed to have the potential to bioaccumulate in the foodchain. The chemicals in the 0 to 10 feet bgs depth interval for soil with a log Kow of greater than 3 are:

- Ethylbenzene
- Xylenes
- 2-Methylnaphthalene
- BEPH
- Fluoranthene
- Hexachlorobenzene
- Naphthalene
- N-nitrosodiphenylamine
- 2,3,7,8-TCDD (and other dioxin congeners)

Use of Default Particulate Emission Factors. While it is true that activity-specific particulate emission factors (PEFs) may be developed to characterize risk during site-specific activities, the extent to which any activity dominates an exposure scenario is limited by the frequency of occurrence relative to other exposure routes (i.e., oral, dermal). In this assessment, the default PEF was used and the result on the risk estimate could be an over- or underestimate based on the actual PEF value that would result from any site-specific activities.

With the possible exception of the construction worker or EOD Training Range supervisor, it is not reasonably anticipated that the receptor would be exposed to particulates via inhalation over that which is assumed based on the default PEF. As for construction workers, there may be occasions wherein particles are suspended via other than wind erosion processes. However, these events are not expected to be typical and representative of the reasonable maximum exposures. As with any exposure factor, the use of a default rather than a site-specific factor is likely to overestimate risk.

However, it is not anticipated that the use of the default PEF would grossly overestimate risk because the oral ingestion rate of 330 mg/day is likely be the primary exposure route for particle associated chemicals.

In summary, based on the assessment of sampling, land use, receptor selection, and associated activities and exposure factors, the exposure assessment is believed to overestimate risk.

6.6.5.3 UNCERTAINTIES IN TOXICITY ASSESSMENT

Toxicity assessment involves the selection of noncancer toxicity indices (i.e., RfDs) and CSFs.

Reference Doses. RfDs are developed using animal data that must be applied to human receptors for the risk assessment. The process typically involves application of several uncertainty factors and modifying factors to animal test data that lower the RfD, given extrapolation from animal tests to human health risk assessment. For instance, uncertainty factors of 10 are often applied to animal data to reduce a threshold dose 10-fold to arrive at the RfD. This application of the uncertainty factors (UFs) is likely to overestimate noncarcinogenic toxicity as noted by Dourson et. al. (1997) and certainly does not reflect probabilities of excess exposures when exceedances of the RfD are noted (Clewell and Crump 2005).

Cancer Slope Factors. CSFs developed by the EPA are conservative and represent the upper bound limit (i.e., upper 95 percent UCL) on the probability of a cancer response occurring. Thus, the actual carcinogenic risk due to exposure to selected chemicals is likely to be lower than the actual risk experienced by the receptor. One other source of uncertainty in the toxicity assessment lies in extrapolating experimental carcinogenic observations at high doses to the low doses experienced by the human population of interest. Because there is no empirical way to detect risks below the five percent to 10 percent dose range, assumptions must be made about the shape of the dose-response curve in the low dose region (Rodricks, 1992). Because the standard default is to assume that all carcinogens have a linear no-threshold dose-response curve, the cancer potency for carcinogenic COPCs (e.g., arsenic) is likely overestimated.

Route-to-Route Extrapolation. When a chemical does not have a toxicity value for a specific exposure route, a known value from a different route is often substituted. In this assessment, inhalation toxicity values (CSFi or RfDi) are sometimes extrapolated from the oral values. Contrarily, the California-modified oral CSFo for naphthalene was extrapolated from the inhalation value. Despite the simple one-to-one extrapolation method, pharmacological differences for chemicals absorbed through the gastrointestinal tract and via the lung may result in somewhat different toxicological responses. Therefore, the use of the one-to-one extrapolation between the oral and inhalation exposure routes may result in either the underestimation or overestimation of resulting risks.

Chemicals with Non-Intergrated Risk Information System Toxicity Values. Per United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (EPA 2003a), the current hierarchy for human toxicity values is:

- Tier 1 – EPA's IRIS
- Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values

The primary source of toxicity information is EPA IRIS. When a toxicity value is not available in IRIS, other sources of toxicity information can be considered in accordance with EPA Guidance

(EPA 2003a); these additional sources are often considered "provisional." In this assessment, the Region 9 PRGs for several chemicals were based on provisional toxicity values to derive site-specific PRGs. The chemicals with provisional RfDs (for noncancer risk) include:

- aluminum
- barium
- chloroform
- cobalt
- copper
- cis-1,2-dichloroethene
- iron
- methylene chloride
- methyl isobutyl ketone
- n-nitrosodiphenylamine
- TCE
- vanadium

The chemicals with provisional CSFs (cancer risk) include:

- cobalt
- methyltertbutyl ether
- 2,3,7,8-TCDD
- PCE
- TCE

Of particular note is the provisional slope factor for TCE since this compound is the carcinogenic risk driver in groundwater. Because the provisional toxicity values are not final IRIS values, the overall effect on the risk estimates for this risk assessment could be over- or underestimates. However, as provisional values are often set to ensure protectiveness in associated evaluations, this use of provisional values, including trichloroethylene, as well as the others, is likely to overestimate the risks.

Chemicals with Updated or Revised Toxicity Values (EPA) – Perchlorate. The RfD for perchlorate has recently been changed in IRIS to 7.0×10^{-4} mg/kg-day. This represents a seven-fold increase over the older value reported in the EPA Region 9 PRG tables. The newer value was used in this assessment.

Chemicals with Updated or Revised Toxicity Values (California). Several chemicals evaluated in this assessment have been recently assigned different toxicity values by the State of California. Chemicals include arsenic, chloroform, lead, benzo(k)fluoranthene, chrysene, naphthalene, and TCE. Toxicity values for these chemicals are considered Tier 3 values under the EPA hierarchy (EPA 2003a) but are peer reviewed and as such, the State of California does not consider theses toxicity values as provisional. EPA Region 9 provides PRGs for these chemicals but assigns them as "California (or Cal-) modified" (EPA Region 9 2004a).

Naphthalene. Naphthalene is not listed as a carcinogen in IRIS. However, in 2002, the National Toxicology Program (NTP) completed its bioassay of naphthalene exposure via the inhalation exposure route, concluding there was, "clear evidence of carcinogenicity" of the compound in rats via inhalation exposure (NTP 2000). Pursuant to that assessment, California EPA placed naphthalene on its list of chemicals that might cause cancer and developed a unit risk value for inhalation exposures in 2004 (Cal-EPA 2004b). However, EPA Region 9 subsequently applied a route to route extrapolation to the inhalation exposure data to develop a CSF for oral (CSFo) exposures.

Another EPA (2003d) study however strongly suggests that the assumption of carcinogenicity via the oral route is premature. Specifically, the EPA (2003d) stated the following:

> *".... the NTP bioassay in rats showed clear evidence for carcinogenic activity within the nasal cavity, but not in other tissues. The new data [in this 2003 report] strengthen the association of carcinogenicity with the inhalation route of exposure and weaken the tenuous association with the oral route. For this reason, the carcinogenic potential of naphthalene via the inhalation route may need to be reevaluated."*

Based on the aforementioned documentation, the use of the oral route-to-route extrapolated CSF in the assessment likely accounts for an overestimation of ILCR.

Arsenic. Slope factors listed in IRIS for arsenic are 1.5 (mg/kg/day)-1 and 15 (mg/kg/day)-1 for oral and inhalation exposure routes, respectively. However, the slope factors developed by California (Cal-EPA 2004a) differ from those endorsed by the EPA with values of 9.5 (mg/kg/day)-1 and 12 (mg/kg/day)-1 for oral and inhalation exposure routes, respectively, suggesting that CalEPA cancer estimates are approximately 10 times greater than those of the EPA.

Different approaches used to establish the CSFs for the EPA and CalEPA explain the principal differences in the derivation of the associated slope factors. For instance, the EPA data set depends in large part on a single well documented and studied sample population located in Taiwan (Tseng 1984). This approach, though limited to the evaluation of skin cancer, provides the benefit of relatively controlled evaluations within a well studied population. Alternatively, CalEPA, in an attempt to evaluate the potential for internal cancers due to arsenic exposures re-assessed not only the Tseng data sets, but also several other data sets associated with potential exposure to various groups of potentially exposed individuals in a broader compliment of geographical locations and exposure scenarios. While the assessment of these many groups is likely to provide sufficient protection via the development of the associated slope factor, the pooling of various populations and cancer types likely results in a higher variation of tumor incidences or cancer responses that may lead to a higher slope factor, suggesting that the CalEPA slope factor is overly protective.

In addition, the inclusion of many data sets that demonstrate different cancers internal suggests that the evaluation may have included differential carcinogenic modes of action in the same numerical analyses. It is uncertain as to whether this would result in an overestimate of the slope factor but it is clear that isolation of a causal relationship between cancer incidence and exposures are confounded.

Chemicals Without Toxicity Values. When chemicals do not have available toxicity factors, then the chemicals cannot be evaluated and potential contribution to the risk/hazard estimates cannot be completed. In all likelihood, the detection of chemicals without toxicity values will yield an underestimate of risk because the chemicals would not be included in the cumulative risk/hazard estimates.

Chemicals detected in soil from the current data that do not have EPA Region 9 soil PRGs due to lack of toxicity values are listed below:

- TPH (various fractions)
- Phenanthrene
- Benzo(g,h,i)perylene
- Nitrate

Chemicals detected in groundwater that do not have EPA Region 9 Tap Water PRGs due to a lack of toxicity values are:

- TPH (various fractions)

Chemicals detected in surface water that do not have EPA Region 9 Tap Water PRGs due to a lack of toxicity values are:

- TPH (various fractions)
- Chloride
- Sulfate

Chemicals detected in sediment that do not have EPA Region 9 Tap Water PRGs due to a lack of toxicity values are:

- TPH (various fractions)

While the lack of toxicity values for the above COPCs imparts additional uncertainty into the risk assessment, the magnitude of this uncertainty is likely low and the effect on the overall risk assessment results for IRP Site 1 is expected to be minimal.

Infrequently Detected Chemicals: In this assessment, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and 2-hexanone were all detected and do not have toxicity values; therefore, risks are likely to be somewhat underestimated. However, all three chemicals had a low frequency of detection. 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene were each detected in 1 sample out of a total of 148 analyses and 2-hexanone was detected in 9 samples out of a total of 174 analyses.

Essential Nutrients: While magnesium, calcium, potassium and sodium were detected, they too have no toxicity values, are essential nutrients and the magnitude of the detected concentrations in the media at IRP Site 1 is relatively small. Thus, it is not expected that the exclusion of these nutrients will underestimate risk.

Dioxins/Furans: The cancer risk from TCDD TEQs is estimated by summing the individual cancer estimates for each dioxin and dibenzofuran congener. The risk calculations for all congeners (with the exception of TCDD) are determined using estimated CSFs based on the assumption of toxicity equivalence to 2,3,7,8 TCDD. While the approach is an estimation procedure that depends on assumed toxicity of dioxin-like chemicals, it is generally understood that absent actual toxicity data for each dioxin congener, the TCDD TEQ process is a potentially better methodology to estimate cancer risk in potentially exposed populations. Nonetheless, despite its general acceptance in the scientific community, the methodology does assume additivity of like cancer effects derived from chemicals of similar structures. Thus based on its use in the risk assessment, cancer risks associated

with potential exposure to dioxins, as presented by the TEQ approach, may be somewhat overestimated.

Maximum Allowed Concentrations: Region 9 has established PRG "max" concentrations for some inorganic analytes or SVOCs with relatively low toxicity. PRG_{max} concentrations are non-health-based ceiling limit concentrations, and are fixed at 1E+05 mg/kg. If a health-based PRG was unavailable for comparison but a PRG_{max} was available, the PRG_{max} was used for qualitative comparison. PRG_{max} values were used as industrial soil PRGs in the evaluation of diethyl phthalate, phenol, aluminum, iron, and zinc. The maximum detected concentration of aluminum exceeded the 1E+05 mg/kg ceiling limit. However, it is not expected that these COPCs are present in concentrations that are likely to result in adverse health effects for the industrial receptor. It is not known whether hazards are overestimated or underestimated through use of "max" concentrations.

Saturation Concentrations: Some EPA Region 9 PRGs are listed as "sat" concentrations. These non-health-based PRGs correspond to a saturation concentration in soil where the absorptive limits of the soil particles and the available soil moisture have been reached. If a health-based PRG exceeded the PRG_{sat}, the PRG_{sat} was listed and used for qualitative comparison. The non-risk-based PRGs for several VOCs (2-butanone, 2-hexanone, 4-methyl-2-pentanone, ethylbenzene, toluene, and xylene) for the industrial receptor were the saturation concentrations reported by Region 9. Additionally, the non-risk-based PRGs for naphthalene and 2-methylnaphthalene were also saturation concentrations for the construction worker, trespasser, and EOD Training Range supervisor. Thus, their HQs and contributions to HI were not estimated and were not included in the calculation of the final HI. The exclusion of chemicals with the non-risk-based PRGs of "sat" concentrations from calculations of HI results in the underestimation of the resulting noncancer hazard. The degree of this underestimation is expected to be of minor significance.

6.6.6 Uncertainties in Evaluation of Indoor Air

Evaluation of the soil migration-indoor air pathway suggests that this exposure pathway is potentially the most significant pathway for a future resident. Incremental lifetime cancer risks via this pathway were twice that from direct contact. The use of the J&E model to estimate chemical concentrations in indoor air includes uncertainty in several areas:

1. The model assumes homogeneity of soil within a horizon. Therefore, selected site-specific values for various soil parameters may fail to provide an accurate measure of the soil variability.
2. The model evaluates building characteristics that, while remaining mostly constant, makes assumptions about the design of a building (e.g., height of the room, air-exchange rate) that is not yet planned for the site.
3. The model cannot assess the likelihood that a building will be constructed at all on the site, or the likelihood that it will be constructed atop or near the area of contamination.

In 2005, an assessment was conducted on the uncertainty of the J&E model on vapor intrusion calculations (Weaver 2005). The study identified a range for all soil and building parameters used in the J&E model, and systematically evaluated how the sensitivity of each variable magnitude affects the resulting risk (instead of indoor air concentration as used for IRP Site 1) as compared to the results using the defaults. One finding is that the air exchange rate in the building is the most sensitive factor, with the low-high values of 0.1 to 1.5 exchanges per hour changing the risk from the default situation by -83 percent to 150 percent. The next four most sensitive factors are water-filled porosity (-54 percent to 65 percent), mixing height of the air space in the building (-25 percent to 50 percent), depth to contaminant source (-20 percent to 35 percent) and soil porosity (-35 percent to 33

percent). When the variability of all parameters are considered simultaneously (9 parameters evaluated in all), the overall risk deviated from that of the default situation by -98 percent to 1,258 percent. Interactions among parameters such as multipliers or divisors of each other produce a synergistic effect that is not explained by the variability if individual parameters alone. Risks using the default settings may overestimate risk (or, as is used at IRP Site 1, indoor air concentration) by a factor of 2, or may underestimate the potential risk by a factor of 13.

A site-specific quantitative evaluation of the uncertainty of the J&E model at IRP Site 1 is likely to provide a similar result, with the exception that the air-exchange rate used for a residential setting (0.5 per hour) and the industrial setting (1.0 per hour) are greater than the default value of 0.25 per hour in the model. For the residential setting, an air exchange rate of 0.5 per hour is approximately the 25th percentile of rates measured in California residences (Cal-EPA 2004c). This value was used in the site-specific calculation of benzene (risk driver) concentration of 4.66 µg/m3 in indoor air. Substituting other values for the air exchange rate such as the lowest value evaluated above (0.1 per hour), the 10th percentile of rates in California residences (0.31 per hour) or 90th percentile (1.95 per hour) suggests that indoor benzene concentrations may be potentially overestimated by a factor of 2 to 5 or underestimated by a factor of 4. For the industrial setting, air exchange rate is not likely to be lower than 1.0 per hour because it is the minimum ventilation requirement pursuant to the 2001 Energy Efficiency Standards for Nonresidential Buildings (California Energy Commission 2001, as reported in Cal-EPA 2004c). Indoor benzene concentrations for the industrial setting could be underestimated by a factor of approximately 2.

The evaluation for risks associated with direct soil exposure (including ingestion, dermal contact, and inhalation of particulates and vapors in ambient air) utilizes the (95 to 99 percent) upper confidence limit of the mean soil concentration (or MDC, whichever is lower) and assumes that exposure could occur anywhere within the site where soil is accessible at the EPC. The same cannot be said of indoor air. Because the location of a residence is stationary, the risk for potential future residents from exposure to vapors in indoor air at the MDC can only be realized if a future residential home is built on an area that is impacted by the VOC in soil at the maximum detected concentration. Thus, the use of MDCs as EPCs for the indoor air scenario presents a "low probability exposure scenario" that, while possible, is not likely to occur.

Support for this "low-probability exposure scenario" concept is further illustrated by examining the frequency of detection and location of the MDC for each chemical whose soil concentrations might lead to levels in excess of the Region 9 PRGs for ambient air. Benzene, ethylbenzene, hexachlorobenzene, 2-methylnaphthalene, naphthalene and xylenes were detected in fewer than 5 percent of the total soil samples. This low frequency of detection suggests that the exposure probability from vapors in indoor air is correspondingly low as well. For many of the VOCs, including ethylbenzene, 2-methylnaphthalene, naphthalene and xylenes, the maximum detected concentration occurs at Trench 34. For benzene, the second highest detection occurs at this location as well. Thus, according to the J&E model, unless the construction of a future residence were to occur directly atop Trench 34 (which would provide the most likely opportunity for soil gas migration to result in exposures to residential receptors) exposure via the indoor air pathway is again likely to be low. Trench 29A (where the maximum detected concentration for benzene occurs and other VOCs are nondetect due to elevated reporting limits) provides a second location where soil vapor could lead to exposures to residential receptors.

While the use of the J&E model at IRP Site 1 may either overestimate risks from the inhalation of indoor VOCs by a factor of 2 to 5 or underestimate the risk by a factor of 13, its application assumes a building atop or near the 2 areas of contamination (Trenches 29A and 34). Thus, a larger overestimation of risks lies in the low likelihood or probability of that occurrence.

6.6.7 Uncertainties in Estimation of Site-Related Risk

EPA Guidance indicates that carcinogenic risks and HQs resulting from various multiple chemicals should be considered additive (EPA 1989). In the absence of supporting data for synergy or antagonism, the assumption of additivity could overestimate or underestimate potential cancer risk or HQs for receptors.

Definition of Site-Related Metals. A site-related release of a metal was identified when the maximum detected concentration exceeded the background level. The finding of a single sample result from background areas that slightly exceeds the reported background level (e.g., arsenic) may happen by chance, especially with an increasing number of samples (Gibbons 1991).

As noted in the preceding text, arsenic is a predominant COPC that has been included in its entirety in the estimation of risk associated with site-related activities. Arsenic is also a common naturally occurring element found in soil consistent with those of the site. The arsenic concentrations detected are consistent with background concentrations at El Toro since the EPCs of arsenic for surface soil and subsurface soil are below the Station average. Therefore, the inclusion of the contribution of naturally occurring arsenic tends to overestimate site-related risk to both generic and site-specific receptors.

6.7 SUMMARY AND CONCLUSIONS

The screening level risk assessment for surface and subsurface soil (i.e., comparison of data to residential and industrial criteria) resulted in cumulative incremental cancer risks within the risk management range of 10^{-6} to 10^{-4}. None of the cumulative incremental cancer risks exceeded $1x10^{-4}$ and most estimates were well below that level. Without the contribution of metals at background levels, risks changed little. Arsenic is the carcinogenic risk driver in soil; however, arsenic is present at concentrations consistent with background levels. Noncancer HIs for surface and subsurface soil range between 5 and 10 for the residential scenario and are near or below 1 for the industrial scenario. Antimony, thallium, and naphthalene are the main contributors to the HI.

Incremental lifetime cancer risks associated with the inhalation of VOCs that have migrated from subsurface soil to indoor air were within the risk management range of 10^{-6} to 10^{-4}. Noncancer hazard estimates exceeded the target HI of 1 for the resident but are based on infrequent (less than four percent) detections of the risk drivers (naphthalene and xylene).

The screening level risk assessment for sediment used residential soil PRGs for comparison. The assessment resulted in cumulative incremental cancer risks that are within the risk management range of 10^{-6} to 10^{-4} for the residential scenario but below this range for the industrial scenario. Noncancer HIs for both residential and industrial exposure scenarios were below 1.

The screening level risk assessment for groundwater resulted in cumulative incremental cancer risks of $1x10^{-3}$, which is primarily associated with TCE. The risk from TCE is based on detections during the initial groundwater sampling event in January 2002. However, TCE was not detected in subsequent groundwater monitoring events that represent current conditions. Other carcinogens detected above the tap water PRGs consist of arsenic, benzene, methylene chloride, and BEPH. Noncancer HIs for groundwater were approximately 10 for the residential scenario. Perchlorate is the main contributor to this hazard. Thallium, chromium, and nickel slightly exceeded their tap water PRGs.

ILCRs associated with the inhalation of VOCs that have migrated from groundwater to indoor air were within the risk management range of 10^{-6} to 10^{-4} but are based on TCE which has not been detected since the original groundwater sampling event of January 2002.

The screening level risk assessment for surface water used tap water PRGs for comparison. The assessment resulted in cumulative incremental cancer risks of $3x10^{-5}$, which is driven by arsenic. No other COPC exceeded its tap water PRG. Noncancer HIs for surface water are less than 1.

Based on the preceding information, the following points summarize the RBS from exposure to various media at the site assuming a residential exposure scenario:

- Estimated cancer risk from exposure to surface and subsurface soil, though within the risk management range of 10^{-6} to 10^{-4}, is driven by the presence of arsenic, which is at background levels. Noncancer hazards exceeded the target hazard of 1.0, but are based on chemicals that are detected in fewer than five percent of the samples. Maximum detections of these compounds were used to estimate the hazard.
- Estimated cancer risk from exposure to surface water and sediment, though within the risk management range of 10^{-6} to 10^{-4}, is driven by the presence of arsenic. The concentrations of arsenic detected in these media were less than detected in groundwater and soil, respectively.
- Estimated cancer risk from exposure to groundwater, though within the risk management range of 10^{-6} to 10^{-4}, is driven by the presence of TCE, which was only detected in the original groundwater sampling event. Although the risk estimate for arsenic also exceeded 10^{-6}, the maximum detection (4.4 µg/L) is below the MCL of 10 µg/L.
- Estimated noncancer hazard from exposure to groundwater (HI = 10 under a RME scenario) exceeds the target HI of 1.0, and is driven by the presence of perchlorate. Perchlorate was detected in 86 percent of the groundwater samples.
- The use of California-modified toxicity values resulted in approximately an order of magnitude increase in cancer risk estimates for surface and subsurface soil. The main reason for the increase is the designation of naphthalene by the State of California as a carcinogen. A higher slope factor for arsenic also contributes to the higher risk estimates. Risk estimates for groundwater exposure were lower.
- Estimated cancer risk from exposure to VOCs in indoor air is within the risk management range of 10^{-6} to 10^{-4}, while the noncancer hazard estimate exceeds the target HI of 1. Both estimates are driven by the presence of chemicals (benzene and naphthalene, respectively) that were detected in fewer than five percent of the samples.

The results of the site-specific risk-based evaluation indicate that:

- Surface soil (0 to 2 feet bgs) poses no unacceptable health risks for a construction worker or casual trespasser under either the RME scenario or the CTE scenario.
- The subsurface soil (0 to 10 feet bgs) does not pose a significant risk for the construction worker exposure scenario as excess cancer risks are very near or below the risk management range of 10^{-6} to 10^{-4}. Noncancer HI values are all less than 1.0.
- Sediments in the Ephemeral Pond do not pose a significant risk for the construction worker, casual trespasser, or EOD Training Range supervisor exposure scenarios as the only COPC (arsenic) is within background levels.
- Groundwater was not evaluated in the SSRBE since site-specific receptors are not expected to become significantly exposed to groundwater.
- The use of California-modified toxicity values resulted in approximately an order of magnitude increase in cancer risk estimates for surface and subsurface soil. The main reason

for the increase is the designation of naphthalene by the State of California as a carcinogen. A higher slope factor for arsenic also contributes to the higher risk estimates.

In summary, the risk estimates for the RBS are below the lower bound or within the EPA established cancer risk management range of 10^{-6} to 10^{-4} for all media except groundwater assuming its use as a potable water source. While the risk estimate for groundwater exceeds 10^{-4}, it is based on TCE, which has not been confirmed in groundwater by subsequent groundwater monitoring events suggesting that current conditions are not represented by those data that have been collected historically. Noncancer hazards for groundwater in the screening level evaluation are driven by perchlorate. However, it must be realized that there is no significant current use of groundwater at the site and the future use of this medium is believed to be unlikely. The evaluation of potential soil vapor migration of chemicals from soil into indoor air resulted in noncancer hazard estimates that exceeded target levels for the resident, but were based on chemicals which were infrequently detected in soil such that the maximum detected concentration was required in both the modeling effort and the resulting risk calculations.

In the SSRBE, excess cancer risks for all receptors and considered media were well below the lower bound (10^{-6}) of the cancer risk management range. The highest noncancer HI of 3 was calculated for the construction/utility worker potentially exposed to subsurface soil. Considering the inherent protectiveness built into establishment of the RfD, an HI value of 3 can be considered marginally greater than 1.0.

7. Ecological Risk Assessment

7.1 INTRODUCTION

This section is a summary of the ecological risk assessment (ERA) at IRP Site 1, the EOD Training Range, at Former MCAS, El Toro, California. The complete Tier 1 ecological SRA and Tier 2, Step 3a baseline ecological risk assessment (BERA), which was conducted in accordance with the Phase II RI Work Plan (Earth Tech 2001a) is presented in Appendix H of this report.

This ERA was conducted in order to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. Soil, sediment, and surface water samples were collected and analyzed for VOCs, SVOCs, hydrocarbons, explosives residues, perchlorate, general chemistry, dioxins, and metals.

Due to discussions with regulators and comments received on the *Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro* (Earth Tech 2003), four additional terrestrial species were added to more thoroughly represent the bird and mammal feeding guilds present at the site. This evaluation used the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and loggerhead shrike as representative birds.

7.2 ECOLOGICAL SCREENING RISK ASSESSMENT

This ecological SRA was conducted according to the Screening-Level Guidance presented in EPA *Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (EPA 1997b). The presentation of this ecological SRA has been structured according to U.S. Navy policy (DON 1999) so that it fulfills both the requirements of an EPA ecological SRA and a U.S. Navy Tier 1 ecological SRA.

The Navy Tier 1 ecological SRA process can be described in two steps. Step 1 of Tier 1 is equivalent to Step 1 of the EPA ERA process and includes a habitat assessment, contaminant identification, receptor and pathway identification, and toxicity evaluation. The goal of this step is to describe the ecological setting of the site and to determine whether complete ecological exposure pathways are present, determine what chemicals may be present, and characterize their toxicity.

Step 2 of the Navy Tier 1 ecological SRA process is equivalent to Step 2 of the EPA ERA process. First, exposure is estimated based on conservative assumptions. Then, risk is estimated by comparing the media-specific exposure point concentrations to conservative, screening-level, media-specific screening values. At this point, a scientific management decision point is made to determine if the exit criteria for Tier 1, Step 2 have been met. These criteria are as follows:

1. There is adequate information to conclude that ecological risks are negligible, and therefore, no need for remediation on the basis of ecological risk;
2. The information is not adequate to make a decision at this point, and the ERA process will continue to Step 3; or
3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

7.2.1 Tier 1, Step 1 – Screening-Level Problem Formulation

Step 1 of the ecological SRA is divided into several sections that help define the problem at the screening level. An abbreviated site history and description is given in Section 2.1.1 of Appendix H.

Assessment endpoints, measurement endpoints, representative species selection, exposure pathway analysis, the development of a conceptual site model, toxicity evaluation, and a description of the affected media and COPCs are identified in Sections 2.1.2 through 2.1.8 of Appendix H, respectively. Appendix H also provides a detailed description of the habitat and plant communities. An overview of the identification of COPCs evaluated in the ecological SRA follows.

7.2.1.1 ANALYTICAL DATA USED IN THE RISK ASSESSMENT

The COPCs for this ecological SRA were selected from chemicals detected in surface water, Ephemeral Pond soil/sediment soil, and surface soil (i.e., 0 to 6 feet bgs). The analytical suite was limited to assess potential media contamination from past training activities that took place onsite. Chemicals that were eliminated as potential COPCs because they are essential nutrients included sodium, potassium, calcium, magnesium, iron, and nitrate as N.

Upgradient surface water and sediment samples were collected in the Ephemeral Pond. Downgradient surface runoff was collected from the site drainage area where it leaves the site at the south boundary. Data from surface water, sediment, and surface soil samples were validated in accordance with U.S. Navy IRP Guidance for data valuation (DON 1998). Any data assigned an R qualifier (data rejected) were eliminated from the data set and not used for the preliminary risk evaluation.

Analytical results for all media samples at IRP Site 1 are presented in Appendix E. A summary and statistical evaluation of the analytical data used for the ERA are presented in Appendix H as Attachments H-1, H-2 and H-3 for surface water, sediment, and surface soil, respectively.

7.2.2 Tier 1, Step 2 - Screening

The Tier 1 screening is a two-step process. First, reporting limits for non-detected chemicals are compared to screening values for each environmental medium to identify those chemicals with analytical reporting limits that exceed screening values. The identified chemicals are retained as COPCs for further evaluation. Second, the Tier 1 exposure point concentrations (EPCs), defined as the maximum detected concentration, are compared to medium-specific direct contact screening values. Those chemicals that have an EPC that exceeds the medium-specific screening value are retained as COPCs and evaluated further in Tier 2. The exceedance is quantified by dividing the EPC by the screening value to obtain the hazard quotient (HQ). Table 7-1 summarizes the maximum detected concentrations in each medium that are used as EPCs in the risk assessment.

7.2.2.1 SURFACE WATER

An initial surface water screen compared the maximum RLs of undetected chemicals to selected surface water screening values to assess if there were any COPCs with RLs above screening concentrations. In the first Ephemeral Pond surface water sample collected (identified as sample LE524), 15 COPCs in surface water had maximum RLs that were higher than their respective surface water screening values.

In the second Ephemeral Pond surface water sample (identified as Sample LE619) and in the runoff water from the Ephemeral Pond (identified as sample LE622), only five COPCs had maximum RLs that were higher than their respective surface water screening values (refer to Attachment H 6-1, Appendix H).

Table 7-1: Maximum Concentrations of Chemicals Detected in Surface Water, Sediment, and Soil

COPC	Maximum Surface Water Concentration 01-Pond Sample LE524	Maximum Surface Water Concentration 01-Pond-Outfall Sample LE619	Maximum Surface Water Concentration 01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
VOCs (µg/L water, µg/kg sediment or soil)					
2-Butanone	nd	nd	nd	nd	9
2-Hexanone	nd	nd	nd	nd	50J
4-Methyl-2-Pentanone	nd	nd	nd	nd	2
Acetone	nd	6J	6J	nd	8,700J
Benzene	nd	nd	nd	nd	610*
Chloroform	nd	nd	nd	nd	2.2
Ethylbenzene	nd	nd	nd	nd	14,000*
Tetrachloroethene	nd	nd	nd	nd	2
Toluene	nd	nd	nd	0.8J	41,000*
Xylenes, Total	nd	nd	nd	nd	98,000*
SVOCs (µg/L water, µg/kg sediment or soil)					
2-Methylnaphthalene	nd	nd	nd	nd	270,000
Bis(2-ethyhexyl)phthalate	nd	nd	nd	nd	420
Diethyl Phthalate	nd	nd	nd	nd	250J
Di-n-butyl Phthalate	nd	nd	nd	nd	307,000 *
Fluoranthene	nd	nd	nd	nd	38
Hexachlorobenzene	nd	nd	nd	nd	220
Naphthalene	nd	nd	nd	nd	128,000
n-nitrosodiphenylamine	nd	nd	nd	nd	66,700 *
Phenol	nd	nd	nd	nd	1,200
Pyrene	nd	nd	nd	2	nd
Explosives Residues(µg/L water, µg/kg sediment or soil)					
1,3-Dinitrobenzene	nd	nd	nd	nd	630
2,4,6-Trinitrotoluene	nd	nd	nd	nd	7,860
2,4-Dinitrotoluene (also SVOC)	nd	nd	nd	nd	7,000
2,6-Dinitrotoluene (also SVOC)	nd	nd	nd	nd	44
2-Amino-4,6-Dinitrotoluene	nd	nd	nd	nd	310
4-Amino-2,6-Dinitrotoluene	nd	nd	nd	nd	228
HMX	nd	nd	nd	nd	1,400
RDX	nd	nd	1	nd	14,000
General Chemistry (µg/L water, µg/kg sediment or soil)					
Perchlorate	nd	nd	nd	nd	1,600
Metals (mg/L water, mg/kg sediment or soil)					
Aluminum	2,840 *	3,740 *	1,390 *	16,900	190,000 *
Antimony	nd	nd	4.7J	nd	103*
Arsenic	nd	1.2	0.8	1.5	12.4
Barium	50.2 *	39.3 *	45.9 *	81.7	537 *

Table 7-1: Maximum Concentrations of Chemicals Detected in Surface Water, Sediment, and Soil

COPC	Maximum Surface Water Concentration 01-Pond Sample LE524	Maximum Surface Water Concentration 01-Pond-Outfall Sample LE619	Maximum Surface Water Concentration 01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
Beryllium	nd	0.1	0.048J	0.98	1.1
Cadmium	0.24J	nd	nd	0.34	156 *
Chromium	7.9	3.3J	2.4J	7.1J	171 *
Cobalt	1.1J	1.1J	0.55J	2.7J	6.6
Copper	4.1J	5.3 *	9.6 *	6.4	16,700 *
Lead	3.1J *	0.93	0.95	12.1	1,580 *
Manganese	26.4	24.2	13.8	121	711 *
Mercury	0.21J	0.89 *	0.3J	0.32J *	7.1 *
Nickel	4.1J	3.5	2.6	4J	112 *
Selenium	nd	0.4J	0.37J	0.19J	4.7 *
Silver	nd	nd	nd	Nd	5.8 *
Thallium	nd	nd	nd	Nd	15.2 *
Vanadium	6.1J	3.8J	3.9J	14.4	60.9 *
Zinc	20.8	15.3	19.3	19.6	29,100 *
Dioxins (ng/kg)					
2,3,7,8-TCDD TEQ (Mammal)	NA	NA	NA	NA	23.7
2,3,7,8-TCDD TEQ (Bird)	NA	NA	NA	NA	39.3

Notes:
* = detected concentration exceeds screening value
µg/kg = micrograms per kilogram on a dry-weight basis
µg/L = micrograms per liter
bgs = below ground surface
COPC = chemicals of potential concern
J = indicates an estimated value
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg = milligrams per kilogram on a dry-weight basis
mg/L = milligrams per liter
NA = not analyzed
nd = not detected
ng/kg = nanograms per kilogram on a dry-weight basis
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient
This table lists analytes detected in soil from 0 feet to 6 feet bgs. The table does not include analytes detected at depths greater than 6 feet bgs in soil.

A comparison of maximum detected chemical concentrations in three surface water samples to ecological screening values for aquatic life is presented in Attachment H 6-1 of Appendix H. In the first surface water sample (LE524), four metals (including iron, a nutrient mineral not considered a COPC) were present at concentrations that exceeded their screening values. Five metals (including iron) exceeded their screening values in the second Ephemeral Pond surface water sample (LE619), and three of the same metals exceeded their screening values in the runoff water from the Ephemeral Pond (LE622). None of the organics in the chemical suite was present at concentrations that exceeded their screening levels. Table 7-1 lists all chemicals detected in the IRP Site 1 Ephemeral Pond surface water. Chemicals that exceed their screening values are indicated by asterisks.

7.2.2.2 SEDIMENT

An initial surface soil/sediment screen compared the maximum RLs for the soil collected in the Ephemeral Pond (when it was dry) in the northern portion of the Northern EOD Training Range to selected sediment screening values to assess if there were any undetected COPCs with RLs above screening concentrations. The following seven COPCs in the Ephemeral Pond soil had maximum RLs that were higher than their respective sediment screening values: bis(2-Ethylhexyl)phthalate, 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, HMX, RDX, and antimony (refer to Attachment H 6-2, Appendix H).

A comparison of maximum detected chemical concentrations in the Ephemeral Pond soil to ecological screening values for benthic organisms is presented in Attachment H 6-2 of Appendix H. Only one chemical (mercury) exceeded its screening value and is considered a COPC in the ecological SRA (see Table 7-1).

7.2.2.3 SURFACE SOIL

Exposure By Direct Contact With Surface Soil. An initial soil screen compared the maximum RLs to EPA Eco SSLs (EPA 2005b) or Oak Ridge National Laboratory (ORNL) values for lower trophic level species to assess if there were any COPCs with RLs above screening concentrations. Twenty five COPCs in surface soil had maximum RLs that were higher than their respective ecological screening values (refer to Attachment H 6-3, Appendix H). These 25 chemicals were retained as COPCs for further consideration in Tier 2.

A comparison of maximum detected chemical concentrations in surface soil to ecological screening values for direct contact by plants and soil invertebrates is presented in Attachment H 6-4 of Appendix H. Surface soil chemicals with maximum concentrations that exceed screening values are indicated in bold type and are considered COPCs in the ecological SRA. Other chemicals may have been detected at depths greater than 6 feet bgs at IRP Site 1; however, chemicals detected at depths greater than 6 feet bgs were not included in the ecological SRA.

Exposure By Ingestion of Surface Soil and Potentially Contaminated Food. The HQ results of risk calculations based on food chain exposure and conservative exposure assumptions for surface soil COPCs are presented in Attachment H-7 of Appendix H.

The HQs for acetone, ethylbenzene, toluene, total xylenes, 2-methylnaphthalene, BEPH, di-n-butylphthalate, hexaclorobenzene, naphthalene, n-nitrosodiphenylamine, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2 amino-4,6 dinitrotoluene, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), RDX, perchlorate, aluminum, antimony, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc, and total 2,3,7,8-TCDD (mammal) and (bird) are 1 or greater, with respect to specific receptors, which indicates a potential for adverse effects to terrestrial ecological receptors.

7.2.3 Risk Characterization

The following subsections describe the risk characterization for sediment, surface water, and surface soil.

7.2.3.1 SURFACE WATER

The results of the Tier 1, Step 2 surface water screening indicate that several metals may pose risks to aquatic life receptors. Surface water was first sampled on 4 January 2005, soon after a heavy and persistent rainfall event. The main focus of the risk assessment for the Ephemeral Pond was the endangered fairy shrimp species (Riverside fairy shrimp) and risks posed by exposures to chemicals that partition from the sediment to the water column. Because the rains persisted and the Ephemeral Pond filled to discharge capacity, the second round of samples was not collected until over seven weeks later (27 February 2005) at which time most chemical partitioning should have taken place.

In the first Ephemeral Pond sample, aluminum, barium, and lead were present at concentrations that potentially pose risks to aquatic life. In the second Ephemeral Pond sample, aluminum, barium, copper, and mercury exceeded aquatic life criteria (refer to Attachment H 6-1, Appendix H).

The Ephemeral Stream runoff sample was collected approximately 2,000 feet downgradient from the Ephemeral Pond. Because the runoff water flowed over soil that had also been contaminated, it is not possible to ascertain how much of any constituent might have originated from chemical patitioning within the Ephemeral Pond. The sample results indicate that aluminum, barium, copper, and mercury exceeded aquatic life criteria.

7.2.3.2 SEDIMENT

The Ephemeral Pond sediment was evaluated to determine if chemicals are present at concentrations that might elicit effects to benthic organisms. The resting eggs (i.e., cysts) of Riverside fairy shrimp and other aquatic organisms that are able to withstand long periods of drought are resilient to most environmental stressors including chemicals. Therefore, while the resting eggs are in or on the dried Ephemeral Pond sediment during dry conditions, they are not thought to be subject to adverse effects from exposures to chemicals while in the cyst form.

The results of the Tier 1, Step 2 sediment screening indicate that only mercury poses potential risks to benthic organisms in the IRP Site 1 Ephemeral Pond. However, bis(2-Ethylhexyl)phthlate, 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, and antimony had at least one RL that exceeded their respective criteria, and thus contribute to uncertainty in the risk assessment (refer to Attachment H 6-2, Appendix H).

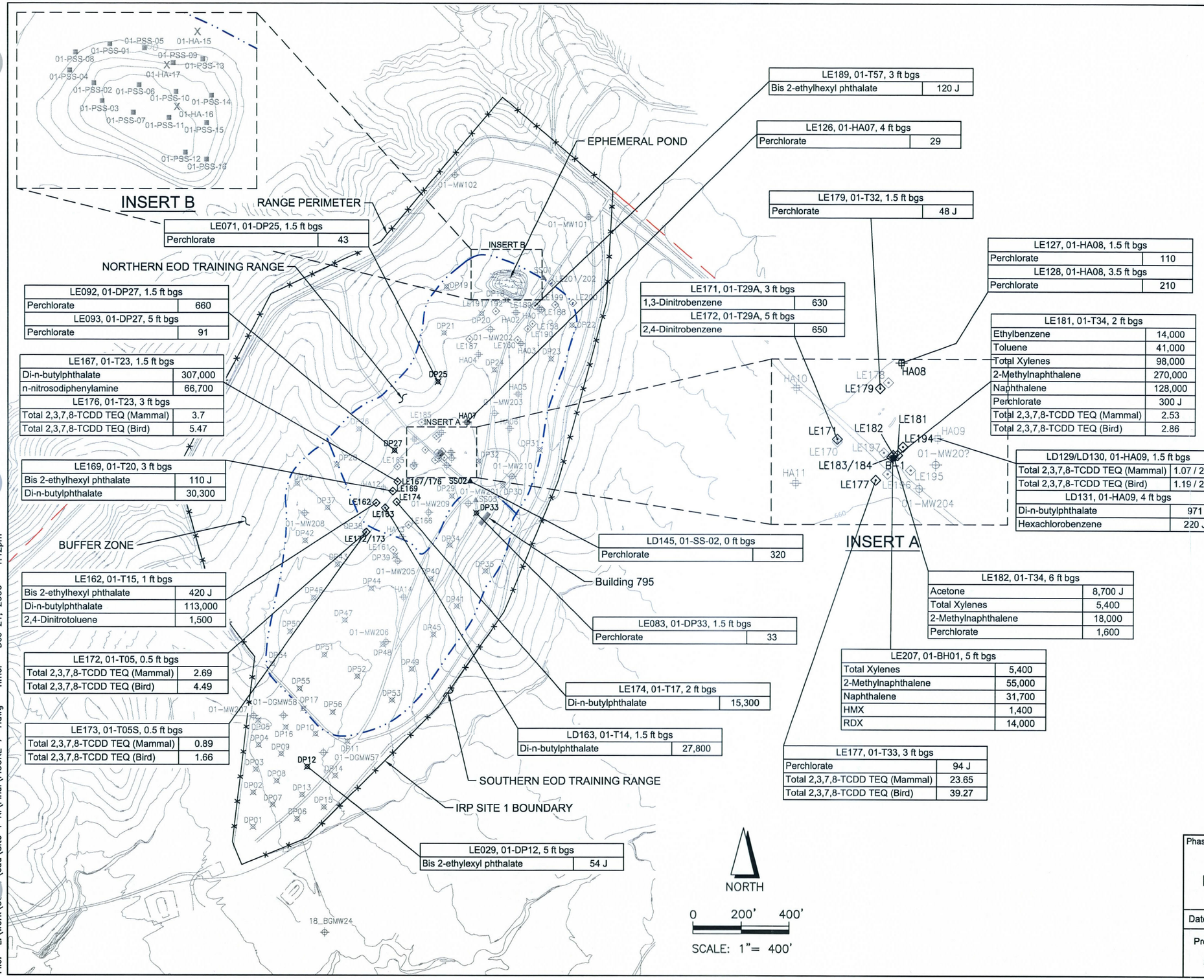
7.2.3.3 SURFACE SOIL

The results of the Tier 1, Step 2 risk calculations indicate that five VOCs (acetone, benzene, ethylbenzene, toluene, an xylenes), six SVOCs (2-methylnaphthalene, BEPH, di-n-butyl phthalate, hexachlorobenzene, naphthalene, and n-nitrosodiphenylamine), six explosives residues (1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6-trinintrotoluene, 2-amino,4,6 dinitrotoluene, HMX, and RDX), 16 metals (aluminum, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc), perchlorate, and dioxins in the surface soil at IRP Site 1 may cause adverse effects to terrestrial ecological receptors (Table 7-2). The concentrations of those risk drivers in surface soil that exceeded Tier 1 ecological screening values were examined to determine their spatial distribution at IRP Site 1. The results of that evaluation are shown on Figure 7-1.

7.2.4 Tier 1, Step 2 Exit Criteria

In the second surface water sample from the IRP Site 1 Ephemeral Pond, four metals (aluminum, barium, copper, and mercury) exceeded screening values for aquatic life receptors (Table 7-2). Also, two VOCs (cis-1,3-dichloropropene and total xylenes), two PAHs (benzo(a)anthracene and benzo(a)pyrene), and one metal (cadmium) had RLs that exceeded their respective screening criteria (Table 7-3), which may lead to an underestimation of risks due to potential exposures to these chemicals (refer to Attachment H 6-1, Appendix H).

For the IRP Site 1 Ephemeral Pond sediment, the mercury concentration exceeded its screening value for benthic receptors (Table 7-2). In addition, one SVOC (bis 2-ethylhexyl phthalate), five explosives residues (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine), and one metal (antimony) had RLs that exceeded their respective screening criteria (Table 7-3), which may lead to an underestimation of risks due to potential exposures to these chemicals (refer to Attachment H 6-2, Appendix H).



LE071, 01-DP25, 1.5 ft bgs	
Perchlorate	43

LE092, 01-DP27, 1.5 ft bgs	
Perchlorate	660
LE093, 01-DP27, 5 ft bgs	
Perchlorate	91

LE167, 01-T23, 1.5 ft bgs	
Di-n-butylphthalate	307,000
n-nitrosodiphenylamine	66,700
LE176, 01-T23, 3 ft bgs	
Total 2,3,7,8-TCDD TEQ (Mammal)	3.7
Total 2,3,7,8-TCDD TEQ (Bird)	5.47

LE169, 01-T20, 3 ft bgs	
Bis 2-ethylhexyl phthalate	110 J
Di-n-butylphthalate	30,300

LE162, 01-T15, 1 ft bgs	
Bis 2-ethylhexyl phthalate	420 J
Di-n-butylphthalate	113,000
2,4-Dinitrotoluene	1,500

LE172, 01-T05, 0.5 ft bgs	
Total 2,3,7,8-TCDD TEQ (Mammal)	2.69
Total 2,3,7,8-TCDD TEQ (Bird)	4.49

LE173, 01-T05S, 0.5 ft bgs	
Total 2,3,7,8-TCDD TEQ (Mammal)	0.89
Total 2,3,7,8-TCDD TEQ (Bird)	1.66

LE029, 01-DP12, 5 ft bgs	
Bis 2-ethylexyl phthalate	54 J

LE189, 01-T57, 3 ft bgs	
Bis 2-ethylhexyl phthalate	120 J

LE126, 01-HA07, 4 ft bgs	
Perchlorate	29

LE179, 01-T32, 1.5 ft bgs	
Perchlorate	48 J

LE171, 01-T29A, 3 ft bgs	
1,3-Dinitrobenzene	630
LE172, 01-T29A, 5 ft bgs	
2,4-Dinitrobenzene	650

LE127, 01-HA08, 1.5 ft bgs	
Perchlorate	110
LE128, 01-HA08, 3.5 ft bgs	
Perchlorate	210

LE181, 01-T34, 2 ft bgs	
Ethylbenzene	14,000
Toluene	41,000
Total Xylenes	98,000
2-Methylnaphthalene	270,000
Naphthalene	128,000
Perchlorate	300 J
Total 2,3,7,8-TCDD TEQ (Mammal)	2.53
Total 2,3,7,8-TCDD TEQ (Bird)	2.86

LD129/LD130, 01-HA09, 1.5 ft bgs	
Total 2,3,7,8-TCDD TEQ (Mammal)	1.07 / 2.22
Total 2,3,7,8-TCDD TEQ (Bird)	1.19 / 2.64
LD131, 01-HA09, 4 ft bgs	
Di-n-butylphthalate	971
Hexachlorobenzene	220 J

LD145, 01-SS-02, 0 ft bgs	
Perchlorate	320

LE083, 01-DP33, 1.5 ft bgs	
Perchlorate	33

LE174, 01-T17, 2 ft bgs	
Di-n-butylphthalate	15,300

LD163, 01-T14, 1.5 ft bgs	
Di-n-butylphthalate	27,800

LE182, 01-T34, 6 ft bgs	
Acetone	8,700 J
Total Xylenes	5,400
2-Methylnaphthalene	18,000
Perchlorate	1,600

LE207, 01-BH01, 5 ft bgs	
Total Xylenes	5,400
2-Methylnaphthalene	55,000
Naphthalene	31,700
HMX	1,400
RDX	14,000

LE177, 01-T33, 3 ft bgs	
Perchlorate	94 J
Total 2,3,7,8-TCDD TEQ (Mammal)	23.65
Total 2,3,7,8-TCDD TEQ (Bird)	39.27

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- DP16 DIRECT-PUSH SAMPLING LOCATION
- HA12 HAND AUGER SAMPLING LOCATION
- 01-HA-15 HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- 01-PSS-08 SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 SURFACE SOIL SAMPLING LOCATION
- B-1 DEEP SOIL BORING
- LE158 SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE

SAMPLE ID LOCATION DEPTH

LE179, 01-T32, 1.5 ft bgs	
Perchlorate	48 J

NOTES:

- µg/kg MICROGRAMS PER KILOGRAM
- ng/kg NANOGRAMS PER KILOGRAM
- bgs BELOW GROUND SURFACE
- ft FEET
- J VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
- MCAS MARINE CORPS AIR STATION
- MEC MUNITIONS AND EXPLOSIVES OF CONCERN
- TCDD TEQ TETRACHLORODIBENZODIOXIN TOXICITY EQUIVALENCY QUOTIENT

UNITS SHOWN ARE mg/kg EXCEPT FOR THE Total 2,3,7,8-TCDD TEQ WHICH IS IN UNITS OF ng/kg

METALS EXCEEDENCES ARE NOT SHOWN ON THIS FIGURE

Phase II Remedial Investigation — Final

Chemical Concentrations in Soil Samples Exceeding Tier 1 Ecological Screening Values

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	7-1

File: L:\work\...\cad\Site 1 RI\Final\FIGURE 7-1.dwg Time: Dec 21, 2006 - 1:42pm

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Table 7-2: Summary of Hazard Quotient Values Equal to or Greater Than 1 for Ecological Receptors After Tier 1, Step 2 Screening

	COPCs with Hazard Quotient Values Equal to or Greater than 1					
	Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors	
COPC	01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Concentration	Lower Trophic Level	Higher Trophic Level
VOCs						
Acetone	-	-	-	DG	DG	x
Benzene	-	-	-	DG	x	-
Ethylbenzene	-	-	-	DG	x	x
Toluene	-	-	-	-	x	x
Xylenes, Total	-	-	-	DG	x	x
SVOCs						
2-Methylnaphthalene	DG	DG	DG	-	DG	x
BEPH	-	-	-	-	DG	x
Di-n-butyl Phthalate	-	-	-	DG	x	x
Hexachlorobenzene	DG	DG	DG	DG	DG	x
Naphthalene	-	-	-	-	x	x
n-nitrosodiphenylamine	DG	DG	DG	DG	x	x
Explosives Residues (also SVOCs)						
1,3-Dinitrobenzene	-	-	-	-	DG	x
2,4-Dinitrotoluene	DG	DG	DG	DG	DG	x
2,4,6-Trinitrotoluene	-	-	-	-	-	x
2 Amino-4,6 Dinitrotoluene	-	-	-	-	-	x
HMX	-	-	-	-	-	x
RDX	-	-	-	-	-	x
General Chemistry						
Perchlorate	DG	DG	DG	DG	DG	x
Metals						
Aluminum	x	x	x	DG	x	x
Antimony	-	-	-	-	x	x
Barium	x	x	x	-	x	x
Beryllium	-	-	-	DG	-	x
Cadmium	-	-	-	-	x	x
Chromium	-	-	-	-	x	x
Copper	-	x	x	-	x	x
Lead	x	-	-	-	x	x
Manganese	-	-	-	-	x	x
Mercury	-	x	-	x	x	x
Nickel	-	-	-	-	x	x
Selenium	-	-	-	-	x	x
Silver	-	-	-	-	x	x
Thallium	-	-	-	DG	x	x
Vanadium	-	-	-	DG	x	-
Zinc	-	-	-	-	x	x

Table 7-2: Summary of Hazard Quotient Values Equal to or Greater Than 1 for Ecological Receptors After Tier 1, Step 2 Screening

COPC	COPCs with Hazard Quotient Values Equal to or Greater than 1					
	Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors	
	01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Concentration	Lower Trophic Level	Higher Trophic Level
Dioxins						
Total 2,3,7,8-TCDD (Mammal)	NA	NA	NA	NA	DG	x
Total 2,3,7,8-TCDD (Bird)	NA	NA	NA	NA	DG	x

Notes:
- = HQ value did not exceed 1 for COPC
x = HQ is 1 or greater for noted COPC
BEPH = bis(2-ethylhexyl)phthalate
COPCs = chemicals of potential concern
DG = Data Gap. Screening criteria not available for this trophic level
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
NA = not analyzed
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzodioxin

Table 7-3: Chemicals with Maximum Reporting Limits Exceeding Screening Levels

Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors
01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
VOCs				
Carbon disulfide	Cis-1,3-Dichloropropene	Cis-1,3-Dichloropropene	-	Benznene
Cis-1,3-Dichloropropene	Total Xylenes	Total Xylenes	-	Ethylbenzene
Trans-1,3-Dichloropropene	-	-	-	Toluene
Total Xylenes	-	-	-	Total Xylenes
SVOCs				
4-Bromophenyl Phenyl Ether	-	-	Bis(2ethylhexyl) Phthalate	1,2,4-Trichlorobenzene
Bis(2ethylhexyl) Phthalate	-	-	-	1,4-Dichlorobenzene
Dibenzofuran	-	-	-	2,4,5-Trichlorophenol
Pentachlorophenol	-	-	-	2,4,6-Trichlorophenol
-	-	-	-	2,4-Dinitrophenol
-	-	-	-	4-Nitrophenol
-	-	-	-	Diethylphthalate
-	-	-	-	Hexachloro-cyclopentadiene
-	-	-	-	N-Nitroso-diphenylamine
-	-	-	-	Napthalene
-	-	-	-	Pentachlorophenol
-	-	-	-	Phenol
PAHs				
Anthracene	-	-	-	Acenaphthene
Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene	-	Fluorene
Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene	-	Flouranthene
Fluorene	-	-	-	-
Explosives Residues(also SVOCs)				
-	-	-	1,3,5-Trinitrobenzene	-
-	-	-	1,3-Dinitrobenzene	-
-	-	-	2,4,6-Trinitrotoluene	-
-	-	-	Hexahydro-1,3,5-Trinitro-1,3,5,-Triazine	-
-	-	-	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	-
Metals				
Beryllium	Cadmium	Cadmium	Antimony	Arsenic
Selenium	-	-	-	Cobalt
Silver	-	-	-	Selenium
-	-	-	-	Silver
-	-	-	-	Thallium
-	-	-	-	Mercury

Notes: HQ is 1 or greater for noted COPC; - = maximum reporting limit did not exceed screening level for trophic level
VOCs = volatile organic compounds; SVOCs = semivolatile organic compounds; PAHs= polycyclic aromatic hydrocarbons

Concentrations of four VOCs, three SVOCs, and 16 metals in surface soil exceed direct contact screening values for terrestrial ecological receptors at IRP Site 1 (Table 7-2 and Attachment H 6-4, Appendix H). Also, four VOCs, 12 SVOCs, three PAHs, and six metals had RLs that exceeded their respective screening values and could not be fully evaluated, so ecological risk may be underestimated for those (Table 7-3 and Attachment H 6-3, Appendix H). Therefore, the site fails the ecological SRA, and surface water, sediment, and soil pathways require further evaluation in a BERA.

7.2.5 Conclusions for the Screening Risk Assessment

Based on the results of the ecological SRA, all chemicals with maximum detected concentrations or RLs exceeding their respective screening values (Tables 7-2 and 7-3, respectively) were retained as COPCs for further evaluation inTier 2, Step 3a (BERA).

Tier 2, Step 3a involves the refinement of the more conservative exposure characteristics used in the SRA, including evaluation of the frequency of COPC detection, comparison of concentrations of inorganics in soil and sediment to background concentrations, use of 95 percent UCLs in place of maximum soil concentrations to represent exposure concentration, use of mean body weights and food ingestion rates for wildlife receptors, and re-estimation of risk using HQs.

7.3 BASELINE ECOLOGICAL RISK ASSESSMENT TIER 2, STEP 3A

The Tier 2, Step 3a assessment (BERA) uses the same representative species, exposure pathways, and toxicity reference values (TRVs), with refined exposure assumptions to more realistically estimate the potential risk to ecological receptors from COPCs that failed the conservative Tier 1 screening process. NOAEL-based TRVs are retained in this BERA because endangered birds may occasionally utilize part of the site for foraging, and NOAEL-based TRVs are protective at the individual level. However, use of NOAEL-based TRVs may overestimate risk to populations of non-endangered species.

The Tier 2 BERA follows a five-step process to evaluate ecological risks and to determine if site remediation is warranted from an ecological perspective. The five steps that make up Tier 2 (Steps 3 through 7) are consistent with and analogous to Steps 3 through 7 of the EPA Superfund process for ERA. The Tier 2 BERA includes two sets of decision criteria (Step 3a and Step 7) for exiting from or proceeding with the ERA process. This Tier 2, Step 3a is part of the problem formulation step of the BERA.

7.3.1 Tier 2, Step 3a

All chemicals detected in IRP Site 1 surface water, sediment, and surface soil (0 to 6 feet bgs), that had HQ values of 1 or greater for aquatic life, benthic organisms, or terrestrial ecological receptors, respectively, were retained for further evaluation in Tier 2, Step 3a of the BERA. Also, those chemicals whose maximum RL ranges were greater than their respective screening values and were not detected in any sample of that particular medium were also retained for discussion in Tier 2, Step 3a.

The HQ results of risk calculations for birds and mammals based on more realistic exposure assumptions for surface soil COPCs are presented in Attachment H-8 of Appendix H and summarized in Table 7-4.

Table 7-4: Tier 2, Step 3a, Hazard Quotient Values Equal 1 or Greater for Soil COPCs after Tier 2, Step 3a BERA Calculations Using NOAEL-based TRVs

COPC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Western Meadowlark	Loggerhead shrike
BTEX						
Total xylenes [1]	80	70	-	600	600	2
VOCs						
Acetone [1]	-	-	-	3	1	-
Explosives Residues						
1,3-Dinitrobenzene [1]	2	7	-	5	3	-
2,4-Dinitrotoluene	-	5	-	300	100	-
HMX [1]	-	4	-	9	3	-
RDX [1]	-	-	-	1	-	-
2,4,6-Trinitrotoluene [1]	-	-	-	6	3	-
2-Amino-4,6-Dinitrotoluene [1]	-	-	-	3	1	-
SVOCs						
2-Methylnaphthalene [1]	3	2	-		4	-
Naphthalene [1]	2	3	-	9	6	-
N-Nitrosodiphenylamine [1]	-	-	-	4	3	-
Bis (2-ethylhexyl)phthalate	-	-	-		5	-
Di-n-butylphthalate	-	-	-	10	40	-
General Chemistry						
Perchlorate	-	3	-	2	1	-
Metals						
Antimony [1]	400	200	2	300	2000	100
Beryllium	-	-	-	5	2	-
Cadmium	6	5	-	-	3	-
Copper	30	20	-	5	20	2
Lead	-	-	-	-	2	-
Mercury	-	-	-	1	2	-
Nickel	10	8	-	-	1	-
Selenium	5	5	-	-	1	-
Silver [1]	-	-	-	-	1	-
Thallium [1]	2	2		2	4	-
Zinc	3	10	-	3	7	-
Dioxins						
Total 2,3,7,8-TCDD (Mammal)[2]	5	2	-	NA	NA	NA
Total 2,3,7,8-TCDD (Bird)[2]	NA	NA	NA	-	-	-

Notes:

[1] EPC is maximum detected concentration, therefore, exposure and risk is overestimated

[2] TEQ value calculated based on TEFs for birds and mammals respectively.

- = HQ is less than 1 for this receptor

COPC = chemical of potential concern

NA = analyte is not a COPC in this medium

SVOCs = semivolatile organic compounds

2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzodioxin

The HQs for COPCs in surface soil; are greater than 1 for at least one receptor for: beryllium; cadmium; copper; lead;, mercury; nickel; selenium; zinc; acetone; total xylenes; 1,3-dinitrobenzene; 2,4-dinitrotoluene; HMX; RDX; 2,4,6-trinitrotoluene; 2-amino-4,6-dinitrotoluene; 2-methylnaphthalene; naphthalene; bis (2-ethyl hexyl)phthalate; di-n-butylphthalate; n-nitrosodinphenylamine; perchlorate; and 2,3,7,8-TCDD (mammal). All other soil COPCs reevaluated in Tier 2, Step 3a have HQ values less than 1 with respect to all receptors and were eliminated as ecological COPCs.

Nineteen organic chemicals and six metals were also carried through to Tier 2, Step 3a because their respective maximum reporting limit ranges exceeded their respective soil screening values for ecological risk, and potential risk could be underestimated. However, those COPCs that were not detected in surface soil at the site could not be further evaluated in Tier 2, Step 3a. Thus the potential risk to ecological receptors may be underestimated for these chemicals. All chemicals that were detected at least once were evaluated quantitatively, whether a reporting limit exceeded a screening value or not.

7.3.2 Background Screening

The background screening eliminates inorganic COPCs retained after Tier 2, Step 3a with HQs > 1, and that are detected at concentrations less than or equal to the soil background concentrations (95th quantile) (BNI 1996). No organic preliminary COPCs in any medium, regardless of whether or not they may occur naturally, were screened out by this method; all were retained for further screening. Background screening was used only for inorganic COPCs in soil by first comparing each COPC maximum concentration from site soil to background concentrations. Eight inorganic chemicals in surface soil (beryllium, cadmium, copper, lead, mercury, nickel, selenium, and zinc) have a maximum detected soil concentration that exceeds their respective background concentration at Former MCAS El Toro. The 95 percent UCL concentration for nickel does not exceed its background concentration at IRP Site 1 (Table 7-5).

Table 7-5: Comparison of Maximum and 95 Percent Upper Confidence Limit Chemical of Potential Concern Concentrations in Surface Soil to Background Concentrations – Inorganic Chemicals of Potential Concern Only

Metals	Maximum Detected Concentration (mg/kg)	95% UCL of the Mean (mg/kg)	Surface Soil Background Concentration* (mg/kg)	Maximum Detected Soil Concentration Exceeds Background?	95% UCL Concentration Exceeds Background?
Beryllium	1.1	1.1[1]	0.669	**Yes**	**Yes[1]**
Cadmium	156	9.158	2.35	**Yes**	**Yes**
Copper	16,700	862	15.3	**Yes**	**Yes**
Lead	1,580	93.3	15.1	**Yes**	**Yes**
Mercury	7.1	0.507	0.22	**Yes**	**Yes**
Nickel	112	12.5	15.3	**Yes**	No
Selenium	4.7	2.12	0.32	**Yes**	**Yes**
Zinc	29,100	1,555	77.9	**Yes**	**Yes**

Notes:
% = percent
mg/kg = milligrams per kilogram on a dry-weight basis
UCL = upper confidence limit
* BNI 1996. Final Technical Memorandum, Background and Reference Levels, Remedial Investigations. San Diego, California.

[1]The 95% UCL for beryllium (1.3) is greater than the maximum detected concentration. Therefore the value defaults to 1.1 and the comparison to the 95% UCL can not be made.

7.3.3 Tier 2 Uncertainties Analysis

Tier 2, Step 3a of the EPA and Navy ERA process is part of the first step in the Problem Formulation phase of the BERA. Exposure assumptions are modified to include scenarios that are less conservative and more closely match the exposure assumptions identified in the CSM. Uncertainties associated with these risk estimates are discussed below.

7.3.3.1 UNCERTAINTIES IN THE DEFINITION OF SURFACE SOIL

For ERA purposes, the California Department of Toxic Substances Control (DTSC) considers all chemicals found in soil from the surface to a depth of 6 feet to be COPCs. This is designed to protect burrowing mammals that may burrow to 6 feet.

Although burrowing mammals may incidentally ingest soil from a depth of 6 feet, the majority of exposure for mammals (and birds) is through diet. The soil invertebrates and plants that comprise the diet take up the bulk of any COPCs from the absorptive root zone of the soil (approximately 0 to 2 feet). Including COPCs from below 2 feet may over-estimate risk to wildlife, especially for those species that do not burrow below 2 feet. Tables 7-6 through 7-9 compare the HQ values obtained for four different exposure point assumptions for four representative species. HQ values for the 0 to 2 foot surface soil dataset are in general lower than those for the 0 to 6 foot surface soil dataset. It is evident that overall risk decreases when the effect of outliers is minimized by using mean concentrations to represent average exposure instead of 95 percent UCL (or maximum).

7.3.3.2 UNCERTAINTIES IN THE SPECIES FORAGING EXPOSURE

The site use factor (SUF) is used to adjust exposure estimates to account for the time a wildlife species spends foraging in the contaminated area as opposed to foraging in uncontaminated areas. For this risk assessment the entire site is assumed to be contaminated by COPCs at their exposure point concentrations. The Northern and Southern EOD Training Ranges cover approximately 33.5 acres. This is larger than the foraging area of all selected representative species (small foraging area was a criterion for species selection). Therefore, the SUF is 1 for all species in both Tier 1 and Tier 2 assessments. The highest concentrations of the risk drivers are in the central portion of the site, and encompass an area of approximately 0.75 acres; therefore, the exposure in the risk assessment is overestimated for the predators because they hunt over an area larger than 0.75 acres.

7.3.3.3 UNCERTAINTIES IN THE ESTIMATION OF SOIL EXPOSURE POINT CONCENTRATION

The EPC for each chemical should represent the level of a chemical in soil likely to be contacted by ecological receptors such as plants, soil invertebrates, birds, and mammals. In Tier 1 the maximum concentration is used as a conservative estimate. This is equivalent of assuming that the representative species at the site forages and lives only at the location where the maximum concentration of a chemical was detected during the sampling; or it assumes that the representative species exist and forage throughout the site and the average concentration is equal to the maximum detected concentration. These conditions are not representative of the way a species utilizes the site; therefore, the calculated HQs will overestimate risk.

For Tier 2 COPCs, the 95 percent UCL of the surface soil concentration is used to estimate the average exposure concentration across the site. The 95 percent UCL was calculated using EPA's ProUCL program (EPA 2001b) and represents an upper limit on the average concentration and is, thus, a conservative value. For large data sets, the mean is a good representative of the average

exposure point concentration because the sample mean is expected to approach the parametric mean (Central Limit Theorem: EPA 2000c; Singh et al. 1997).

Because the maximum concentrations of the majority of the risk drivers represent outliers, the 95 percent UCL and EPC are skewed upward and overestimate potential risk to wildlife. Tables 7-6 through 7-9 compare the HQ values obtained for four different exposure point assumptions for four representative species. It is evident that overall risk decreases when the effect of outliers is minimized by using mean concentrations to represent average exposure instead of 95 percent UCL (or maximum).

7.3.3.4 Uncertainties in the Toxicity Reference Values

This ERA uses NOAEL values from laboratory toxicity studies to estimate toxicity of COPCs to wildlife. This approach is protective of individual birds and mammals and is used in Tier 2 because a threatened species (California coastal gnatcatcher) is known to utilize the site. However, the gnatcatcher utilizes the Coastal Sage Scrub habitat found on the side slopes (Buffer Zone) of the site. The primary areas and highest levels of contamination are confined to the sparsely vegetated area now covering the former disposal trenches. The gnatcatchers are not expected to spend any significant time foraging in this habitat, and thus are not likely to be exposed to the risk drivers. Other representative species are likely to use the area, but they are not endangered. Protection of non-endangered species using NOAEL may be overprotective, because, although a few individuals may suffer adverse effects from exposure to COPCs, the species population can respond to fluctuations in mortality by changing natality (birth rates). LOAEL-based TRVs represent the lowest concentrations at which an adverse effect may be observed. At the LOAEL exposure level some adverse effects to individuals may occur, but not enough to be detrimental to the species population. Thus LOAEL-based TRVs may better represent the protective wildlife exposure levels for chemicals found in surface soil at EOD IRP Site 1. Perchlorate TRVs and physical/chemical characteristics are discussed in Attachment H-11 of Appendix H.

Bird TRVs for total xylenes and antimony are not available in the literature, so bird TRVs were developed from mammalian TRVs using an uncertainty factor of 10. This conservative approach assumes that birds are at least 10 times more sensitive to xylenes and antimony than mammals. However, birds may actually be less sensitive or have the same sensitivity to these chemicals, in which case risk to birds from exposure to antimony and xylenes would be overestimated.

Table 7-6 Summary of Risk Driver Hazard Quotient Values for Ornate Shrew Based On Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	**2**	9.15	**6**	1.17	<1	3.98	**3**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**4**	862	**30**	12.18	<1	45.4	**1**
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**7**	12.5	**10**	4.25	**5**	6.76	**8**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**3**	67.76	<1	213	<1
Perchlorate	0.0416	<1	0.087	<1	0.038	<1	0.66 *	**3**
Total 2,3,7,8-TCDD TEQ	0.00000289	<1	0.00000673	**5**	0.000000975	<1	0.0000027	**2**
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	<1	41	<1

Notes:
* maximum
[1] – not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
< = less than
COPC = chemical of potential concern
HQ = hazard quotient
mg/kg = milligrams per kilogram on a dry-weight basis
NA= not analyzed
UCL = upper confidence limit
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 7-7. Summary of Risk Driver Hazard Quotient Values for Deer Mouse Based On Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	1	9.15	**5**	1.17	<1	3.98	**2**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**2**	862	**20**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	NA	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**4**	12.5	**8**	4.25	**3**	6.76	**4**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**10**	67.76	<1	213	1
Perchlorate	0.0416	**2**	0.087	**3**	0.038	1	0.66 *	**20**
Total 2,3,7,8-TCDD TEQ	0.00000289	<1	0.00000673	**2**	0.000000975	<1	0.0000027	<1
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
Phenol	2.32	<1	1.2	<1	2.14	<1	NA	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	<1	41	<1

Notes:
* maximum
[1] – not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
< = less than
COPC = chemical of potential concern
HQ = hazard quotient
mg/kg = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 7-8. Summary of Risk Driver Hazard Quotient Values for Western Meadowlark Based On Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	1	1.1	**2**	0.4	<1	0.555	1
Cadmium	2.2	<1	9.15	**3**	1.17	<1	3.98	**1**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**3**	862	**20**	12.18	<1	45.4	1
Lead	21.98	<1	93.3	**2**	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	**2**	0.22	<1	0.86	**3**
Nickel	5.81	<1	12.5	1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	1	1,560	**7**	67.76	<1	213	<1
Perchlorate	0.0416	<1	0.087	**2**	0.038	<1	0.66 *	**7**
Total 2,3,7,8-TCDD TEQ	0.00000452	<1	0.0000128	<1	0.00000132	<1	0.0000045	<1
Toluene	0.29	<1	1.83	1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**10**	22.1	**40**	9.12	**20**	22.1	**40**
N-nitrosodiphenylamine	Not a COPC[1]		NA	NA	3.37	<1	66.7	**3**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	**2**	41	**40**

Notes:
* maximum
[1] – not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
< = less than
COPC = chemical of potential concern
HQ = hazard quotient
mg/kg = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 7-9. Summary of Risk Driver Hazard Quotient Values for Mourning Dove Based On Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	**2**	1.1	**5**	0.4	**2**	0.555	**2**
Cadmium	2.2	<1	9.15	<1	1.17	<1	3.98	<1
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	<1	862	**5**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	1	0.22	<1	0.86	**2**
Nickel	5.81	<1	12.5	<1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	<1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	<1	1560	**3**	67.76	<1	213	<1
Perchlorate	0.0416	1	0.087	**2**	0.038	1	0.66 *	**20**
Total 2,3,7,8-TCDD TEQ	0.00000452	<1	0.0000128	<1	0.00000132	<1	0.0000045	<1
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**4**	22.1	**10**	9.12	**4**	22.1	**10**
N-nitrosodiphenylamine	Not a COPC[1]		NA	NA	3.37	<1	66.7	**4**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	**5**	41	**90**

Notes:
* maximum
[1] – not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
< = less than
COPC = chemical of potential concern
HQ = hazard quotient
mg/kg = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Uncertainty in the Toxicity of Perchlorate Ion to Wildlife Receptors. The primary target of the perchlorate anion (perchlorate) in vertebrates such as birds and mammals is the thyroid gland. Perchlorate inhibits the transport of iodide (I) from the blood into the thyroid follicle cells. The inhibition is thought to be accomplished by perchlorate competitively blocking iodide binding to a barrier, or sodium/iodide symporter (NIS), which catalyzes the simultaneous transfer of Na^+ and I^- across the basolateral membrane of thyroid follicle cells. Perchlorate inhibition of the NIS can limit the availability of iodide needed for the production of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which in turn, may affect the circulating levels of T4 and T3. All toxic effects of perchlorate on the thyroid hormone system derive directly or secondarily from the inhibition of

the NIS. The competitive inhibition is completely reversible. If perchlorate exposure is removed, the perchlorate is lost from the thyroid and the blocking effect on the iodine binding site is lost (ATSDR, 2005).

A problem in ecological risk assessment is translating effects on the thyroid and circulating thyroid hormones into ecologically relevant endpoints such as survival, growth and reproduction. Measurable effects on thyroid function can be observed at relatively low levels of perchlorate in the blood. However, adverse effects on survival, growth or reproduction may not be measurable until perchlorate levels are much greater.

The ecotoxicologists for the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) have been reviewing the perchlorate toxicology literature to develop mammalian and avian toxicity reference values (TRV) for use in ecological risk assessments at Army sites (personal communication, Dr. Mark Johnson, Nov. 1, 2005). The following TRVs are based on their toxicity assessment presented in the draft USACHPPM document (USACHPPM, 2005) using ecologically relevant endpoints. External review of the Draft document has been completed (as of June 2006) and USACHPPM is anticipating to publish the Final report in the fall of 2006.

Table 7-10 presents the selected ingestion TRVs for mammals. A medium level of confidence has been given by USACHPPM to these TRVs because, though much data are available, there is considerable uncertainty regarding the relevance of thyroid structural and functional changes in wildlife" (USACHPPM, 2005).

Table 7-10. USACHPPM Ingestion TRVs for the Class Mammalia

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	0.64	Medium
LOAEL-based	6.4	Medium

Notes:
LOEAL = lowest-observed-adverse-effect-level
mg/kg/d = milligrams per kilogram per day
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

Table 7-11 presents the selected ingestion TRVs for birds. A medium level of confidence has been given by USACHPPM to these TRVs because these studies were of high quality, but lacking in regards to data from other species and lack of other developmental and reproductive data.

Table 7-11. USACHPPM Ingestion TRVs for the Class Aves

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	1.3	Medium
LOAEL-based	2.6	Medium

Notes:
LOEAL = lowest-observed-adverse-effect-level

mg/kg/d = milligrams per kilogram per day
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

If the reversible changes in thyroid metabolism and thyroxin production were to be considered ecologically relevant, EPA has proposed a NOAEL for mammalian herbivores of 0.001 mg/kg-day based on perturbations in thyroid and pituitary hormones, thyroid histopathology, and changes in brain morphometry in mice (EPA 2002). For birds, the Navy reviewed existing toxicity data for perchlorate exposure in birds. Based on studies by McNabb et al. (2004) of the effects of perchlorate ion on thyroid function in bobwhite quail chicks, the Navy proposed an alternative NOAEL TRV for birds of 0.00162 mg/kg-day. Table 7-12 presents the ranges of the modeled exposure for the four representative species and their calculated hazard quotients based on the USACHPPM wildlife TRVs and the thyroid function TRVs. The model calculations are presented in Attachment H 13-1.

The HQ values are approximately three orders of magnitude higher if reversible thyroid disruption is considered an endpoint directly related to maintenance of wildlife populations.

Table 7-12. *Comparison of Tier 2, Step3a, Chronic Daily Intake and Hazard Quotients for Perchlorate Exposure for Representative Wildlife at El Toro IRP Site 1*

Representative Species	Soil EPC [95% UCL] (mg/kg dw)	CDI Soil Ingestion (mg/kg-day)	CDI Plant Ingestion (mg/kg-day)	CDI Invertebrate Ingestion (mg/kg-day)	DCI Ingestion Sum (mg/kg-day)	NOAEL-based TRV (mg/kg-day)	Hazard Quotient
TRV Based on Survival, Growth and Reproduction Endpoints (USACHPPM, 2005)							
Deer Mouse	0.087	0.000177	2.05	0.00728	2.06	0.64	3
Ornate Shrew	0.087	0.00015	0.235	0.0157	0.25	0.64	0.4
Mourning Dove	0.087	0.000735	3.19	0	3.19	1.3	2
Western Meadowlark	0.087	0.000831	1.26	0.0077	1.27	1.3	1
TRV Based on Thyroid Disruption (Altered Thyroid Function) (EPA, 2002b for Mammals, McNabb et al., 2004 for Birds)							
Deer Mouse	0.087	0.000177	2.05	0.00728	2.06	0.00119	2000
Ornate Shrew	0.087	0.00015	0.235	0.0157	0.25	0.00128	200
Mourning Dove	0.087	0.000735	3.19	0	3.19	0.00162	2000
Western Meadowlark	0.087	0.000831	1.26	0.0077	1.27	0.00162	800

Notes:
% = percent
CDI = chronic daily intake
EPA = United States Environmental Protection Agency
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram on a dry weight basis per day
mg/kg dw = milligrams per kilogram on a dry weight basis
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value
UCL = upper confidence limit
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

7.3.4 Risk Characterization

7.3.4.1 SURFACE WATER

Potential risk to aquatic life in surface water at IRP Site 1 is indicated for several COPCs in surface water. Aluminum and barium have HQs of 1 or greater in the IRP Site 1 Ephemeral Pond water. Downgradient of the site, copper had an HQ of 1 in the discharge/runoff water.

7.3.4.2 SEDIMENT

The Tier 2, Step 3a risk calculations for sediment using the 95 percent UCL for the only COPC remaining from the SRA (mercury) resulted in an HQ of less than 1. Therefore, no COPCs remain for the sediment medium of the Ephemeral Pond.

7.3.4.3 SOIL

The following eight metals in surface soil have HQ values greater than 1 after the Tier 2, Step 3a risk calculations using NOAEL-based TRVs and ProUCL-suggested 95 percent UCL EPCs: beryllium, cadmium, copper, lead, mercury, nickel, selenium, and zinc. This indicates that they have the potential to cause adverse effects in terrestrial wildlife individuals at IRP Site 1. Di-n-butylphthalate, perchlorate and dioxins also have HQ values that exceed 1 after the Tier 2, Step 3a evaluation. Because the EPC is based on a highly skewed data set, the EPC is likely overestimated. Antimony, total xylenes, and 2,4-dinitrotoluene also have HQs that exceed 1, but the HQs are based on using maximum reported concentrations as the EPCs, which overestimates exposure and risk.

The risk from exposure to mercury in the soil is driven by high concentrations (3.6 and 10.6 [duplicate] mg/kg) found at sample location HA-09. The risk from exposure to cadmium, copper, lead, nickel, selenium, and zinc is driven by high concentrations found at a depth of 3 feet at sample locations 01-T23 and 01-T33. The highest concentration of di-n-butylphthalate was also detected at sample location 01-T23 (at 1.5 feet). Beryllium was found at its maximum concentration at a depth of 5 feet at sample location 01-DP23.The highest perchlorate concentration was identified at a depth of 6 feet at sample location T-34.

For 2,3,7,8-TCDD TEQ (mammal), the BERA risk calculations for the ornate shrew (HQ=5) and the deer mouse (HQ=2) are based on NOAEL-based TRVs. Since no endangered mammals are known from the area, a LOAEL-based TRV can be used to estimate a low-effect HQ to assess risk at the population level.

The bioavailability of dioxins in soil may also be overestimated. Large organic molecules, such as dioxins/furans, bind tightly with organic matter found in natural soil and may not be generally bioavailable. This may result in an over estimation of risk from dioxin exposure.

Also, the BERA risk calculations of dioxins for the ornate shrew (HQ=5) and the deer mouse (HQ=2) are based on the ProUCL-recommended 95 percent UCL (0.00000673 mg/kg) soil concentration. This value is driven by elevated concentrations detected in two out of 11 surface soil samples analyzed for dioxins, at Phase II RI Tier II trench locations 01-T23 and 01-T33, located at a depth of 3 feet.

For small mammals, copper, nickel, and zinc HQ values equaled or exceeded 10 using NOAEL-based TRVs. For birds, copper, and di-n-butylphthalate HQ values equaled or exceeded 10 using NOAEL-based TRVs. The chronic daily intake of these soil chemicals may cause unacceptable adverse effects to individual birds and mammals.

7.3.4.4 ASSESSMENT OF NON-THREATENED OR NON-ENDANGERED BIRD AND MAMMAL POPULATIONS

The threatened California coastal gnatcatcher is specialized to forage in the CSS habitat. Typically, gnatcatchers glean insects and arthropods from the CSS vegetation are generally not ground feeders. The Federally regionally sensitive cactus wren forages in a similar fashion in the CSS. As a result, Coastal California gnatcatchers are not likely to be exposed to IRP Site 1 COPCs in normal feeding activities and LOAEL-based TRVs are more appropriate to assess the threat to non-threatened or endangered bird and mammal populations. Attachments H 5-5 through H 5-7 present the LOAEL-

based bird and mammal TRVs for all soil COPCs in Appendix H Tables 3-4 to 3-7 with HQ values exceeding 1. The potential risk (i.e., HQ) to wildlife from the Tier 2 COPCs was recalculated using LOAEL-based TRVs and 95 percent UCL EPCs estimated using the ProUCL software. Attachments H 8-7 through H 8-10 present exposure calculations and HQ values for those assessment endpoints and COPCs with NOAEL-based HQ values that exceed 1 in Appendix H Tables 3-4 to 3-7. Table 7-13 summarizes the final HQ values using the 95 percent UCL EPCs and LOAEL-based TRVs.

Table 7-13. Final HQ Values for Site 1 Using LOAEL-based TRVs for Protection of Representative Wildlife Populations

Chemical	95 Percent UCL (mg/kg)	Ornate Shrew HQ	Deer Mouse HQ	Western Meadowlark HQ	Mourning Dove HQ	Loggerhead Shrike HQ
2,3,7,8-TCDD TEQ - Mammal	0.00000673	<1	<1	NA	NA	NA
2,3,7,8-TCDD TEQ - Bird	0.0000128	NA	NA	<1	<1	<1
Total xylenes	98 (max)	**8**	**7**	**50**	**30**	<1
Antimony	130 (max)	**30**	**20**	**100**	**10**	<1
Beryllium	1.30	<1	<1	<1	<1	<1
Cadmium	9.16	<1	<1	<1	<1	<1
Copper	862	**3**	**2**	**2**	<1	<1
Mercury	0.507	<1	<1	<1	<1	<1
Nickel	12.5	1	<1	<1	<1	<1
Perchlorate	0.0876	<1	<1	<1	<1	<1
Selenium	2.12	<1	<1	<1	<1	<1
Zinc	1,560	<1	1	<1	<1	<1
2,4-Dinitrotoluene	7	<1	<1	**8**	**10**	<1
Di-n-butylphthalate	22	<1	<1	**3**	1	<1

Notes:
Bold indicates HQ greater than 1
NA = not applicable
UCL= upper confidence limit
mg/kg= milligrams per kilogram
HQ= hazard quotient
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

The potential risk (i.e., HQ) to the representative wildlife receptors were recalculated using LOAEL-based TRVs and reasonable maximum EPCs (the lesser of the 95 percent UCL of the mean, estimated using the ProUCL software; or the maximum concentration). Tier 2 HQs for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples for calculation of a 95 percent UCL): HQs for copper ranged from 2 to 3; and HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPCs are overestimated, and thus the HQs are overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected in fewer than 5 percent of samples using their maximum detected concentrations because there were fewer than 10 detections for these chemicals. Only three of these COPCs had HQs greater than 1; HQs for antimony ranged from 10 to 100; HQs for total xylenes ranged from 7 to 50; and HQs for 2,4-dinitrotoluene ranged from 8 to 10. The elevated HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. The HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. The HQs for 2,4-dinitrotoluene were driven by the

maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. The HQs for these three COPCs represent the exposure at the locations of the maximum detection only, and overestimates the average exposure across the site and thus the risk to receptors across the entire site. Because of their low frequency of detection and limited distribution, exposure of wildlife to these three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

Because of the overestimation of bioaccumulation of phthalates in the food chain, the risk from exposure to di-n-butyl phthalate is expected to be acceptable.

7.3.4.5 Distribution of Tier 2 HQ Exceedances Across IRP Site 1

Figure 7-2 shows the distribution of chemicals with concentrations that exceed Tier 2 LOAEL-based soil screening values (Tier 2 HQ exceeds 1) (see calculation of soil concentrations with an HQ equal to 1 in Attachment H-12). The exceedances are centered around the former disposal trenches (T14, T15, T17, T20, T23, T33, and T34). This area does not include the CSS habitat that is found on the sloped hillsides of the bowl-shaped IRP Site 1 (Figure 7-2). Although concentrations of several individual metals may exceed a LOAEL-based screening HQ of 1 in the central part of the site, the risk calculation is based on the EPC across the entire site represented by the 95 percent UCL and not on the exposure at these individual locations.

7.3.5 Conclusions of Tier 2, Step 3a Baseline Ecological Risk Assessment Process

Although potential risk to aquatic life in surface water at IRP Site 1 is indicated for two COPCs (aluminum and barium) in surface water within the Ephemeral Pond, concentrations of these COPCs are not at levels that are likely to cause adverse effects to the ephemeral aquatic community present. The aquatic life criteria that were used in the ecological SRA and BERA comparisons are for all aquatic life and are extremely conservative in nature. Given that ephemeral habitat species are well-adapted to environmental extremes, and that a seemingly viable and reproducing aquatic community (including Riverside fairy shrimp) existed in the Ephemeral Pond during the sampling period, the conclusion must be made that aluminum and barium do not pose risks to these aquatic life receptors in the IRP Site 1 Ephemeral Pond.

Exposure to chemicals in sediment at the IRP Site 1 Ephemeral Pond does not present a significant threat of adverse effects to benthic receptors (based on refined exposure assumptions for sediment).

The potential risk (i.e., HQ) to the representative wildlife receptors for exposure to chemicals in surface soil at IRP Site 1 was recalculated using LOAEL-based TRVs and reasonable maximum EPCs. Tier 2 HQs for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site: HQs for copper ranged from 2 to 3; and HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPCs are overestimated, and thus the HQs are overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs in surface soil that were detected in less than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only three of these COPCs had HQs greater than 1: HQs for antimony ranged from 10 to 100; HQs for total xylenes ranged from 7 to 50; and HQs for 2,4-dinitrotoluene ranged from 8 to 10. The HQs for these three COPCs represent the exposure at the locations of the maximum detection only, and overestimate the average exposure and thus the risk to receptors across the entire site. Because of their low frequency of detection and limited distribution, exposure of wildlife to these three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

The results of the ecological SRA and BERA evaluation suggest that chemicals reported in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individual plant and invertebrates, if colocated with the maximum reported detections of some chemicals, may suffer from adverse effects.

7.4 SUMMARY AND CONCLUSIONS

This ERA was conducted in order to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. Soil, sediment, and surface water samples were collected and analyzed for VOCs, SVOCs, hydrocarbons, explosives residues, perchlorate, general dioxins, and metals.

7.4.1 Tier 1

Tier 1 (ecological SRA), Step 1 included a habitat assessment, contaminant identification, receptor and pathway identification, and toxicity evaluation. Tier 1, Step 2 included exposure estimation based on conservative assumptions. Risk was then estimated by comparing the media-specific exposure point concentrations to conservative, screening-level, media-specific screening values.

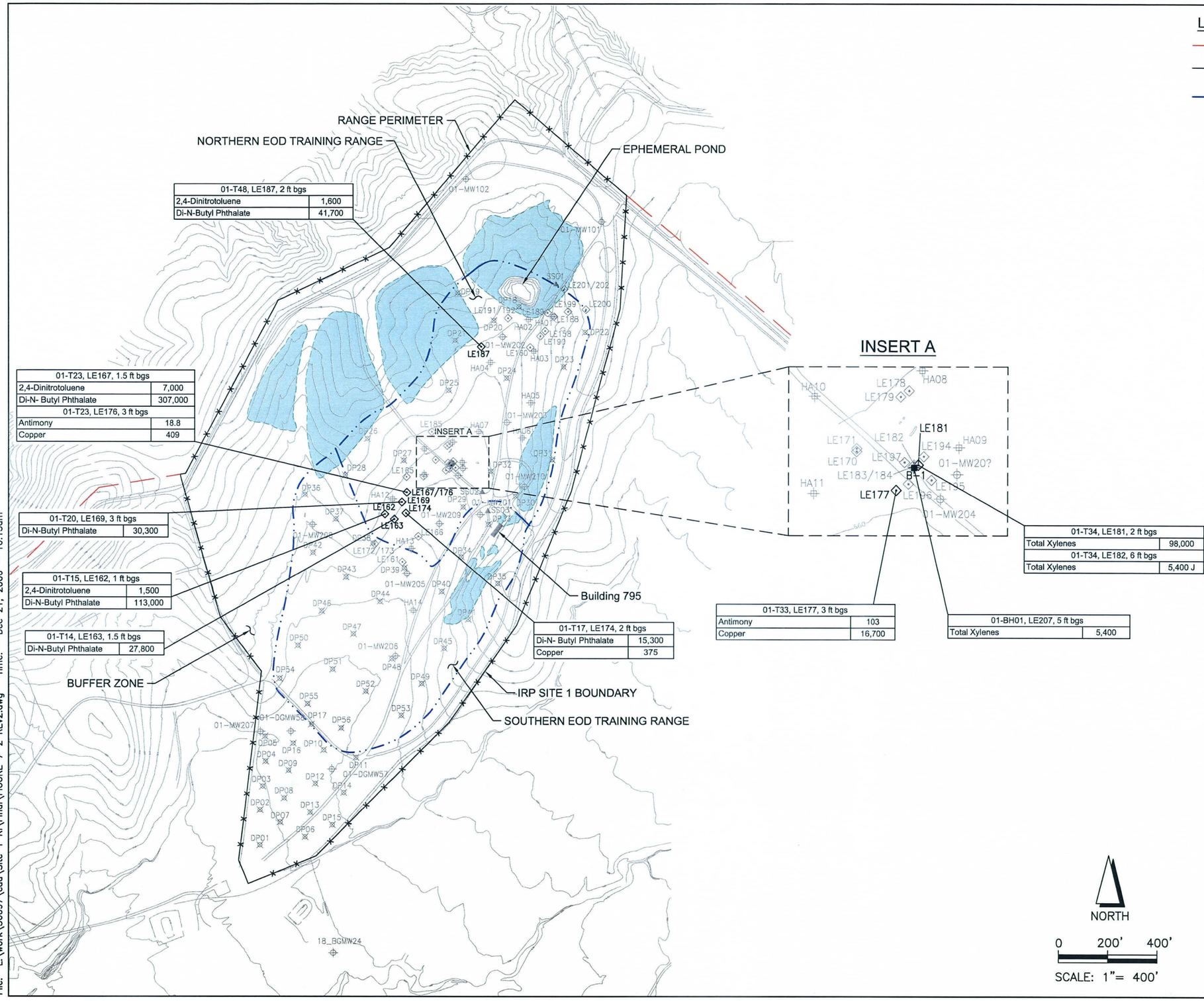
The results of the Tier 1 assessment for surface water indicated that four metals (aluminum, barium, copper and mercury) exceeded screening values for aquatic life receptors. The results of the Tier 1 assessment for Ephemeral Pond chemistry, sediment indicated that mercury exceeded its screening value for benthic receptors. The concentrations of four VOCs, three SVOCs, and 16 metals in surface soil exceeded the Tier 1 screening values for direct contact for terrestrial ecological receptors. Therefore, the site failed the ecological SRA, and surface water, sediment, and soil pathways required further evaluation in a BERA.

7.4.2 Tier 2

Tier 2 (BERA), Step 3a used the same representative species, exposure pathways, and TRVs, with refined exposure assumptions to more realistically estimate the potential risk to ecological receptors from COPCs that failed the conservative Tier 1 screening process.

The potential risk (i.e., HQ) to the representative wildlife receptors for exposure to chemicals in surface soil at IRP Site 1 were recalculated using LOAEL-based TRVs and reasonable maximum EPCs. Tier 2 HQs for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site. HQs for copper ranged from 2 to 3, and HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPCs are overestimated, and thus the HQs are overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected in fewer than 5 percent of samples using maximum detected concentrations because there were fewer than 10 detections for these chemicals. Only three of these COPCs had HQs greater than 1: HQs for antimony ranged from 10 to 100; HQs for total xylenes ranged from 7 to 50; and HQs for 2,4-dinitrotoluene ranged from 8 to 10. The HQs calculated for the 3 COPCs represent the exposure at the locations of the maximum detection only and overestimates the average exposure and thus the risk to receptors across the entire site. Because of their low frequency of detection and limited distribution, exposure of wildlife to the three COPCs are not likely to adversely effect wildlife populations at IRP Site 1.



01-T48, LE187, 2 ft bgs	
2,4-Dinitrotoluene	1,600
Di-N-Butyl Phthalate	41,700

01-T23, LE167, 1.5 ft bgs	
2,4-Dinitrotoluene	7,000
Di-N- Butyl Phthalate	307,000
01-T23, LE176, 3 ft bgs	
Antimony	18.8
Copper	409

01-T20, LE169, 3 ft bgs	
Di-N-Butyl Phthalate	30,300

01-T15, LE162, 1 ft bgs	
2,4-Dinitrotoluene	1,500
Di-N-Butyl Phthalate	113,000

01-T14, LE163, 1.5 ft bgs	
Di-N-Butyl Phthalate	27,800

01-T17, LE174, 2 ft bgs	
Di-N- Butyl Phthalate	15,300
Copper	375

01-T33, LE177, 3 ft bgs	
Antimony	103
Copper	16,700

01-BH01, LE207, 5 ft bgs	
Total Xylenes	5,400

01-T34, LE181, 2 ft bgs	
Total Xylenes	98,000
01-T34, LE182, 6 ft bgs	
Total Xylenes	5,400 J

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 — GROUNDWATER MONITORING WELL
- DP16 — DIRECT-PUSH SAMPLING LOCATION
- HA12 — HAND AUGER SAMPLING LOCATION
- 01-HA-15 — HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- 01-PSS-08 — SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 — SURFACE SOIL SAMPLING LOCATION
- B-1 — DEEP SOIL BORING
- LE158 — SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE
- LOCATION OF COASTAL SAGE SCRUB BASED ON HABITAT ASSESSMENT AT IRP SITE 1 CONDUCTED IN DECEMBER 2000 BY LINCER AND ASSOCIATES

SAMPLE ID — LOCATION — DEPTH

01-T20, LE169, 3 ft bgs	
Di-N-Butyl Phthalate	30,300

NOTES:

µg/kg	MICROGRAMS PER KILOGRAM
mg/kg	MILLIGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
ft	FEET
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN

UNITS SHOWN ARE µg/kg FOR ORGANIC COMPOUNDS.

ALL METALS CONCENTRATIONS ARE IN UNITS OF mg/kg.

THIS MAP SHOWS LOCATIONS OF INDIVIDUAL CHEMICAL CONCENTRATIONS THAT EXCEED A VALUE EQUIVALENT TO AN HQ OF 1 USING LOAEL-BASED TRVs IN TIER 2 OF THE ECOLOGICAL RISK ASSESMENT. THEY REPRESENT THE FEW SAMPLES OF MORE THAN 140 SAMPLES THAT EXCEED THE SCREENING VALUES. THE RISK CALCULATION IS BASED ON THE EXPOSURE POINT CONCENTRATION (EPC) ACROSS THE ENTIRE SITE REPRESENTED BY THE 95 PERCENT UCL AND NOT EXPOSURE AT THESE INDIVIDUAL LOCATIONS.

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Chemical Concentrations in Soil Samples Exceeding Tier 2 LOAEL Ecological Screening Values

IRP Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	7-2

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE 7-2 REV2.dwg Time: Dec 21, 2006 – 10:13am

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7.4.3 Conclusions

The results of the Tier 2 assessment indicated that COPCs reported in surface water and sediment in the Ephemeral Pond are not likely to cause adverse effects to the ephemeral aquatic and benthic community present, thus no further evaluation is necessary to protect aquatic or benthic ecological receptors at Site 1.

The results of the ecological SRA and BERA evaluation suggest that COPCs reported in soil are not likely to adversely effect wildlife populations at IRP Site 1; although some individual plant and invertebrates, if present where the maximum reported concentrations are located, may suffer from adverse effects. No further evaluation is necessary to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1.

8. Munitions and Explosives of Concern Risk Assessment

The explosives safety risk at IRP Site 1 has been evaluated in accordance with the interim R3M Guidance (DoD 2000). Explosives safety risks are presented in qualitative terms using a scale that ranges from A (lower risk) to E (higher risk). The estimation methods have been developed primarily to characterize risks to individual human receptors. The MEC risk has been evaluated for each of the four areas investigated: Northern EOD Training Range, Southern EOD Training Range, Buffer Zone, and Range Perimeter. Each area was evaluated using the following three risk factors: Accessibility Assessment, Overall Hazard Assessment, and Exposure Assessment. For purposes of this risk evaluation, it is assumed (based on the assumption of a Federal agency-to-Federal agency transfer of IRP Site 1 to the FBI) that the overall land use within the four areas of IRP Site 1 will remain consistent with past EOD training activities. For a summary of risks presented below, see Table 8-1.

8.1 Northern Explosive Ordnance Disposal Training Range

The Northern EOD Training Range was the site for the majority of former EOD training activities, as evidenced by the magnitude of MEC-related materials, establishment of permanent/semi-permanent demolition infrastructure (e.g., subsurface firing wire, viewing stands with sighting scopes, and obvious demolition pits), and the confirmation of MEC in this area. Other evidence found included burial pits possibly used in training activities.

Accessibility Assessment. Based on best professional judgment, migration of MEC is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of MEC that may be buried at shallow depths. The level of activity, based on anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool is 5 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Hazard Assessment. Four MEC items (one of which contained a mass explosion compound) were recovered in the Northern EOD Training Range during the field investigation: one 4-inch-long flex-linear shaped charge, two 40mm cartridge casings with primer, and 0.25-pound of smokeless powder (see Figure 4-1). The MEC items were recovered on the surface and at a depth of 12 inches bgs. A total of 409 MD items were recovered between the surface and 96 inches (8 feet) bgs. MD is inert (nonenergetic) and does not pose an explosives safety risk. The presence of MEC suggests the potential for additional MEC in this area. The sensitivity of the types of MEC recovered is low (unfuzed) and the explosive fillers were in small quantities (less than 0.5-pound each). However, the hazard score, based on the explosives safety risk tool is 5 on a scale of 1 to 5 (lowest to highest). This is due to the presence of Class/Division 1.1 explosives (mass explosion). Refer to Attachment E of Appendix C.

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (2 to 8 entries per month). MEC density, which was computed by dividing the acreage of the Northern EOD Training Range by the total number of MEC found, is anticipated to be less than two MEC items per acre. The intensity of activity is expected to be moderate (less than or equal to six hours per entry) and portability of MEC was defined as easily portable since most items found in this area were small (i.e., less than 5 pounds each). The exposure score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E, Appendix C.

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Northern EOD Training Range, based on the explosives safety risk tool is characterized as Explosive Safety Risk "E" (higher risk). Refer to Attachment E of Appendix C.

8.2 SOUTHERN EXPLOSIVE ORDNANCE DISPOSAL TRAINING RANGE

The Southern EOD Training Range contained some of the former EOD training activities, but at a much smaller scale than the Northern EOD Training Range, as evidenced by the absence of MEC, small quantities of MD , and the lack of visual evidence of burial pits.

Accessibility Assessment. No MEC items were recovered during the field investigation of the Southern EOD Training Range. However, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on best professional judgment, migration of MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallowdepths. The level of activity, based on anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Hazard Assessment. No MEC items were recovered during the field investigation of the Southern EOD Training Range (see Figure 4-1); however, 26 MD items were recovered between the surface and 24 inches bgs. MD is inert (nonenergetic) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in the Southern EOD Training Range (i.e., 20mm and 40mm expended cartridge casings), potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These types of MEC are considered low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool is 3 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (two to eight entries per month). MEC density (because no MEC items were recovered) is anticipated to be less than two MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to six hours per entry) and portability of MEC was defined as easily portable since most items found at the site were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Southern EOD Training Range, based on the explosives safety risk tool is characterized as Explosive Safety Risk "A" (lower risk). Refer to Attachment E of Appendix C.

8.3 BUFFER ZONE AND RANGE PERIMETER (INSIDE THE FENCE)

The Buffer Zone and Range Perimeter (area within the perimeter fence) contained kick-outs from the former EOD training activities, as evidenced by the small quantities of MEC-related materials/scrap recovered during the field investigation. No MEC items were recovered during the field investigation, and there was no evidence of burial pits.

Accessibility Assessment. MEC items were not recovered during the field investigation of the Buffer Zone and Range Perimeter (area inside the fence line); however, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on the best professional judgment, migration of potential MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallow depths. The level of activity, based on the best professional judgment and anticipated land use, will be moderate intrusion with ground disturbances

up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Hazard Assessment. No MEC items were recovered during the field investigation of the Buffer Zone and Range Perimeter (area inside the fence line) (see Figure 4-1); however, 165 MD items were recovered between the surface and 12 inches bgs. MD is inert (nonenergetic) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in this area during the field investigation, potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These MEC types have low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool is 3 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Exposure Assessment. Based on the best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (two to eight entries per month). MEC density (because no MEC was recovered) is anticipated to be less than two MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to six hours per entry). Portability of MEC was defined as easily portable since most items found in this area were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Buffer Zone (including the area inside the Range Perimeter fence), based on the explosives safety risk tool is characterized as Explosive Safety Risk "A" (lower risk). Refer to Attachment E of Appendix C.

8.4 RANGE PERIMETER (OUTSIDE THE FENCE)

The Range Perimeter outside of the perimeter fence contained kick-outs from the former EOD training activities, as evidenced by the small quantities of MEC-related materials/MD recovered in the three areas investigated (see Figure 4-1). No MEC items were recovered during the field investigation, and there was no evidence of burial pits. Based on the patterns of MD located outside of the perimeter fence, isolated open burn/open detonation activities may have occurred in the past on the outer edges of the Northern EOD Training Range or in open areas of the Buffer Zone.

Accessibility Assessment. No MEC items were recovered during the field investigation of the Range Perimeter (area outside perimeter fence); however, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on the best professional judgment, migration of potential MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallow depths. The level of activity, based on the best professional judgment and anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Hazard Assessment. There were no MEC items recovered during the field investigation of the Range Perimeter (area outside perimeter fence); however, 176 MD items were recovered between the surface and 10 inches bgs (see Figure 4-1). MD is inert (nonhazardous) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in this area, potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These MEC types have low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool is 3 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Exposure Assessment. Based on the best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (two to eight entries per month) due to the extremely steep grade from the nearby freeway to the north, and the lack of pedestrian access on or near the freeway. MEC density (because no MEC was recovered) is anticipated to be less than two MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to six hours per entry). Portability of MEC was defined as easily portable since most items found in this area were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool is 2 on a scale of 1 to 5 (lowest to highest). Refer to Attachment E of Appendix C.

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Range Perimeter (outside the perimeter fence), based on the explosives safety risk tool (Attachment E), is characterized as Explosive Safety Risk "A" (lower risk).

8.5 SUMMARY OF MEC RISKS

Based on the recovery of four safe-to-move MEC items in the Northern EOD Training Range, as well as the recovery of 776 MD items from all four investigation areas (the Northern EOD Training Range, Southern EOD Training Range, Buffer Zone, and Range Perimeter), it is estimated that there are less than two safe-to-move energized MEC items present per acre at IRP Site 1. MEC risk was evaluated, based on the sampling results, for all four areas, assuming that the overall land use within the four areas of IRP Site 1 will remain consistent with past EOD training activities. Each area was evaluated using three risk factors - accessibility assessment, overall hazard assessment, and exposure assessment. Table 8-1 presents the summary of risks. The explosivity risk would be higher for any activity that results in more land disturbance than the like use scenario due to higher potential for encountering MEC items.

Table 8-1: Summary of Munitions an Explosives of Concern Risks

Investigation Area	Accessibility Assessment[a]	Overall Hazard Assessment[a]	Exposure Assessment[a]	Overall Explosives Safety Risk[b]
Northern EOD Training Range	5	5	2	E
Southern EOD Training Range	2	3	2	A
Buffer Zone and Range Perimeter (inside fenceline)	2	3	2	A
Range Perimeter (outside fenceline)	2	3	2	A

Notes:
EOD =. Explosive Ordnance Disposal
[a] Scale is 1 to 5, lowest to highest risk.
[b] Scale is A to E, lowest to highest risk.

9. Summary and Conclusions

Prior to the Phase II RI, several investigations were conducted at IRP Site 1, each addressing a particular environmental medium or potential contaminant at the site. Phase II RI field activities addressed soil, sediment, groundwater, and surface water; and together with the results of previous investigations, provide a complete assessment of the nature and extent of contamination at IRP Site 1. This delineation of the nature and extent of contamination provides a basis for the evaluation of risk to human health and environment.

9.1 SUMMARY

9.1.1 Nature and Extent of Contamination

The nature and extent of MEC and chemical contamination of various environmental media, including soil, sediment, groundwater, and surface water was characterized using the data collected during field activities in support of the Phase II RI, as well as from previous investigations.

9.1.1.1 NATURE AND EXTENT OF MUNITIONS AND EXPLOSIVES OF CONCERN

Four Safe-to-Move MEC items and approximately 5,000 pounds of MD were recovered during MEC field investigations at IRP Site 1. MEC was recovered in the Northern EOD Training Range and MD was recovered from all the remaining portions of the site investigated including: the Southern EOD Training Range; the Buffer Zone to the north, northwest, and southwest of the Northern and Southern EOD Training Ranges; and from the Range Perimeter. The maximum depth at which MEC/MD was recovered at IRP Site 1 was 8 feet bgs.

9.1.1.2 NATURE AND EXTENT OF SOIL CONTAMINATION

Soil investigations performed at IRP Site 1 may be divided into two parts – investigations of a 3.3-acre area located in the southern part of the site (in support of a Site-Specific Environmental Baseline Survey [EBS]), and investigations of the Northern and Southern EOD Training Ranges.

Environmental Baseline Survey Soil Investigation

COPCs were not reported in soil at concentrations above either their respective EPA Region 9 PRGs for residential or for industrial soil within the 3.3-acre area sampled in support of the EBS. Metals were reported at concentrations below respective residential and industrial PRGs with the exception of arsenic, for which concentrations in ten samples exceeded respective residential and industrial PRGs, and one sample exceeded the Former MCAS El Toro background concentration. For the explosives residues, only RDX exceeded its respective EPA Region 9 residential PRG in only one soil sample.

Northern and Southern Explosive Ordnance Disposal Training Ranges

The following presents a summary of the nature and extent of contamination in soil in the Northern and Southern EOD Training Ranges:

1. Various COPCs were detected in soil during previous investigations and during the Phase II RI, including: VOCs, SVOCs, hydrocarbons, explosive residues, perchlorate, metals, and dioxins/furans.
2. VOCs detected in soil at the Northern and Southern EOD Training Ranges include: acetone; benzene; 2-butanone; chloroform; ethylbenzene; 2-hexanone; 4-methyl-2-pentanone; PCE; toluene; and xylenes. All reported concentrations of VOCs in soil were below their respective EPA Region 9 PRGs for industrial soil.

3. SVOCs detected in soil at the Northern and Southern EOD Training Ranges include: diethyl phthalate; di-n-butyl phthalate; hexachlorobenzene; phenol; 2,4-dinitrotoluene; 2-methylnaphthalene; bis(2-ethylhexyl) phthalate; naphthalene; and N-nitrosodiphenylamine. Concentrations of all SVOCs reported in soil were below respective EPA Region 9 PRGs for residential and industrial soil with the exception of naphthalene. Reported concentrations of naphthalene in soil exceeded respective Cal-Modified EPA PRGs for residential and industrial soil of 1.7 and 4.2 mg/kg, respectively; at seven sampling locations.

4. Hydrocarbons detected in soil at the Northern and Southern EOD Training Ranges include TPH-MO, TPH-D, and TPH-G (PRGs are not available for TPH). Concentrations ranged from 1 to 37,000 mg/kg for TPH-D, 0.03 to 1,600 mg/kg for TPH-G, and 4 to 69 mg/kg for TPH-MO.

5. Explosives residues detected in soil at the Northern and Southern EOD Training Ranges include: 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; and RDX. These compounds were reported at concentrations below respective EPA Region 9 PRGs for industrial soil. Reported concentrations of these compounds did not exceed respective PRGs for residential soil except in the case of RDX, which was reported detected above the residential PRG of 4.42 mg/kg in one sample taken at 5 feet bgs during the Tier III soil investigation.

6. Perchlorate was detected in soil at low concentrations and at low frequencies at the Northern and Southern EOD Training Ranges. All reported detections were below the EPA Region 9 residential and industrial PRGs of 7.82 mg/kg and 102.2 mg/kg, respectively. The maximum concentration of perchlorate detected at the Northern and Southern EOD Training Ranges is 1.6 mg/kg.

7. None of the metals reported in soil during the *Verification of Perchlorate Study* and Phase II RI Tier I and Tier III investigations exceeded respective EPA Region 9 PRGs for residential or industrial soil (with the exception of arsenic), and very few exceeded respective background concentrations. However, many of the metal concentrations in soil from the Tier II investigations exceeded respective background concentrations, with few of them exceeding respective PRGs for residential and industrial soil. Metals in soil from the Northern and Southern EOD Training Ranges that exceeded respective residential and/or industrial PRGs include: aluminum, antimony, arsenic, cadmium, copper, lead, thallium, and zinc.

8. TEQs for dioxins/furans in soil samples collected during the *Verification of Perchlorate Study* and Tier III investigation did not exceed respective EPA Region 9 PRGs for residential soil. However, during the Tier II investigation, one soil sample exceeded respective residential and industrial PRGs and one soil sample exceeded the residential PRG.

9. Results from the Tier I, II, and III investigations were combined to estimate the depth of contamination at IRP Site 1. These results indicate that only minimal amounts of VOCs, SVOCs, petroleum hydrocarbons, perchlorate, and explosives residues are present at IRP Site 1 and they are restricted to shallow depths (less than 5 feet bgs). Borehole B-1, located in the central portion of the site is likely to be the only location where this contamination extends to a maximum depth of 20 feet bgs.

10. Only negligible concentrations of explosives residues and perchlorate exist in IRP Site 1 soil and they are restricted to shallow depths (less than 5 feet bgs). It is likely that Borehole B-1 is the only location where low concentrations of explosives residues and/or perchlorate extend to a maximum depth of 35 feet bgs.

11. The radiological scan surveys and soil sampling concluded that the occurrence and distribution of Ra-226 at IRP Site 1 is consistent with the naturally occurring background

concentrations. Therefore, a recommendation was made to remove the radionuclides from the list of COPCs at IRP Site 1.

9.1.1.3 GROUNDWATER CONTAMINATION

Based on the results from Stationwide groundwater monitoring, from the *Verification of Perchlorate Study*, and from the Phase I and Phase II evaluation of radionuclides in groundwater, it is concluded that:

1. Very few VOCs were detected in groundwater at IRP Site 1 during Stationwide groundwater monitoring, and during Tier I groundwater monitoring events. Reported concentrations of VOCs were generally low and below respective MCLs.
2. SVOCs were detected only sparingly and at very low concentrations at IRP Site 1. This suggests that negligible SVOC contamination exists at IRP Site 1.
3. Low concentrations of TPH-MO, TPH-D, and TPH-G were detected at some IRP Site 1 monitoring wells.
4. Perchlorate concentrations exceeding the perchlorate DWEL of 24.5 µg/L (EPA 2006) by over 1 order of magnitude were observed in the central portion of IRP Site 1 in the Northern EOD Training Range. An evaluation of historical operations and soil sampling results indicates that this area is likely the source of perchlorate contamination in groundwater for areas located south of IRP Site 1 including the alluvial aquifer between IRP Site 1 and IRP Site 2.
5. Elevated concentrations of perchlorate were reported in groundwater south of the central source area, particularly in the aquifer between IRP Site 1 and IRP Site 2 along the Ephemeral Pond. Perchlorate is present predominantly in the weathered bedrock at IRP Site 1; however, downgradient of IRP Site 1 perchlorate is present both in the saturated alluvium and saturated weathered bedrock.
6. The Phase I and Phase II radionuclide evaluations concluded that radionuclides in groundwater at IRP Site 1 are naturally occurring and are not related to past site use.

9.1.1.4 SEDIMENT CONTAMINATION

COPCs detected in sediment samples collected in the Ephemeral Pond include toluene (a VOC) and petroleum hydrocarbons. SVOCs, explosives residues, PAHs, and perchlorate were not reported in any of the sediment samples from the Ephemeral Pond. Toluene was detected at low concentrations at two sampling locations. Petroleum hydrocarbons detected in the sediment samples included low concentrations of TPH-MO, TPH-D, and TPH-G. None of the detected concentrations of metals exceeded their respective EPA Region 9 residential or industrial PRGs except arsenic, which exceeded its residential PRG in all 19 sediment samples. However, none of these samples had an arsenic concentration greater than its established background concentration of 6.86 mg/kg.

9.1.1.5 SURFACE WATER CONTAMINATION

1. Acetone was the only VOC detected in any of the surface water samples; it was detected at a concentration of 6 µg/L (below the EPA Region 9 PRG for tap water) in only two samples, one from the Ephemeral Pond and one from the downgradient stream location.
2. RDX was the only explosive residue detected in surface water samples; it was detected in only one sample collected from the western reach of Borrego Canyon Wash at the southern portion of IRP Site 1 at a concentration of 1 µg/L.

3. Low concentrations of TPH-MO, TPH-D, and TPH-G were detected in three surface water samples collected near the Ephemeral Pond and western reach of Borrego Canyon Wash. Maximum reported concentrations of TPH-MO, TPH-D, and TPH-G were 0.09 mg/L, 0.08 mg/L, and 0.05 mg/L, respectively.
4. SVOCs, PAHs, and/or perchlorate were not detected in any of the surface water samples.
5. Of the metals detected in surface water samples from the Ephemeral Pond, aluminum, arsenic, barium, copper, iron, lead, and mercury exceeded their National Recommended Water Quality Criteria or risk-based screening values for aquatic life. Only copper exceeded its screening criteria in the surface water sample collected from the downgradient portion of the site.

9.1.2 Human-Health Risk Assessment

9.1.2.1 Surface and Subsurface Soil

The Tier 1 SRA for surface and subsurface soil (i.e., comparison of data to EPA Region 9 residential and industrial PRGs) resulted in ILCRs that were within the risk management range of 10^{-6} to 10^{-4}. The use of California-modified toxicity information resulted in approximately an order of magnitude increase in these risk estimates, which remained within this risk management range. Arsenic is the primary carcinogenic risk driver in soil; however, arsenic is present at background concentrations. Noncancer HIs for surface and subsurface soil range between 5 and 10 under a residential scenario, and are near 1 under an industrial scenario. Antimony, thallium, naphthalene, and 2-methylnapthalene are the main contributors to the HI. However, the surface and subsurface HIs are based mostly on chemicals that are detected in fewer than five percent of the samples. Maximum detections of these compounds were used to estimate the hazard, and therefore may have resulted in an overestimate of the hazard.

The evaluation of potential soil vapor migration into indoor air resulted in estimated ILCRs for resident and industrial workers that were within the cancer risk management range of 10^{-6} to 10^{-4}. Noncancer hazard estimates exceeded the target HI of 1. Cancer risk and noncancer hazard estimates were driven by chemicals that were detected in fewer than five percent of the soil samples. As a result, maximum detected concentrations were used in the evaluation, and therefore may have resulted in an overestimate of risks.

The surface soil (0 to 2 feet bgs) and the subsurface soil (0 to 10 feet bgs) do not pose a significant risk to a construction worker, casual tresspasser, or to an EOD Training Range supervisor; as incremental cancer risks and HIs are near or below the cancer risk management range or noncancer target levels, respectively.

9.1.2.2 Ephemeral Pond Sediment

The Tier 1A SRA for sediment in the Ephemeral Pond used EPA Region 9 residential soil PRGs for comparison. This assessment resulted in cumulative incremental cancer risks slightly above $1x10^{-6}$ for a residential scenario (but below the point of departure for the industrial scenario), which is primarily driven by the presence of arsenic. The concentrations of arsenic detected in sediment were less than those detected in surface and/or subsurface soil, and are believed to represent background conditions.

9.1.2.3 Groundwater

The Tier 1A SRA for groundwater resulted in ILCRs of $1x10^{-3}$ under a high-end or RME assumption. Under an average exposure (or CTE) assumption, cumulative incremental cancer risks

are $9x10^{-5}$. Arsenic, benzene, TCE, methylene chloride, and bis 2-ethylhexyl phthalate were detected above their respective carcinogenic EPA Region 9 tap water PRGs. The primary risk driver is TCE, which was only detected in the original groundwater sampling event in January 2002. TCE was not detected in subsequent groundwater monitoring events. Although the risk estimate for arsenic also exceeded $1x10^{-6}$, the maximum detection (4.4 µg/L) is below the current MCL of 5 µg/L. Estimated noncancer hazards from exposure to groundwater are approximately 10 for both RME and CTE scenarios. Perchlorate is a significant contributor to this hazard as the conservative estimate of the mean concentration in groundwater exceeds DWEL (EPA 2006). The mean concentration of nitrate also exceeded its noncancer tap water PRG. The maximum detected concentration of. TCE, thallium, chromium, and nickel exceeded their respective noncancer tap water EPA Region 9 PRGs. ILCRs for future offsite residents potentially residing near IRP Site 1 are less due to groundwater mixing and potential biodegradation.

The evaluation of potential vapor migration from groundwater through the soil column and into indoor air resulted in estimated ILCRs for the resident that were within the risk management range of 10^{-6} to 10^{-4}. Noncancer hazard estimates were below the target HI of 1. The cancer risk estimate was driven by TCE, for which the continued presence has not been confirmed.

The likelihood of groundwater in the site vicinity to be used for residential drinking water is unknown but expectedly low. Groundwater was not evaluated in the Tier 1B SSRBE since other site-specific receptors are not expected to become significantly exposed to groundwater.

9.1.2.4 Surface Water

The SRA for surface water used EPA Region 9 tap water PRGs for comparison. The assessment resulted in cumulative incremental cancer risks of $3x10^{-5}$, which is driven by arsenic. Only arsenic and RDX exceeded their respective tap water PRG. The concentration of arsenic detected in surface water was less than detected in groundwater. Noncancer HIs for surface water are less than 1.

9.1.2.5 Summary of Human Health Risks

In summary, the cancer risk estimates are below or within the EPA established risk management range of 10^{-4} to 10^{-6} for all media except groundwater. While the cancer risk estimate for groundwater exceeds 10^{-4}, it is based on TCE, which has not been confirmed in groundwater by subsequent groundwater monitoring events. Noncancer hazards for groundwater exceed EPA's acceptable target hazard of 1. The majority of this risk is driven by the presence of perchlorate, TCE, nickel and thallium. Based on the data collected and its evaluation in the risk assessment, further evaluation of groundwater may be necessary. Noncancer hazard estimates for other media are generally near or below one; however, indirect exposure to chemicals in soil through soil vapor migration into potential buildings could result in a slightly higher noncancer hazard. Much of the noncancer hazard is based on chemicals that are infrequently detected. Table 6-2 summarizes the human health risk at IRP Site 1 for potential onsite residents and industrial workers. Table 6-5 summarizes the risk for other site-specific receptors which may potentially exist at IRP Site 1.

9.1.3 Ecological Risk Assessment

An ERA was conducted at IRP Site 1 to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. Due to discussions with regulators and comments received from the regulators on the *Draft Screening Ecological Risk Assessment (SRA)*, (Earth Tech 2003), four additional terrestrial species were added and the depth of soil evaluated was increased from 0 to 2 feet bgs to 0 to 6 feet bgs to represent the bird and mammal feeding guilds present at the site. This evaluation now uses the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and

loggerhead shrike as representative birds. Soil samples from 0 to 6 feet bgs are used to represent potential exposure of deep burrowing animals.

Although potential risk to aquatic life in surface water at IRP Site 1 is indicated for two COPCs (aluminum and barium) in the Ephemeral Pond, concentrations of these COPCs are not at levels that are likely to elicit adverse effects to the ephemeral aquatic community present. The aquatic life criteria that were used in ecological SRA (Tier 1) and BERA (Tier 2, Step 3a) comparisons are for all aquatic life and are extremely conservative in nature. Given that ephemeral habitat species are well-adapted to environmental extremes, and that a viable and reproducing aquatic community existed in the Ephemeral Pond during the Winter-Spring 2005 sampling period, the conclusion is made that aluminum and barium do not pose risks to these aquatic life receptors in the IRP Site 1 Ephemeral Pond.

Ecological risk from exposure to sediment at IRP Site 1 Ephemeral Pond does not present a significant threat of adverse effects to benthic receptors, based on refined site-specific exposure assumptions for sediment in the BERA.

Potential risks (i.e., HQs) to representative wildlife receptors were recalculated using Lowest Observable Effects Level (LOAEL)-based TRVs and reasonable maximum EPCs (the lesser of the 95 percent UCL of the mean, estimated using the ProUCL software or the maximum concentration). Tier 2 HQs for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples for calculation of a 95 percent UCL); HQs for copper ranged from 2 to 3, and HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that average EPCs are overestimated, and thus the HQs are overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected fewer than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only three of these COPCs had HQs greater than 1: HQs for antimony ranged from 10 to 100; HQs for total xylenes ranged from 7 to 50; and HQs for 2,4-dinitrotoluene ranged from 8 to 10. The elevated HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. The HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. The HQs for 2,4-dinitrotoluene were driven by the maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. HQs calculated for these three COPCs represent exposures at the locations of the maximum detection only, and overestimates the average exposure across the entire site, and thus the risk to receptors across the entire site. Because of their low frequency of detection and limited distribution, exposure of wildlife to the three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

The results of the ecological SRA and BERA evaluation suggest that the chemicals in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individual plant and invertebrates, if located at the locations of maximum chemical detection, may suffer from adverse effects. No further evaluation to protect aquatic, benthic or terrestrial ecological receptors at IRP Site 1 is required.

9.1.4 Munitions and Explosives of Concern Risk Assessment

Based on the recovery of four safe-to-move MEC items in the Northern EOD Training Range, as well as the recovery of 776 MD items from all four investigation areas (the Northern EOD Training

Range, Southern EOD Training Range, Buffer Zone, and Range Perimeter) during the *Munitions and Explosives of Concern Range Evaluation Study*, it is estimated that there are less than two safe-to-move energized MEC items present per acre at IRP Site 1. MEC risk was evaluated, based on the sampling results, for all four areas, assuming that the overall land-use within the four areas of IRP Site 1 will remain consistent with past EOD training activities. Each area was evaluated using three risk factors - accessibility assessment, overall hazard assessment, and exposure assessment. The explosivity risk would be higher for any activity that results in more land disturbance than the like-use scenario due to the higher potential for encountering MEC items.

9.2 CONCLUSIONS

Data obtained during the Phase II RI were combined with data from previous investigations to resolve the decision questions developed during the DQO evaluation process in the Phase II RI Work Plan.

The following answers were obtained for the project Decision Questions (Section 2.1). A more thorough evaluation of the conclusions follows these answers:

1. *Are the analytical data from shallow (less than 10 feet bgs) soil samples adequate to characterize the risk, or are additional data required?*

   Yes, both the HHRA and the ERA were satisfactorily completed with the soil data that was collected.

2. *Has the lateral extent of the impacted shallow soil been defined or are additional data required?*

   Yes, the results of the investigation indicated that the impacted shallow soil has been defined and is located only in the central portion of the site.

3. *Does the contamination extend beyond 10 feet bgs (i.e., is the vertical extent defined)?*

   Investigation results indicate with one exception, that COPCs are restricted to the shallow soil (less than 5 feet bgs). At one location low concentrations of COPCs were present to a maximum depth of 35 feet bgs; this is likely to be the only location where contamination has affected deeper soil.

4. *Do the existing groundwater monitoring wells adequately characterize impact to groundwater or is there a need for additional wells?*

   Yes, existing groundwater monitoring wells adequately characterize impact to groundwater; however, there may be a need for additional wells in support of the Feasibility Study.

5. *Is surface water runoff an exposure pathway?*

   Yes, surface water runoff is a potentially complete pathway during significant rain events, based on observations made during the 2004-2005 winter season.

6. *Have potential human and ecological receptors been identified, and are they likely to be at risk for adverse health effects at this site?*

   Yes, all potential human and ecological receptors have been identified. Based on an evaluation of the data conducted during the risk assessment, IRP Site 1 poses low risk to human health; however, an elevated HI indicates that further evaluation of groundwater may be warranted. The results of the SRA and BERA evaluation indicate that IRP Site 1 poses

low risk, and no further evaluation is necessary to protect aquatic, benthic or terrestrial ecological receptors.

7. *Do the concentrations of target analytes in the Ephemeral Pond sediments (located in the northern portion of IRP Site 1) exceed the established decision thresholds (for Riverside fairy shrimp [a Federally-endangered species])?*

   Yes, the concentrations of target analytes in the Ephemeral Pond sediments exceed the established decision thresholds. However, based on refined exposure assumptions for sediment and water within the Ephemeral Pond, it is concluded that aquatic and benthic organisms are not at risk of adverse effects.

8. *Do the data suggest that the perchlorate detected downgradient from IRP Site 1 is related to IRP Site 1 releases?*

   Yes, the data suggest that the perchlorate detected downgradient from IRP Site 1 is related to IRP Site 1 releases.

9.2.1 Nature and Extent of Contamination

The soil investigations generated sufficient data to define the lateral and vertical extent of contamination at IRP Site 1. These investigations indicate that low concentrations of VOCs, SVOCs, explosives residues, hydrocarbons, and perchlorate are present at the site. For the most part, these COPCs are below respective EPA Region 9 residential and/or industrial PRGs, and are restricted to shallow soil (less than 5 feet bgs). At one location however, in the central portion of the site, low concentrations of COPCs were present to a depth of 35 feet bgs; this is likely to be the only location where contamination has affected soil deeper than 5 feet bgs.

Low concentrations of VOCs, SVOCs and hydrocarbons are present in IRP Site 1 groundwater. The predominant contaminant in groundwater at IRP Site 1 is perchlorate. Perchlorate was reported in groundwater at concentrations exceeding its DWEL (EPA 2006) by over 1 order of magnitude, in the central portion of IRP Site 1. In addition, relatively high concentrations of perchlorate are present in groundwater south of IRP Site 1 and in groundwater between IRP Site 1 and IRP Site 2, particularly along the western reach of Borrego Canyon Wash.

9.2.2 RCRA Facility Closure

Consistent with agreements during the preparation of the Phase II RI Work Plan (Earth Tech 2001a), this RI Report incorporates substantive requirements of the RCRA facility closure process for the proposed OB/OD Unit at IRP Site 1. The DON maintains that activities conducted at the Former EOD Training Range were not regulated under RCRA.

The DON included a table cross-referencing the RCRA closure checklist into the final Phase II RI Work Plan (Earth Tech 2001a). This table provides a cross-reference of where the substantive RCRA closure requirements are addressed in the RI Report and subsequent CERCLA documents. This table is provided as Appendix A to this Report. As indicated in a DTSC letter dated 19 March 2001, closure and post-closure requirements apply to the OB/OD Unit located within the investigation boundary (assumed to be the CERCLA investigation). The RI encompasses the area shown in the Part A Permit Modification submitted by the Marine Corps to EPA Region 9 in June 1988. The DON will continue to evaluate this area as an integral component of the IRP Site 1 RI, and will incorporate as necessary, substantive closure and post-closure requirements into the response action process.

9.2.3 Human Health Risk

To evaluate the risk for adverse health effects due to contaminants at IRP Site 1, a human-health screening risk assessment was conducted for surface and subsurface soil, sediments, groundwater, and surface water at the site. The HHRA conducted for surface and subsurface soil at IRP Site 1 indicates that health risks for a construction worker, casual trespasser, or EOD Training Range supervisor are generally acceptable. Additionally, sediments in the Ephemeral Pond do not pose a significant risk under any of the construction worker, casual trespasser, or EOD Training Range supervisor exposure scenarios. While the risk estimate for groundwater exceeds 10^{-4}, it is based on TCE, which has not been confirmed in groundwater by subsequent groundwater monitoring events suggesting that current conditions are not represented by those data that have been collected historically. Noncancer hazards for groundwater in the screening level evaluation are driven by perchlorate. However, it must be realized that there is no significant current use of groundwater at the site and the future use of this medium is believed to be unlikely.

In the SSRBE, excess cancer risks for all receptors and considered media were well below the lower bound (10^{-6}) of the cancer risk management range. The highest noncancer HI of 3 was calculated for the construction/utility worker potentially exposed to subsurface soil. Considering the inherent protectiveness built into establishment of the RfD, an HI value of 3 can be considered marginally greater than 1.0.

9.2.4 Ecological Risk

An ERA was conducted at IRP Site 1 to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. The evaluation uses the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and loggerhead shrike as representative birds. Soil samples from 0 to 6 feet bgs are used to represent potential exposure of deep burrowing animals.

The results of the SRA Tier 1 and BERA Tier 2, Step 3a ecological risk evaluation indicates no potential for adverse ecological effects to benthic organisms exposed to IRP Site 1 Ephemeral Pond sediments or aquatic organisms exposed to surface water in the Ephemeral Pond or in runoff. Surface water chemicals were not found at concentrations that threaten adverse effects to the Riverside fairy shrimp. Chemicals in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individuals may suffer from adverse effects.

The results of the SRA and BERA evaluation indicate no further evaluation is necessary to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1.

9.2.5 MEC Risk

An explosives safety assessment was performed at IRP Site 1 to evaluate the risks due to MEC contamination at the site. The explosive safety risk assessment concluded that due to the potential for buried MEC, elevated risk is present at the Northern EOD Training Range, with slightly elevated risk at the Southern EOD Training Range caused by potential for kick-outs.

9.2.6 Conclusions

On the basis of results from the human-health and MEC risk assessments performed for IRP Site 1, it is recommended that an evaluation for conducting a response action for perchlorate-impacted groundwater, as well as an evaluation for removal of MEC from soil be included in the remedial alternatives evaluated in the FS for IRP Site 1. In addition, since the incremental cancer risk for naphthalene in soil falls in the risk management range of 10^{-4} to 10^{-6}, it is also recommended that a

human-health-based removal of naphthalene-impacted soil from the central portion of IRP Site 1 be included in the remedial alternatives evaluated in the FS. It is anticipated that a human-health-based removal action conducted for naphthalene-impacted soil would also likely reduce ecological risk at the site, and no further action would be required to further reduce risks to ecological receptors.

10. References

Agency for Toxic Substances and Disease Registry (ATSDR) 2003. Public Health Assessment - Air Pathway Evaluation - Isla de Vieques Bombing Range, Vieques, Puerto Rico - August 26, 2003.

American Society for Testing and Materials (ASTM). 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*. Designation E 1739-95.

Bechtel Jacobs Company LLC. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Bechtel Jacobs Company LLC, Oak Ridge, Tennessee. BJC/OR-133.

Bechtel National, Inc. (BNI). 1995. *Final Work Plan Phase II Remedial Investigation/Feasibility Study*, San Diego, CA.

_____. 1996. *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations*. San Diego, CA.

———. 1999a. *Draft Evaluation of Perchlorate in Groundwater*. San Diego, CA.

_____. 1999b. D*raft Final CERCLA Groundwater Monitoring Plan.* San Diego, CA.

_____. 2002. *CLEAN II Program Procedures Manual*. San Diego, CA.

Brown and Caldwell. 1986. *Initial Assessment Study of Marine Corps Air Station, El Toro, California.* San Diego, CA.

California Department of Fish and Game (CDFG). 1994. *Designated Endangered, Threatened, or Rare Plants and Candidates with Official Listing Dates*.

California Environmental Protection Agency (Cal-EPA). 2004a. *Public Health Goal for ARSENIC in Drinking Water.* Prepared by Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Pesticide and Environmental Toxicology Section. April.

_____. 2004b. Denton to Tamminen Memorandum. *Adoption of a Unit Risk Value for Naphthalene*. August 2.

_____. 2004c. Vapor Intrusion Guidance Document – Final Interim California Environmental Protection Agency, Department of Toxic Substances Control. December (as revised February 2005).

_____. 2005. PM10 database. http://www.arb.ca.gov/aqd/oldpm10/pmgeosel.htm.

California Regional Water Quality Control Board, Santa Ana Region (CRWQCB). 1995. *Water Quality Control Plan, Santa Ana River Basin*. Santa Ana, CA.

———. 1996. Memo dated January 5, 1996 from Loretta K. Barsamaian, Executive Officer to the San Francisco Bay Area Agencies Overseeing UST Cleanup. Subject: *Supplemental Instructions to State Water Board, December 8, 1995, Interim Guidance on Required Cleanup at Low Risk Fuel Sites*.

Camp Dresser & Mckee (CDM). 1997a. *Groundwater Monitoring Report, November-December 1996 Sampling Round. Marine Corps Air Station El Toro, California.* San Diego. February.

———. 1997b. *Groundwater Monitoring Report, March 1997 Sampling Round. Marine Corps Air Station El Toro, California.* San Diego. June.

———. 1997c. *Groundwater Monitoring Report, July 1997 Sampling Round. Marine Corps Air Station El Toro, California.* San Diego. October.

———. 1998. *Final Groundwater Monitoring Report, October 1997 Sampling Round. Marine Corps Air Station El Toro, California.* San Diego. March.

———. 2000a. *Final Groundwater Monitoring Data Summary Report, October – November 1998, Sampling Round 8. Marine Corps Air Station El Toro, California.* San Diego. May.

———. 2000b. *Groundwater Monitoring Data Summary Report, January – August 1999, Sampling Rounds 9, 10 & 11. Marine Corps Air Station El Toro, California.* San Diego. June.

———. 2001a. *Final Groundwater Monitoring Report June 2000 Monitoring Round 12. Marine Corps Air Station El Toro, California.* San Diego. June.

———. 2001b. *Final Groundwater Monitoring Report February 2001 Monitoring Round 13. Marine Corps Air Station El Toro, California.* San Diego. October.

———. 2002a. *Final Groundwater Monitoring Report September 2001 Monitoring Round 14. Marine Corps Air Station El Toro, California.* San Diego. February.

———. 2002b. *Final Groundwater Monitoring Report March 2002 Monitoring Round 15. Marine Corps Air Station El Toro, California.* San Diego. August.

———. 2005. *Final Groundwater Monitoring Report March 2005 Monitoring Round 21, Former Marine Corps Air Station El Toro, California.* San Diego. August.

Clewell and Crump. 2005. Quantitiative Estimates of Risk for Noncancer Enpoints. Risk Analysis 25(2): 285-289.

Coates, J. D.; Michaelidou, U.; Bruce, R.A.; O'Connor, S.M.; Crespi, J.M.; Achenbach, L.A. 1999. Applied and Environmental Microbiology; 65: 5234-5241.

Department of the Navy (DON). 1998. *Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP).* Prepared for Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM). October.

———. 1999. *Navy Policy for Conducting Ecological Risk Assessments.* Letter from A. A. Granuzzo, Chief of Naval Operations, to Commander, Naval Facilities Engineering Command. Ser. N453E/9U595355. Washington, D.C. 5 April.

_____. 2001a. Installation Restoration Program Manual (Draft) 2001 Update.

———. 2001b. Navy Policy: Conducting Human Health Risk Assessment (HRAs) under the Environmental Restoration Program, Ser N453E/1U595168. Washington, D.C. February.

———. 2003. *Base Realignment and Closure Business Plan, Draft.* Marine Corps Air Station, El Toro, California. San Diego, CA. January.

———. 2004a. Navy Policy on the Use of Background Chemical Levels, Ser N45C/N4U732212. Washington, D.C. January.

———. 2004b. Policy on Using Provisional Toxicity Factors. Email communication from Navy to Earth Tech. May.

_____. 2004c. Risk Assessment Guidance for Superfund, Volume I; Human Health Evaluation Manual (PART E, Supplemental Guidance for Dermal Risk Assessment) Final Guidance.

Department of Defense (DoD). 2000. *Interim R3M Range Rule Risk Methodology. Interim Procedures Manual.* Washington D.C. March.

Dourson, M.L., S.F. Felter, and D. Robinson. 1997. "Evolution of science-based uncertainty factors in non-cancer risk assessment." Human and Ecological Risk Assessment. 3(4):579-590.

Dunn, Ann Bailey. 1998. *A closer look: The Western Meadowlark.* North Dakota Outdoors 60(8)9. Northern Prairie Wildlife Research Center Home Page.

Earth Tech, Inc. 1998. *CLEAN Field Health and Safety Manual.* Honolulu.

———. 1999. *PACDIV Risk Assessment Protocols*. Prepared for PACDIV. Honolulu. June.

———. 2000. *Technical Memorandum, Evaluation of Radionuclides in Groundwater, Marine Corps Air Station, El Toro, California.* Draft. Honolulu. March.

———. 2001a. *Final Work Plan, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. November.

———. 2001b. *Technical Memorandum, Verification of Perchlorate at IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. July.

———. 2001c. *Final Site-Specific Environmental Baseline Survey Report, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. August.

———. 2001d. *Final Federal Agency-to-Agency Property Transfer Environmental Summary Document For Certain Property (Parcel 5a2), Marine Corps Air Station, El Toro, California* Honolulu. August.

———. 2001e. *Technical Memorandum, Phase II Evaluation of Radionuclides in Groundwater at Former Landfill Sites and the EOD Range, Marine Corps Air Station, El Toro, California.* Draft. Honolulu. December.

———. 2002. *Amendment No. 2 to Work Plan, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California* Honolulu. December.

———. 2003. *Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California.* Honolulu. February.

———. 2004a. *Sampling and Analysis Plan Amendment No. 1, Phase II Remedial Investigation, IRP Site 1, Former Marine Corps Air Station, El Toro, California.* Honolulu. December.

———. 2004b. *Draft Technical Memorandum, Aquifer Test, IRP Site 2, Magazine Road Landfill, Former Marine Corps Air Station, El Toro, California.* Honolulu. November.

———. 2005. *Sampling and Analysis Plan Amendment No. 3, Phase II Remedial Investigation, IRP Site 1, Former Marine Corps Air Station, El Toro, California.* Honolulu. January.

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.* ES/ER/TM-85/R3. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN, November.

Efroymson, R.A., M.E. Will, G.W. Suter II. 1997b. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.* ES/ER/TM-85/R2. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN, November.

Everett, W.T. 1979. *Threatened, declining and sensitive bird species in San Diego County.* Sketches. June.

Federal Bureau of Investigation (FBI). 2000. Letter Report Stating the FBI's Use of the MCAS El Toro EOD Range. Los Angeles, CA. March.

Gibbons, Robert. 1991. Statistical Tolerance Limits for Ground-Water. Ground Water, Vol. 29, No. 4, July-August.

Gobas, F., C. MacIntosh, G. Webster, J. Blair, and M. Ikonomou, 2006. Including Metabolic Transformation in Bioaccumulation Assessments: The Phthalate Ester Case Study, SETAC, 27T Annual Meeting, North America, Montreal.

Hurst, R.E. 2004. *The Role of Naturally-Occurring Isotopes in Forensic Investigations of Perchlorate-Impacted Soil and Groundwater*, in Groundwater Resources Association of America (GRA) 11th Annual Symposium: CLO_4^- 2004: Perchlorate in California Groundwater, August 4, 2004, Glendale, California.

Interstate Technology Regulatory Council (ITRC). 2002. *A Systematic Approach to In-Situ Bioremediation in Groundwater including Decision Trees on In-Situ Bioremediation for Nitrates, Carbon Tetrachloride, and Perchlorate.* August.

Izmeroff, N.F., et al. 1982. Toxicometric Parameters of Industrial Toxic Chemicals Under Single Exposure," Izmerov, N.F., et al., Moscow, Centre of International Projects, GKNT, 1982 Volume. Pg. 85.

Jackson, W. A., Anandam, S-K, Anderson, T., Lehman, T., Rainwater, K., Rajagopalan, S., Ridley, M.K. and Tock, R. 2005. *Perchlorate occurrence in the Texas Southern High Plains Aquifer System.* Groundwater Monitoring and Remediation. 25, 137-149.

Jacobs Engineering Group, Inc. (JEG) 1991. *Geophysical Survey Report.* Irvine, CA.

_____. 1993a. *Draft Phase I Remedial Investigation Technical Memorandum.* Irvine, CA.

_____. 1993b. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study. Draft Work Plan.* Irvine, CA.

KEA Environmental (KEA). 1998. *Letter Report to Rovert Montana regarding Biological Resources Report, MCAS El Toro Habitat Preserve*. Prepared by Christina M. Schaefer. Attached field notes by C. Schaefer. May.

Logan, B.E. 2001. Assessing the Outlook for Perchlorate Remediation. Environmental Science and Technology; 35 (23): 482A – 487A. December.

Marqusee, J. 2001. In situ bioremediation of perchlorate in groundwater. Federal Remediation Technologies Roundtable General Meeting. May 30, 2001.

McNabb, A., D. Jang, and C. Larsen, 2004. Does Thyroid Function in Developing Birds Adapt to Sustained Ammonium Perchlorate Exposure? Toxicol. Sci. 82:106-113.

Morton, D.M., Hauser, R.M., Ruppert, K.R. 1999. Preliminary digital geologic map of the Santa Ana 30'x60' quadrangle, southern California, version 1.0

National Academy of Sciences. 1989. Recommended Dietary Allowances: National Academy of Sciences; 10th ed.

———. 1997. Dietary Reference Intakes, 1997: Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride.

National Toxicology Program (NTP). 2000. *Toxicology and Carcinogenesis Studies of Naphthalene (CAS No. 91-20-3) in F344/N Rats (Inhalation Studies)*. Technical Report Series No. 500. NIH Publication No. 00-4434. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NTP, Research Triangle Park, NC.

Naval Energy and Environmental Support Activity (NEESA). 1986. *Initial Assessment Study of Marine Corps Air Station, El Toro, California.* Port Hueneme. CA. May

Naval Facilities Engineering Service Center (NFESC). 1999. Navy Installation Restoration Chemical Data Quality Manual (IRCDQM). NFESC Special Report SP-2056-ENV. Washington, D.C.: Naval Facilities Engineering Command. September.

Office of Environmental Health Hazard Assessment (OEHHA). 2002. *Draft Public Health Goal for Perchlorate in Drinking Water*. Pesticide and Environmental Toxicology Section. Office of Environmental Health Hazard Assessment California Environmental Protection Agency. March.

Roberson, K. 2004. Regulation of Perchlorate Impacts to Surface Waterat a Rocket Motor Plant in Santa Clara County, California, in Perchlorate in California's Groundwater. August 4, 2004, Groundwater Resources Association, Eleventh Symposium in GRA's Series on Groundwater Contamination.

Rodricks, J.V. 1992. Calculated Risks: Understanding The Toxicity And Human Health Risks Of Chemicals In Our Environment. XXVI+256p. Cambridge University Press: Cambridge, England; New York, New York. Illus. ISBN 0-521-41191-2. 0 (0).

Science Applications International Corporation (SAIC). 1993. *Final Report Aerial Photograph Assessment. Marine Corps Air Station El Toro*. San Diego, CA. October.

Singh, A. K., A. Singh, and M. Engelhardt, 1997. The Lognormal Distribution in Environmental Applications, EPA/600/R-97/006, Technology Support Center Issue, U. S. Environmental Protection Agency, Office of Research and Development, Washington, DC, December.

Smith PN, Theodorakis CW, Anderson TA, Kendall RJ. 2001. *Preliminary assessment of perchlorate in ecological receptors at the Longhorn Army Ammunition Plant (LHAPP), Karnack, Texas.* Ecotoxicology 10:313.

Stralka, D. 1995. EPA Region IX Toxicologist. Personal communication with Xuannga Mahini of Ogden Environmental and Energy Services, Inc. 30 August

Roy F. Weston (Weston). 2000. *Final Historical Radiological Assessment (HRA), Marine Corps Air Station, El Toro.* Vallejo, CA. May.

———. 2001. *MCAS El Toro Radiological Survey Plan.* Vallejo, CA. January.

———. 2006. *Draft Radiological Release Report Former Explosive Ordnance Disposal (EOD) Range – IRP Site 1, Defense Reutilization and Marketing Office (DRMO) Yard 3, Nuclear, Biological & Chemical (NBC) Complex, including Aerial Photograph Anomaly (APHO) 38 and Paved Area South of Building 295. Marine Corps Air Station, El Toro.* Vallejo, CA. June.

Tseng W.P., H.M. Chu, S.W. How, J.M. Fong, C.S. Lin, and S. Yen. 1968. *Prevalence of skin cancer in an endemic area of chronic arsenicism in Taiwan.* J. Natl. Cancer Inst. 40(3): 453-463.

Tseng W.P. 1977. *Effects and dose-response relationships of skin cancer and Blackfoot disease with arsenic.* Environ. Health Perspect. 19: 109-119.

Tseng, WP., Chu, HM., How, SW., Fong, JM., Lin, CS., Yeh, S. 1968. Prevalence of skin cancer in an endemic area of chronic arsenism in Taiwan. J. Natl. Cancer Inst. 40:453-463.

United States Army Corps of Engineers (USACE). 1998. *Range Identification and Preliminary Range Assessment.* Draft. MCAS El Toro. St. Louis. March.

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). 2005. Wildlife Toxicity Assessment for Perchlorate. Draft Report. November.

United States Environmental Protection Agency (EPA). 1986. Guidelines for Carcinogenic Risk Assessment. Federal Register 51 (185):33992-34003. Available from: http://www.epa.gov/ncea/raf/.

———. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Office of Emergency and Remedial Response.

———. 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A).* Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response. December.

———. 1990. *National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule.*

———. 1991a. *Risk Assessment Guidance for Superfund, Volume I—Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals).* Interim. EPA/540/R-92/003. Office of Emergency and Remedial Response. December.

———. 1991b. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.* Office of Emergency and Remedial Response. Toxics Integration Branch. Washington. March.

———. 1991c. *Site Analysis, El Toro Marine Corps Air Station. Orange County, California.* November.

———. 1992a. Guidance for Data Useability in Risk Assessment (Part A). Final. 9285.7-09A. Office of Emergency and Remedial Response. Washington. April.

———. 1992b. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* Memorandum from Larry G. Reed, Director of Hazardous Waste Site Evaluation Division, Office of Emergency and Remedial Response. EPA/9285.7-081. 22 June.

_____. 1994 Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis. February

———. 1995. EPA Region IX Toxicologist, Stralka, D. Personal communication with Xuannga Mahini of Ogden Environmental and Energy Services, Inc. 30 August.

———. 1997a. Exposure Factors Handbook. EPA/600/P-95/002Fa,b,c. Office of Research and Development. August.

———. 1997b. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (ERAGS).* Interim Final. EPA 540/R-97/006. Office of Solid Waste and Emergency Response, Washington, D.C. June.

———. 1999. *Perchlorate.* Office of Groundwater and Drinking Water. Washington DC. http://www.epa.gov/ogwdw000/ccl/perchlor/perchlo.html.

———. 2000a. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 1. NUREG-1575; Rev.1, EPA/402/R-97/016 Rev. 1; DOE/EH-0624, Rev.1.* August.

———. 2000b. *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, Part I: Estimating Exposure to Dioxin-like Compounds, vol. 2 (Sources of Dioxin-like Compounds in the United States), and Part II: Health Assessment for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds, Chapter 9. Toxicity Equivalence Factors (TEF) for Dioxin and Related Compounds.* Office of Research and Development, Washington, D.C. NCEA-I-0836. May.

———. 2000c. *Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G9, QA00 Update,* EPA/600/R-96/084 U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC.

———. 2001a, *Record of Decision for the Western Groundwater Operable Unit OU-3 Aerojet Sacramento Site, Rancho Cordova, California.* San Francisco, CA. July.

_____. 2001b. ProUCL- Version 2, [software for Windows 95, accompanied by "Pro UCL User's Guide." Prepared for EPA by Lockheed Martin.

———. 2002a. Calculating Upper Confidence Limits For Exposure Point Concentrations at Hazardous Waste Sites. Office Of Emergency and Remedial Response. OSWER 9285.6-10. December.

———. 2002b. *Perchlorate Environmental contamination: Toxicological Review and Risk Characterization. External Review Draft,* NCEA-1-0503. US Environmental Protection Agency, Office of Research and Development, January.

———. 2003a. Memorandum, Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. Washington. 5 December.

———. 2003b. *Integrated Risk Information System (IRIS).* On-line database of human health effects that may result from exposure to various substances found in the environment. URL: http://www.epa.gov/iris/.

———. 2003c. Draft Final Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001A. NCEA-F-0644A. Risk Assessment Forum. February.

———. 2003d. *Health Effects Support Document for Naphthalene.* U.S. Environmental Protection Agency Office of Water (4304T) Health and Ecological Criteria Division, Washington, DC 20460 www.epa.gov/safewater/ccl/pdf/naphthalene.pdf,EPA 822-R-03-005,February.

———. 2004a. EPA Region 9 PRGs. Site is located at EPA Internet home page: http://www.epa.gov/region09/waste/sfund/prg/. November.

_____. 2004b. Distribution of OSWER Radionuclide ARAR Dose Compliance Concentrations (DCCs) for Superfund Electronic Calculator, January 28, 2004. http://epa-dccs.ornl.gov/

———.2004c. ProUCL - Version 3 [software accompanied by "ProUCL User's Guide."] Prepared for EPA by Lockheed Martin.2004.

———. 2004d. *Risk Assessment Guidance for Superfund: Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).* Office of Emergency and Remedial Response. July.

_____. 2004e. Johnson & Ettinger Excel Spreadsheet for Evaluating Vapor Intrusion. February. http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

_____. 2005a. Guidelines for Carcinogenic Risk Assessment. EPA/630/P-03-001F.

———. 2005b. Guidance for Developing Ecological Soil Screening Levels. Office of Solid Waste and Emergency Response. February.

———. 2006. Assessment Guidance for Perchlorate. Office of Solid Waste and Emergency Response. January.

United States Fish and Wildlife Service (USFWS). 1989. *Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Animal Notice of Review. 50 CFR Part 17.*

_____. 1990. *Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review. 50 CFR Part 17.*

_____. 1992. *Endangered and Threatened Wildlife and Plants. United States Fish and Wildlife Service Federal Register. 50 CFR 17.11 and 17.12, pp. 1–38, August 29, 1992.* as updated.

_____. 1993. *Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review. 50 CFR, Part 17.*

Urbansky, E. T. 1998. Perchlorate Chemistry: Implications for Analysis and Remediation. CRC Press. http://clu-in.org/contaminantfocus/default.focus/sec/perchlorate/cat/Chemistry_and_Behavior/

_____. *2002. Perchlorate as an Environmental Contaminant. Environmental Science and Pollution Research; 9 (3): 187 – 192.*

World Health Organization (WHO). 1997. *Toxicity Equivalent Factors* (TEF). Geneva.

Xu, J.; Song, Y.; Min, B.; Steinberg, L.; Logan, B. E. 2003. Microbial Degradation of Perchlorate: Principles and Applications. Environmental Engineering Science; 20 (5): 405 – 422.

Appendixes
(included on compact disc in Adobe Acrobat® format)

Appendix A
CERCLA Documentation Process and RCRA Facility Closure Comparison

Appendix A
CERCLA Documentation Process and RCRA Facility Closure Comparison

CERCLA	RCRA	REMARKS
Draft Remedial Investigation (RI) Work Plan Final RI Work Plan	Closure Plan (Interim Status Facility) • Facility Information • Waste Description • Soil Sampling • Groundwater Sampling • Analytical Methods • Soil Removal Procedures 45-day Public Notice Approval of Closure Plan	Application for Open Burn/Open Detonation Unit Permit was submitted in June 1988. The Closure Plan is a component of the Part B Application. Public Notice of Permit Actions and Public Comment period applies to a Draft Permit. Process for Closure Plan approval and associated requirements must be agreed upon between DTSC and Navy. RI Work Plan and RI Report will undergo BCT review.
RI Field Work Implementation	Implementation of Closure Plan	
Final RI Report		
Feasibility Study (FS) *Draft Final Proposed Plan (PP)*	*Post-Closure Plan* *Draft Permit* *45 day Public Notice*	*FS and PP documents will undergo BCT review. The Draft Final PP will also be made available for public review/comments.*
Record of Decision (ROD)/No Further Action (NFA) Decision Document	*Issuance of Post Closure Permit*/Closure Certification Report	*The ROD will undergo BCT review and public review/comments.*
Remedial Design (RD) *Remedial Action (RA)* *Operation and Maintenance (O&M)*	*Implementation of Post Closure Plan*	
Long Term Monitoring (LTM) Site Close-out	*Post-Closure Certification Report*	

Note:
Italicized tasks will be conducted only if required.
BCT = BRAC (Base Realignment and Closure) Cleanup Team
DTSC = Department of Toxic Substances Control

Appendix B
Borehole and Interpretive Logs

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW101
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197826.9 *Easting:* 6124760.45	Sheet *1* of *5*
Drilling Agency: Layne Environmental Services	Driller:	
Drilling Equipment:	Date Started: 2/8/1996	Total Depth (feet): 159.0
Drilling Method:	Number of Samples:	Date Finished:	Depth to Bedrock (feet): 3.0
Drilling Fluid:	Borehole Diameter (in): 9	Depth to Water (feet): *Drilling:* 120.00 *Static:* 63.80
Completion Information: Completed as a monitoring well	Elevation (feet MSL): *Ground:* 752.00 *Top of Casing:* 752.61	
	Logged By: D. Parker/ Bechtel	Checked By: C. Lind/ Bechtel

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND; very dark grayish brown (10YR3/2), dry, fine to coarse grained, well graded, dense.		
										WBr	SANDSTONE; white (N9), semiconsolidated, predominantly quartz, trace silt, dry, very fine to very coarse-grained, hard to friable, subangular grains, slightly weathered.		
5													
10													
15													
20													
25													
30													

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW101
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
35													
40													
45													
50													
55													
60													
65													

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW101
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 5

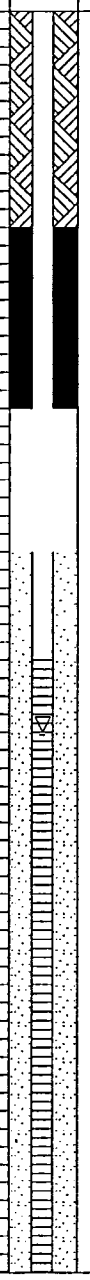
Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
70													
75													
80													
85													
90													
95													
100													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW101
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
105													
110													
115													
120													
125													
130													
135													



EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW101
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 5 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
140													
145													
150													
155													

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW102	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2198004.75 *Easting:* 6124203.59	Sheet *1* of *5*	
Drilling Agency: Layne Environmental Services	Driller:		
Drilling Equipment:	Date Started: 2/14/1996	Total Depth (feet): 140.5	
Drilling Method:	Number of Samples:	Date Finished: 2/28/1996	Depth to Bedrock (feet): 3.0
Drilling Fluid:	Borehole Diameter (in): 9	Depth to Water (feet): *Drilling:* 122.50	*Static:* 108.50
Completion Information: Completed as a monitoring well		Elevation (feet MSL) : *Ground:* 759.89	*Top of Casing:* 759.40
		Logged By: D. Parker/ Bechtel	Checked By: C. Lind/ Bechtel

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										ML	SILT; brown (10YR), dry, some fine to medium grained sand, stiff, organics (grass, weeds).		
5										WBr	SANDSTONE, semiconsolidated, white (N9), predominantly quartz, approximately 15% biotite, silty matrix, fine- to coarse-grained, slightly hard to friable, crumbles easily from hard pressure, massive, slightly weathered.		
10													
15													
20													
25													
30													

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW102
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
35													
40													
45													
50													
55													
60													
65													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW102
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
70													
75													
80													
85													
90													
95													
100													

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW102
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
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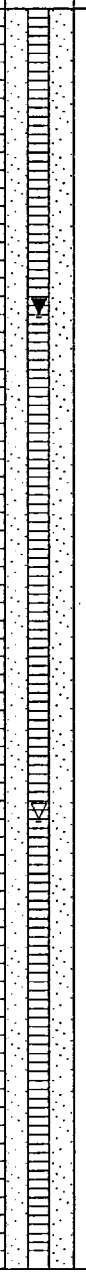
110													
115													
120													
125													
130													
135													



IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW102
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 5 of 5

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
140													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW201	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196636.9	*Easting:* 6124259.7	Sheet *1* of *3*
Drilling Agency: Layne Environmental Services	Driller:		
Drilling Equipment:	Date Started: 3/25/1999	Total Depth (feet): 62.0	
Drilling Method:	Number of Samples:	Date Finished: 3/26/1999	Depth to Bedrock (feet): 17.0
Drilling Fluid:	Borehole Diameter (in): 10.5	Depth to Water (feet): *Drilling:* 37.50	*Static:* 37.90
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 665.49	*Top of Casing:* 665.99
		Logged By: D. Parker/ Bechtel	Checked By: C. Lind/ Bechtel

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SW	SAND, grayish brown (10YR5/2), slightly moist, dense, fine- to coarse-grained, subangular grains.		
5										SM	SILTY SAND, dark reddish gray (5YR4/2), moist, medium- to very coarse-grained, medium dense, subrounded grains.		
10													
15													
20										WBr	SANDSTONE, semiconsolidated, white, predominantly quartz, approximately 5% biotite medium- to very coarse-grained.		
25													
30													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW201
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
35													
40													
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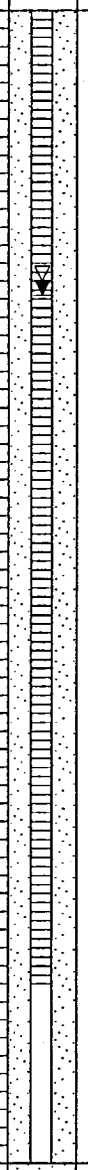
55													
60													



EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW201
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples					Field Analysis			Log		Lithologic Description	Well Construction Diagram	Remarks
	Number	Type	Blow Count	Percent Recovery	Time	FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Graphic	USCS or Rock Type			

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW202	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197363.17 *Easting:* 6124357.73	Sheet *1* of *2*	
Drilling Agency: Layne Environmental Services	Driller: Louie Monye		
Drilling Equipment: AP 1000	Date Started: 10/26/1999	Total Depth (feet): 60.0	
Drilling Method: Air Percussion	Number of Samples: 7	Date Finished: 10/28/1999	Depth to Bedrock (feet): 13.0
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 46.60	*Static:* 20.06
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well		Elevation (feet MSL): *Ground:* 689.32	*Top of Casing:* 691.79
		Logged By: R. Lazo	Checked By: J. Stanek 4/4/2000

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SC	CLAYEY SAND; 90% medium to coarse sand; 10% medium plasticity clay; slightly moist		Hand-augered to 10 feet
5													
10	LD021			100	1055								
											SANDSTONE; pale yellow; uncemented		
15										WBr			Dry
20	LD022			40	1123						SANDSTONE; light gray; uncemented but dense		Slightly moist
25	LD023			40	1150						SANDSTONE as above		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW202
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD024				1205						SANDSTONE; light gray; cemented; 80% quartz/10% plagioclase/10% potassium feldspar; slightly moist		
35	LD025				1218						SANDSTONE as above		
40	LD026				1232						SANDSTONE as above		
45	LD027				1255					WBr	SANDSTONE; light gray; 90% quartz/10% plagioclase/10% potassium feldspar; moist to water saturated		First water at 46.6'
50											SANDSTONE as above; moist		
55											SANDSTONE as above		
60											Total Depth = 60.0 feet		

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW203	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197012.59	*Easting:* 6124374.23	Sheet *1* of *2*
Drilling Agency: Layne Environmental Services	Driller: Louie Monye		
Drilling Equipment: AP 1000	Date Started: 10/28/1999	Total Depth (feet): 60.0	
Drilling Method: Air Percussion	Number of Samples: 11	Date Finished: 10/29/1999	Depth to Bedrock (feet): 5.0
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 43.00	*Static:* 27.75
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well		Elevation (feet MSL): *Ground:* 679.08	*Top of Casing:* 681.46
		Logged By: R. Lazo	Checked By: J. Stanek 4/4/2000

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND		Hand-augered first 10 feet on 10/27/99
5											SANDSTONE; light gray; uncemented; slightly moist		
10	LD029				1313					WBr	SANDSTONE; light gray; uncemented but dense; 80% quartz/10% potassium feldspar; 10% plagioclase; slightly moist		
15	LD030				1335						SANDSTONE as above but dry		
20	LD031				1346						SANDSTONE as above but slightly moist		
25	LD032				1413						SANDSTONE as above		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW203
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD033				1422						SANDSTONE; light gray; uncemented; very dense; friable; slightly moist		
35	LD034				1440						SANDSTONE as above; moisture increasing slightly		
40	LD035				1451					WBr	SANDSTONE as above but moist		
45	LD036				1508						SANDSTONE as above; moist		
50	LD037				1520						SANDSTONE as above; moist		
55	LD038				1537						SANDSTONE as above; moist		
60	LD039				1553						Total Depth = 60.0 feet		

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW204	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196799.89	*Easting:* 6124173.1	Sheet *1* of *2*
Drilling Agency: Layne Environmental Services	Driller: Louie Monye		
Drilling Equipment: AP 1000	Date Started: 10/29/1999	Total Depth (feet): 57.0	
Drilling Method: Air Percussion	Number of Samples: 7	Date Finished: 11/1/1999	Depth to Bedrock (feet): 39.0
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 36.70	*Static:* 37.39
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 663.35	*Top of Casing:* 665.99
		Logged By: R. Lazo	Checked By: J. Stanek 4/4/2000

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND		Hand-augered first 10 feet
5										SP	SAND; brown; 95% medium sand; 5% silt; soft; loose; wet		
10	LD042				1444								
15	LD043				1454						SAND as above but no silt; yellowish brown; wet		
20	LD044				1459						SAND; pale brown; 100% fine to medium sand; loose; wet		
25	LD045				1506						SAND; yellowish brown; medium to coarse sand; loose; poorly graded; moist to wet		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW204
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD046				1513						SAND; yellowish brown; 95% fine to medium sand; 5% silt; loose; water saturated		
35	LD047				1522						SAND; pale brown; fine to medium sand; trace silt and clay; water saturated		
40	LD048				1532					WBr	SANDSTONE; weathered, light gray; uncemented; soft; moist		
45											SANDSTONE; light gray; moist		
50											SANDSTONE as above		
55											SANDSTONE as above but brown; moist		
											SANDSTONE; light gray; moist Total Depth = 57.0 feet		

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW205	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196396.95	*Easting:* 6123963.72	Sheet *1* of *2*
Drilling Agency: Layne Environmental Services	Driller: Louie Monye/Jim Kline		
Drilling Equipment: AP 1000/HSA	Date Started: 11/1/1999	Total Depth (feet): 60.0	
Drilling Method: Air Percussion/HSA	Number of Samples: 9	Date Finished: 11/5/1999	Depth to Bedrock (feet): 33.0
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 47.20	*Static:* 34.71
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well.	Elevation (feet MSL): *Ground:* 642.14	*Top of Casing:* 644.57	
	Logged By: R. Lazo\R. Brenner	Checked By: J. Stanek 4/4/2000	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND; dark brown to black; moist; soft		Hand-augered first 5 feet
5										SM	SILTY CLAYEY SAND; black; compacted; hard; dense; dry		No recovery
10	LD050				1312								Hard to collect samples
										SP	SAND; pale olive; medium to coarse sand; poorly graded, loose; moist		
15	LD051				1320								
20	LD052				1330						Sand as above		
										CL	SANDY CLAY; olive brown; 90% high plasticity clay; 10% medium sand; moist; dense		
25	LD053				1336								
30													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW205
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD054				1344					SP	SAND; pale yellow; 95% fine to medium sand; trace clay; soft; dense; moist		
										WBr	SANDSTONE; light gray; uncemented; friable; moist		Bedrock
35	LD055				1357								
40	LD056				1410						SANDSTONE; light gray; slightly moist		
45	LD057				1421						SANDSTONE as above		
											SANDSTONE as above		
50	LD058				1500								Drilled on 11-2-99
55											SANDSTONE as above		
60											Total Depth = 60 feet		

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW206	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196059.47 *Easting:* 6123914.6	Sheet *1* of *2*	
Drilling Agency: Layne Environmental Services	Driller: Jim Kline		
Drilling Equipment: Hollow Stem Auger	Date Started: 11/2/1999	Total Depth (feet): 60.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 12	Date Finished: 11/4/1999	Depth to Bedrock (feet): 18.0
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 32.70	*Static:* 33.88
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 633.66	*Top of Casing:* 635.81
		Logged By: R. Brenner	Checked By: J. Stanek 4/4/2000

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND; dark brown; 75% fine sand; 25% silt; some organic matter (roots); trace clay; moist; loose		Hand augered first 5 feet
5	LD060		9 8 8		0912								
10	LD061		6 6 8		0926					SC	CLAYEY SAND; dark brown; 75% fine to medium sand; 25% plastic fines; loose; moist		
15	LD062		5 4 4		0942						CLAYEY SAND; light brown; 85% fine to medium sand; 15% plastic fines; loose; moist		
20	LD063		9 10 14		0950					WBr	SANDSTONE, Weathered; light yellowish brown to gray; 80% fine to medium sand; poorly graded; 20% plastic fines; interbedded clay; micaceous		Partially cemented
25	LD064		8 18 24		1001					WBr	SANDSTONE; yellowish brown; 95% fine to medium sand; poorly graded; 5% non-plastic fines; loose; slightly moist; micaceous		
30													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW206
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD065		21 34 40		1014					WBr	POORLY GRADED SAND; light gray; 95% fine to medium sand; poorly graded; 5% fines; some clay; medium dense; slightly moist; micaceous		
35	LD066		11 82		1032						Same as above		
40	LD067		17 21 34		1052						Same as above; dense		
45	LD068		16 41 50/5"		1115						Same as above		
50	LD069		32 68		1138						Same as above with trace gravel; dense; moist; angular		
55	LD070		12 50/2"		1201						Same as above; light gray; fine to medium sand; moist; dense Same as above; moisture content slightly higher than at 55'		
60	LD071		14 23 67		1218						Total Depth = 60.0 feet		

EARTH TECH

Borehole/Well Construction Log

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW207	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195753.96	*Easting:* 6123365.07	Sheet *1* of *2*
Drilling Agency: Layne Environmental Services	Driller: Jim Kline		
Drilling Equipment: Hollow Stem Auger	Date Started: 11/3/1999	Total Depth (feet): 56.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 9	Date Finished: 11/4/1999	Depth to Bedrock (feet): 19.5
Drilling Fluid: Air	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 39.00	*Static:* 42.17
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 618.18	*Top of Casing:* 620.23
		Logged By: R. Brenner	Checked By: J. Stanek 4/4/2000

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND; Dark Brown; 85% Fine Sand; 15% Plastic Silt		Hand augered first 5 feet
5	LD073				0815								
10	LD074		5 11 24		0824					SC	CLAYEY SAND; Light Yellowish Brown; 80% Fine To Medium Sand; 20% Plastic Clays; Moist		
15	LD075		7 12 34		0838						Same As Above		Small 4" layer of SM at 14.5' as described at 5'; dark brown
20	LD076		16 27 50		0850					WBr	SANDSTONE: weathered; poorly graded; Light Yellowish Brown; 95% Fine To Coarse Sand; 5% Non-plastic Silt; Dry; Loose		Alluvium/bedrock contact
25	LD077		9 17 48		0901						Same As Above		
30													

IRP Site 1, MCAS El Toro\Verification of Perchlorate at IRP Site 1\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Verification of Perchlorate at IRP Site 1	Project Number: 36097	Borehole Number: 01-MW207
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	LD078		11 15 50		0912					WBr	SANDSTONE; Light Yellowish Brown; 95% Fine To Coarse Sand; 5% Non-plastic Fines; Moist		
35	LD079		10 50		0922						Same As Above		
40	LD080		87/6"		0952						Same As Above; Saturated		
45	LD081		107/6"		1004						Same As Above		
50											Same As Above		
55													
											Total Depth = 56.0 feet		

EARTH TECH

Borehole/Well Construction Log

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW208	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196593.18 *Easting:* 6123574.74	Sheet *1* of *2*	
Drilling Agency: BC2	Driller: Diego Torices		
Drilling Equipment: CME 85	Date Started: 5/16/2002	Total Depth (feet): 65.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 5/17/2002	Depth to Bedrock (feet): 19.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 48.00	*Static:* 42.32
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 661.13	*Top of Casing:* 663.59
		Logged By: R. Lazo	Checked By: D. Swensson 8/2002

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	Silty Sand, dark olive gray (5Y3/2), med. to fine sand, loose, with some low plasticity silt, soft, slightly moist		Hand augered to 5 ft.
5		X	1 18 22		1253		0			SM	Silty Sand, as above, but dense.		Sampling for lithologic description only.
10		X	15 20 21		1300		0			SP	Poorly Graded Sand, olive brown (2.5Y4/3) med. to fine sand, poorly graded, dense, moist.		
15		X	17 17 21		1304		0			SP	Poorly Graded Sand, as above, but light gray (5Y7/2) in color.		
20		X	28 30 45		1308		0			WBr	Weathered Bedrock Sandstone- (Sand), light gray (5Y7/2), fine grained sand, very dense, trace of iron oxidation, slightly moist.		Trace rust-like staining.
25		X	43 50		1312		0			WBr	Weathered Bedrock-Sandstone, as above		
30													

IRP Site 1, MCAS El Toro\Tier III\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW208
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	36 37 50		1320		0			WBr	Weathered Bedrock Sandstone (Sand), pale olive (5Y6/3), fine grained sand, very dense, some iron oxidation, slightly moist.		
35		X	40 49		1330		0			WBr	Weathered Bedrock Sandstone, as above but, moist.		Moisture.
40		X	32 48 50		1335		0			WBr	Weathered Bedrock-Sandstone, as above		
45		X	30 32 45		1342		0			CBr	Bedrock Sandstone (Sand), gray (5Y6/1), med. to fine grained sand, very dense and very moist.		Moisture. First water.
50		X	20 21 22		1350		0			CBr	Bedrock-Sandstone, as above, but dense and water saturated.		
55					1400		0			CBr	Bedrock Sandstone; as above, water saturated.		
60					1410		0			CBr	Bedrock Sandstone, as above ,water saturated.		
65					1418		0						

EARTH TECH

Borehole/Well Construction Log

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW209	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196596.41	*Easting:* 6124094.27	Sheet *1* of *2*
Drilling Agency: BC2	Driller: Diego Torices		
Drilling Equipment: CME 85	Date Started: 5/15/2002	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 5/17/2002	Depth to Bedrock (feet): 25.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 30.60	*Static:* 36.94
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 651.28	*Top of Casing:* 653.73
		Logged By: R. Lazo	Checked By: D. Swensso8/2002

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	Silty Sand, dark olive brown (2.5Y4/4), med. to fine sand, with some low plasticty silt, slightly moist.		Hand augered to 5 ft.bgs
5		X	30 47 50		0910		0			SP	Poorly Graded Sand, olive brown (2.5Y4/4), med. to coarse sand, very dense, with some gravel subangular, slightly moist.		Sampling for lithologic description only
10		X	18 27 38		0935		0			SP	Poorly Graded Sand, light olive brown (2.5Y5/3), med. to coarse sand, very dense, trace med. plasticity clay, slightly moist.		
15		X	17 25 38		0940		0			SP	Sand, as above		
20		X	14 28 30		0945		0			SP	Poorly Graded Sand; light brownish gray (2.5Y6/2), med. to fine sand, very dense, trace clay, moist.		Moisture
25		X	25 49 45		0950		0			WBr	Weathered Bedrock-Sandstone; light gray (5Y7/2), med. to fine sand, very dense,slightly moist.		
30													

IRP Site 1, MCAS El Toro\Tier III\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW209
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	49 30 50		1000		0			WBr	Weathered Bedrock-Sandstone; light gray (5Y7/2), med. to fine sand, very dense, slightly moist.		
35		X	40 50 50		1007		0			CBr	Bedrock-Sandstone; white(5Y8/1), sand, med. to fine grained, poorly graded, very dense, slightly moist.		
40		X	35 50 30		1015		0			CBr	Bedrock-Sandstone, as above.		
45		X	30 40 50		1025		0			CBr	Bedrock-Sandstone as above but, moist.		
50		X	50 50		1040		0			CBr	Bedrock-Sandstone; as above		
55		X	50		1050		0						

EARTH TECH

Borehole/Well Construction Log

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW210	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196755.36 *Easting:* 6124443.41	Sheet *1* of *3*	
Drilling Agency: BC2	Driller: Diego Torices		
Drilling Equipment: CME 85	Date Started: 5/15/2002	Total Depth (feet): 70.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 5/17/2002	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 37.50	*Static:* 42.95
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 689.83	*Top of Casing:* 692.08
		Logged By: R. Lazo	Checked By: D. Swensso8/2002

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										WBr	Weathered Bedrock-Sandstone		Bedrock-Sandstone on surface
5			50		1240		0			WBr	Weathered Bedrock-Sandstone; white (5Y8/1), med to fine poorly graded sand, dense to very dense, slightly moist.		Sampling for lithologic description only
10			35 45 50		1250		0			WBr	Weathered Sandstone; as above		
15			27 43 47		1300		0			WBr	Weathered Sandstone; as above		
20			27 31 40		1307		0			CBr	Bedrock-Sandstone; light gray (5Y7/1), moist.		Moisture
25			38 40 44		1315		0			CBr	Bedrock-Sandstone, as above.		
30													

IRP Site 1, MCAS El Toro\Tier III\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW210
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	21 38 50		1325		0			CBr	Bedrock-Sandstone; light gray (5Y7/1), med. to fine sand, poorly graded, very dense, trace angular gravel up to 1/4 inch, slightly moist.		
35		X	33 48 41		1335		0			CBr	Bedrock-Sandstone; as above		
40		X	44 50		1345		0			CBr	Bedrock-Sandstone; as above		
45		X	40 49 50		1355		0			CBr	Bedrock-Sandstone; light gray (5Y7/1), med. to fine poorly graded sand, with some fragments of sandstone, very dense, slightly moist.		
50		X	31 50 50		1415		0			CBr	Bedrock-Sandstone; as above		
55		X	27 39 48		1434		0			CBr	Bedrock-Sandstone; as above		
60		X	39 40 43		1447		0			CBr	Bedrock-Sandstone; as above		
65													

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: Tier III	Project Number: 36097	Borehole Number: 01-MW210
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	40 50		1500		0			CBr	Bedrock-Sandstone; as above.		
70													

IRP Site 1, MCAS El Toro\Tier III\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW211	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2192697.77	*Easting:* 6121623.74	Sheet *1* of *3*
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/16/2004	Total Depth (feet): 70.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/16/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* 55.50	*Static:* 45.48
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 545.54	*Top of Casing:* 547.64
		Logged By: L. Browne	Checked By:

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				90	1210					SM	SILTY SAND; light olive brown (2.5Y 5/3); 80% fine sand; 20% silt; trace subangular to subrounded gravel; dry; loose.		
										ML	SILT; grayish brown (10YR 5/2); 60% silt; 20% fine sand; 20% clay; dry; reacts strongly with HCl; white concretions throughout; slightly moist.		
5				75	1220						Massive.		
10				0	1230					SM	No sample recovery - description from cuttings: SILTY SAND; (10YR 5/1); about 70% sand; 30% silt; dry; loose; no odor.		Very soft according to driller.
15				90	1238					SW	SAND; light gray (10YR 7/2); 90% fine to coarse, subangular, arkosic sand; 5% subangular to subrounded gravel; 5% silt; micaceous; dry; loose; no odor.		
										ML	SILT with SAND; brown (10YR 5/3); 70% silt; 25% fine sand; 5% white concretions (reacts with HCl); slightly moist; massive; no odor.		
20				0	1245					SP	No sample recovery - description from cuttings: poorly graded SAND; (10YR 8/2); 95% fine sand; 5% silt; dry; loose; no odor.		Very soft according to driller.
25				90	1310					ML	SILT with SAND; brown (10YR 5/3); 70% silt; 20% fine sand; 10% white concretions; $CaCO_3$ cementation reacts strongly with HCl; moist; nonplastic.		
30													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW211
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100							Color change to brown (7.5YR 4/4); grading to 70% silt; 10% clay; 10% sand; 10% $CaCO_3$; moist.		
35				100						CL	CLAY with SAND; yellowish brown (10YR 5/4); 70% clay; 25% fine sand; 5% silt; moist; nonplastic.		
										WBr	SILTSTONE; yellowish brown (10YR 5/4); 60% silt; 20% fine sand; 10% clay; 10% $CaCO_3$; reacts with HCl; moist		
											Laminar bedding 1/16" thick.		
40				100							Color change to yellow (10YR 8/6); grades to 90% silt; 5% fine sand; 5% clay; very moist; massive; reacts with HCl from 41.5-42.5 feet (10% $CaCO_3$).		
45				100							Color variation from yellow (10YR 8/6) to olive (5Y 5/3).		Bentonite seal from 46-48 feet.
											Color change to yellow (10YR 7/6); massive; moist; no odor.		# 3 Sand from 48-61 feet.
50				100							Color grades to yellow (2.5Y 8/6).		0.020-inch slotted screen 50-60 feet.
55				100						WBr	WEATHERED SANDSTONE; light yellowish brown (2.5Y 6/4); 60% fine sand; 40% silt; very moist; trace clay.		Producing water from 55.5-58 feet.
60				100						WBr	SILTSTONE; yellow (2.5Y 7/6) with FeO staining; laminar bedding olive (5Y 5/3); 60% silt; 40% fine sand.		
											Grades to massive; trace medium sand; micaceous; moist; yellow (2.5Y 7/6).		
65													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

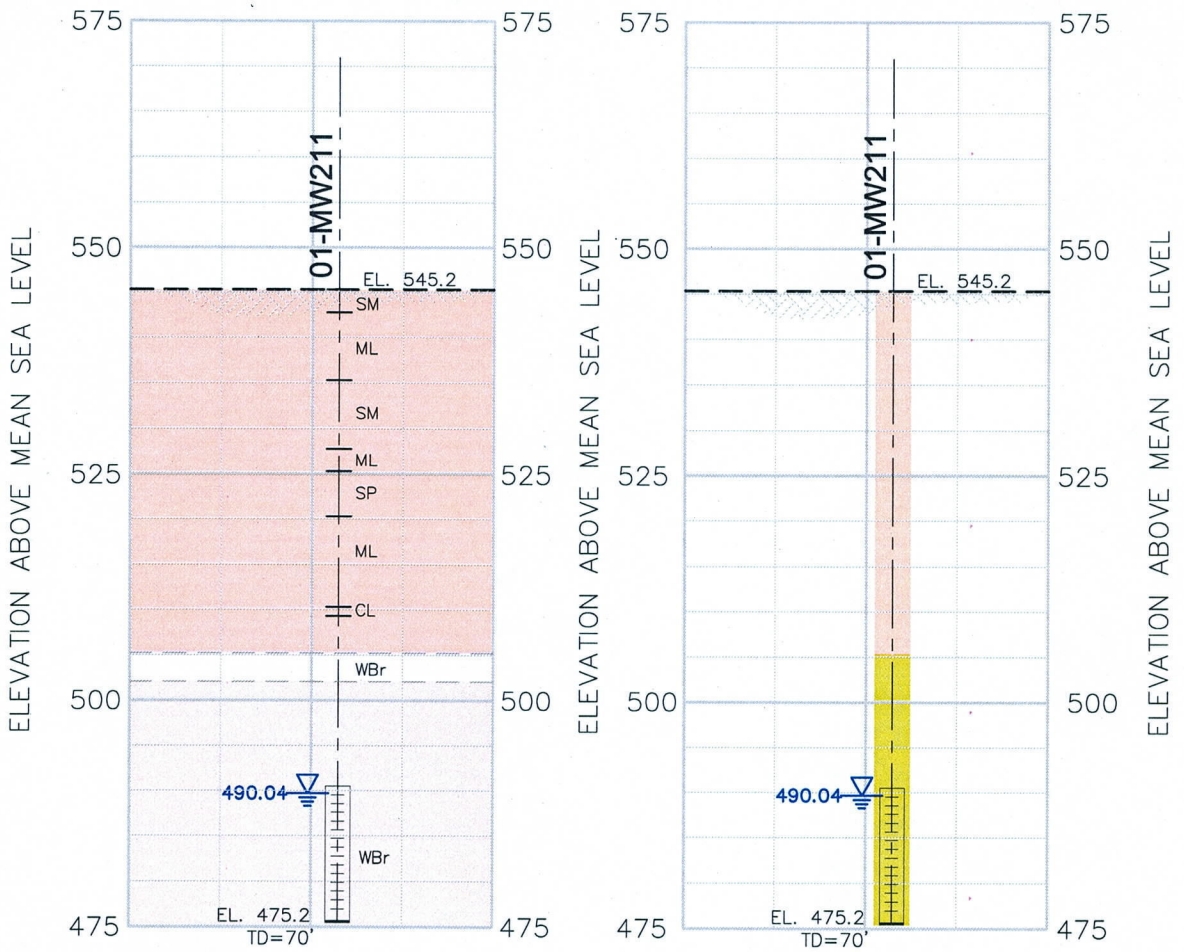
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW211
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100							Grading to 75% silt; 25% fine sand; moist.		Borehole filled with grout to 61 feet.
											Color change to very dark gray (10YR 3/1).		Boring termination @ 70 feet bgs.
70											Total Depth = 70 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

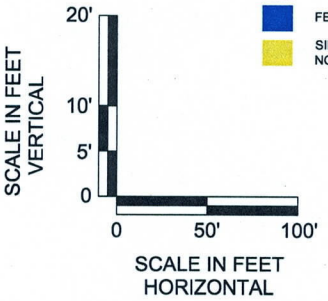
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

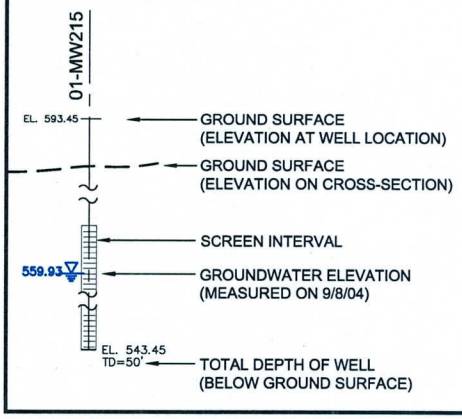
CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI	Perchlorate Summary Memo

01-MW211
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro	
Project No. 36097	EarthTech A Tyco International Ltd. Company	

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW212	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194721.48	*Easting:* 6122226.11	Sheet *1* of *2*
Drilling Agency: West Hazmat Drilling Corp.	Driller: Troy Robinson		
Drilling Equipment: CME 85	Date Started: 8/10/2004	Total Depth (feet): 35.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 8/10/2004	Depth to Bedrock (feet): 28.0
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* 30.00	*Static:* 32.30
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 585.45
		Logged By: L. Browne	Checked By:

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											No Sample Recovery.		2-inch dia., 5-foot length core barrel for continuous sampling.
				100	1505					SM	SILTY SAND; light olive brown (2.5Y 6/4); 80% fine sand; 20% silt; dry; loose; no odor.		
5				100	1509					SC	CLAYEY SAND; brown (10YR 5/3); 70% fine sand; 30% clay; slightly moist; trace subangular to subrounded gravel.		
				100	1514						Increasing gravel content with depth.		
10				100	1521					WBr	CLAYSTONE; (5Y 7/6); 60% clay; 40% fine sand; slightly moist; soft; no odor; laminar deposition; some FeO stains (laminar).		
				100	1529								
15											Color change to (2.5 Y 6/6).		
											Color change to (5Y 6/4); increasing clay content; grading to 75% clay; 25% silt; fine sand.		Bentonite seal from 16 to 18 feet.
				100	1538								# 3 Sand from 18-35 feet.
20													
				100	1549								
25											Moist.		
				90						WBr	SANDSTONE; (5Y 8/2); fine grained sands; weathered feldspars; micaceous; very moist.		
30													

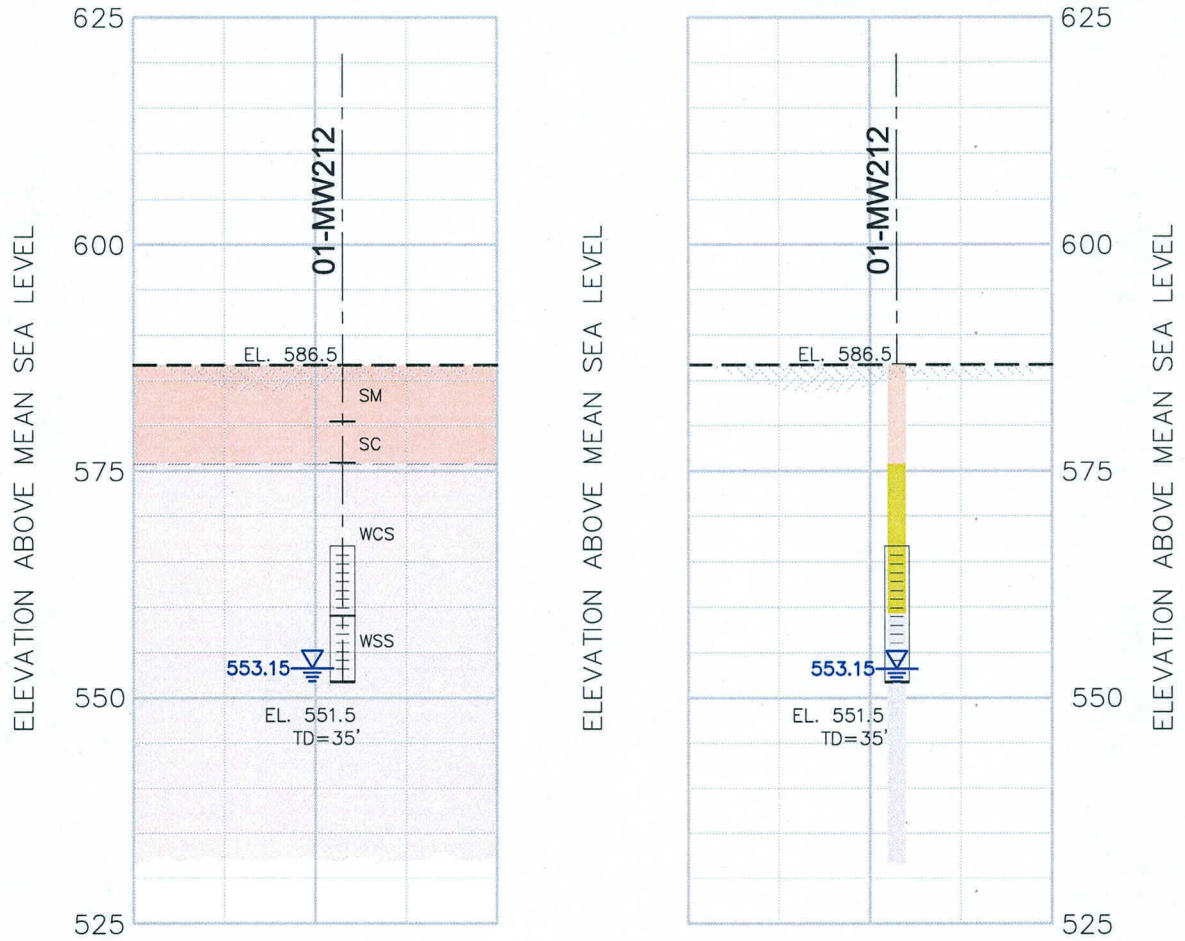
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW212
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										WBr	Same as above.		0.020-inch slotted screen 20-35 feet.
				100	1600					WBr	Grades to highly weathered SANDSTONE; 95% fine to medium sand; 5% silt; micaceous; loose; saturated.		
35											Total Depth = 35 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

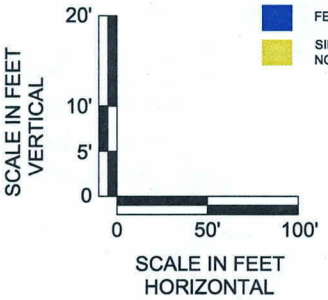
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



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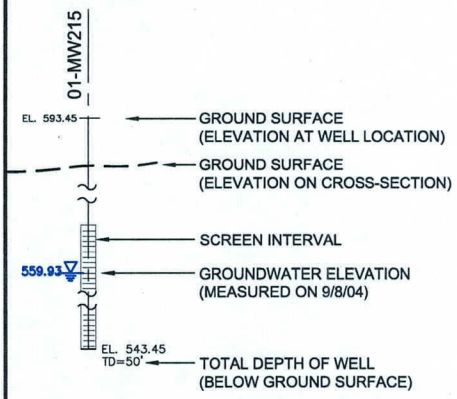

Phase II RI

01-MW212
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW213	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194507.79	*Easting:* 6122166.97	Sheet *1* of *2*
Drilling Agency: West Hazmat Drilling Corp.	Driller: Troy Robinson		
Drilling Equipment: CME 85	Date Started: 8/11/2004	Total Depth (feet): 43.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 8/11/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* 30.00	*Static:* 28.82
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 580.49	*Top of Casing:* 583.04
		Logged By: V. Diep	Checked By:

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP-SM	(Top Soil) SILTY SAND; gray (10YR 5/1); 90% fine sand, 10% silt; dry; loose; grass; no odor.		
										ML	SILT; grayish brown (10YR 5/2) 95% silt, 5% fine sand; dry; loose; no odor.		
5													
											Grading to 90% silt, 10% fine sand; color change to brown (10YR 5/3); trace angular rock fragments.		
10													
15										ML	SILT with SAND; brown (10YR 4/3); 80% silt, 20% sand; loose; soft; no odor.		
										CL	CLAY: 90% clay, 10% fine sand; low plasticity; moderate density; faintly moist; no odor.		
20										SM	SILTY SAND; 75% sand, 25% silt; low plasticity; moderate density; faintly moist; no odor.		Bentonite seal from 21-23 feet.
										SC	CLAYEY SAND; brown (10YR 5/3); 60% fine sand, 40% clay, trace gravel to 1.5 inches in diameter; moist; soft; no odor.		# 3 Sand from 23-41 feet.
25											Grading to 75% clay, 25% fine to medium, subangular to subrounded sand; trace rock fragments and subrounded pebbles.		0.020-inch slotted
30													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

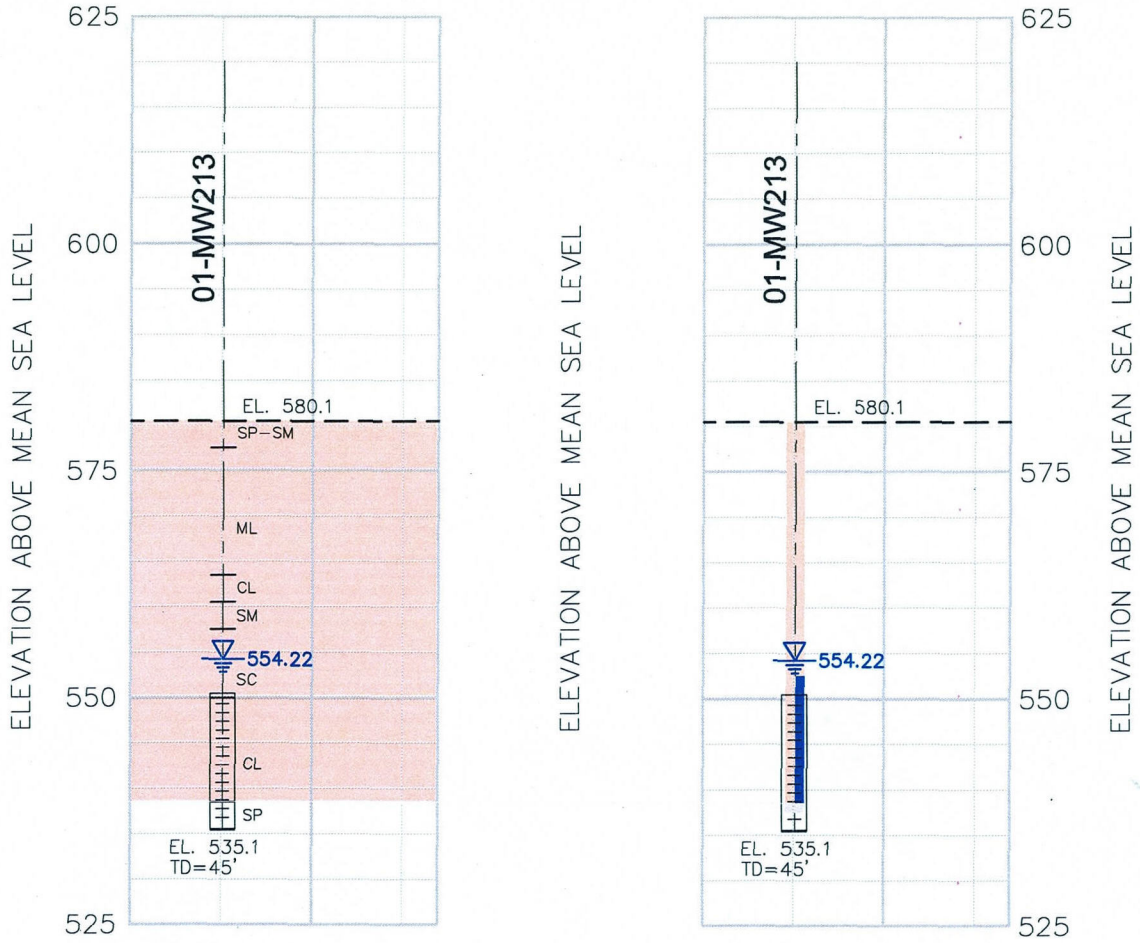
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW213
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										CL	CLAY with SAND; 80% clay, 20% sand.		screen 25-40 feet.
35											CLAY; light olive brown (2.5Y 5/4), 90% clay; 10% fine sand; plastic; trace subrounded gravel; trace organics; light FeO staining; clay content increasing with depth.		
40										SP	SAND; 95% fine sand, 5% clay; trace subrounded pebbles; soft; very moist.		Borehole filled with grout to 41 feet.
											Total Depth = 43 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY *AND HIGHLY WEATHERED BEDROCK OF THE* CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

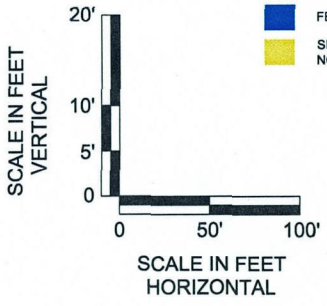
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



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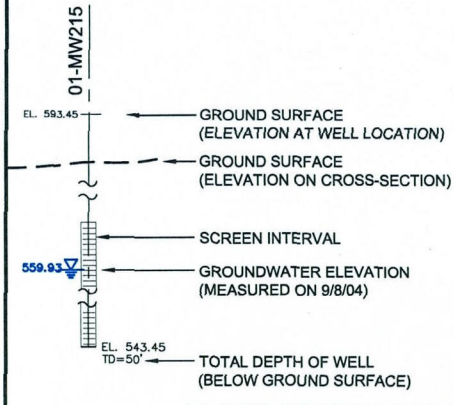

Phase II RI

01-MW213 INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW214	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194517.49	*Easting:* 6122360.37	Sheet *1* of *2*
Drilling Agency: West Hazmat Drilling Corp.	Driller: Troy Robinson		
Drilling Equipment: CME 85	Date Started: 8/11/2004	Total Depth (feet): 50.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 8/11/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* 40.00	*Static:* 34.76
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 587.85	*Top of Casing:* 590.86
		Logged By: V. Diep	Checked By:

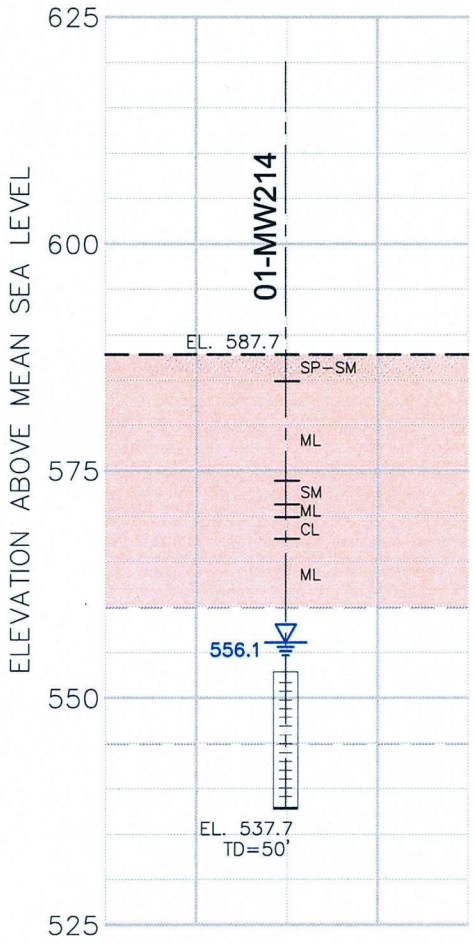
Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP-SM	SAND with SILT; light olive brown (2.5Y 5/4); 90% fine sand, 10% silt; trace rock fragment; trace organics (grass).		Grab sample.
										ML	SILT with SAND; light olive brown (2.5Y 5/4); 85% silt, 15% sand; trace rock fragments; faintly moist.		
5										ML	Grading to SILT; 95% silt, 5% fine sand; trace gravel to 1-inch diameter.		
											Same as above; trace roots; color change to olive brown (2.5Y 4/3)		
10											Trace gravel up to 2 inches in diameter.		
										ML	SILT with SAND; light olive brown (2.5Y 5/4); 75% silt, 25% sand; trace gravel 1 inch in diameter; loose.		
15										SM	SILTY SAND; 80% fine sand, 20% silt.		
										ML	SILT with SAND; 80% silt,; 20% sand; moderate density.		
20										CL	CLAY with SAND; 85% clay, 15% sand.		
										ML	SILT; olive brown (2.5Y 4/3); 90% silt, 10% sand, trace gravel; moderate density; faintly moist.		
25											15% gravel at 26 feet.		
											Color change to light olive brown (2.5Y 5/4).		
											No Sample Recovery.		
30													Bentonite seal from

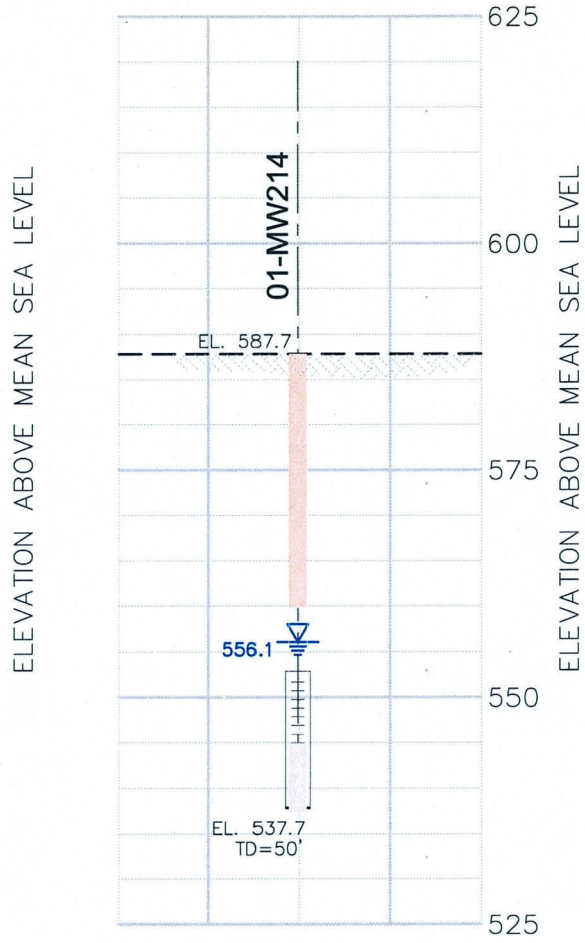
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW214
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
													29-31 feet.
													# 3 Sand from 31-50 feet.
				0							No Sample Recovery.		
35													0.020-inch slotted screen 33-48 feet.
				0							No Sample Recovery.		
40				10									
										SP	SAND; brown (10YR 5/3); 95% fine sand, 5% coarse sand, 5% silt; light FeO staining throughout; trace rock fragments and gravel; saturated.		
45										SP	SAND; 90% fine sand, 5% coarse sand, 5% silt; trace gravel; saturated.		
										SM	SILTY SAND; 85% fine sand, 15% silt; moist.		Borehole filled with grout to 50 feet.
50										SM	SILTY SAND as above.		
											Total Depth = 50.5 feet.		





LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

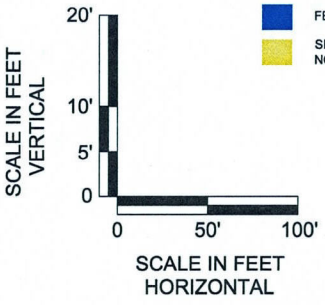
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

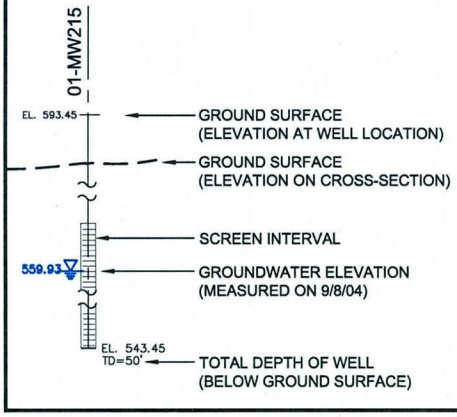
CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI

01-MW214
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:48pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW215	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194807.74 *Easting:* 6122561.78	Sheet *1* of *2*	
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/13/2004	Total Depth (feet): 50.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/13/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 35.47
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 593.45	*Top of Casing:* 595.40
		Logged By: R.Lopez	Checked By:

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	(Top Soil) SILTY SAND; dark brown; 70% fine to medium, angular to subangular sand (mode fine sand); 30% silt; loose; dry; no odor.		
										SW	WELL GRADED SAND; light brown (7.5YR 6/4); 55% coarse sand, 35% medium sand, 10% fine sand; trace subrounded fine gravel (maximum diameter =10 mm); angular to subangular; loose; dry; no odor.		
										CL-ML			
5					09:24					CL	SILTY CLAY; dark grayish brown (10YR 4/2); trace coarse subrounded sand; very hard; dry; no odor.		
										SP	CLAY; very dark grayish brown (10YR 3/2); streaks of white calcium carbonate; plastic; very hard; dry; no odor.		
10					09:29					CL	POORLY GRADED SAND (interpreted as decomposing SANDSTONE); brown (10YR 5/3); 100% fine, angular to subangular; loose; dry; no odor.		
											CLAY; very dark grayish brown (10YR 3/2); 89% clay, plastic; 10% subrounded gravel (max. dia. 1 inch), increasing gravel with depth; 1% coarse, subangular to subrounded sand.		
15					09:41					WBr	Interpreted as redeposited SILTSTONE; pale brown (10YR 6/3), mottled with dark brown (10YR 3/3) streaks/whrils; some fine sand; trace fine gravel; crumbles to firm, damp to dry, no odor.		
20					09:50					WBr	Weathered SANDSTONE; very pale brown (10YR 7/4), trace of multicolored horizontal laminations: white, brownish yellow, pale brown and brown; fine grained; angular to subangular; moderate spherosity; hard; no odor.		
25				0	10:25						No recovery.		Strong HCl reaction.
30													

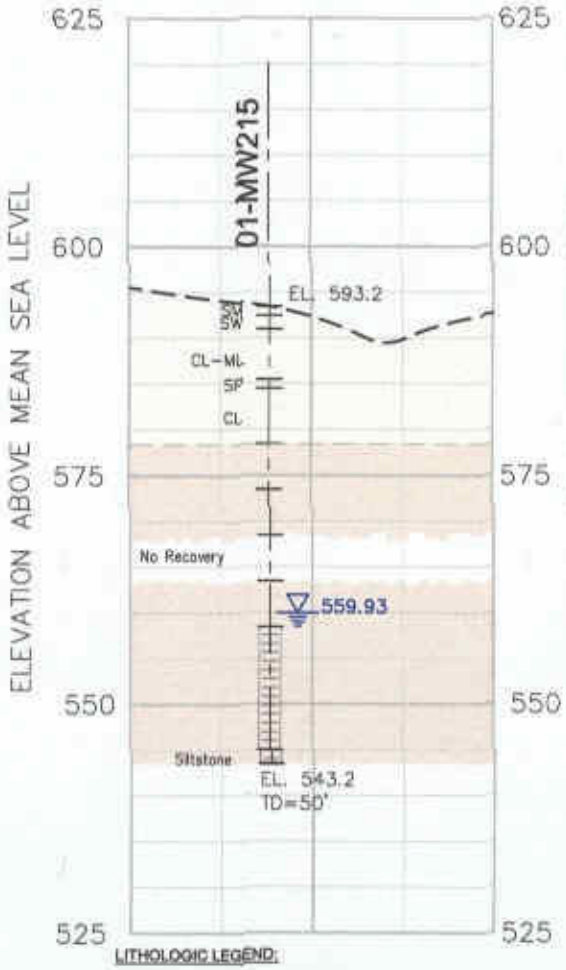
IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

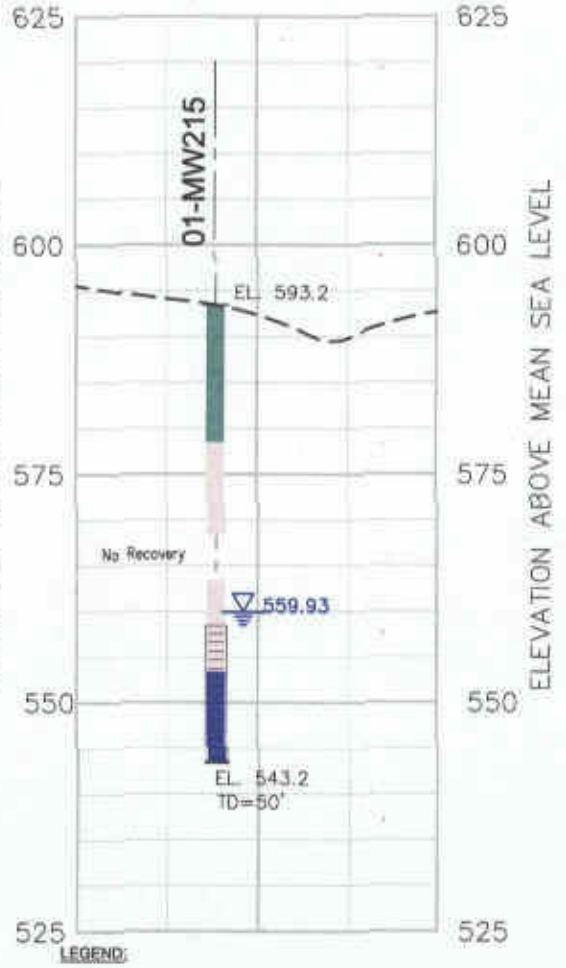
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW215
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					13:03					WBr	30-35 feet bgs. (Slough) SANDY SILT; light yellowish brown (10YR 6/4); 55% silt, 45% sand; trace gravel; hard; non-calcite concretions; $CaCO^3$ veins; dry.		Weak to moderate HCl reaction. ~~Bentonite seal from 31-33 feet.~~ ~~# 3 Sand from~~ 33-50 feet.
35										WBr	35-40 feet bgs. WELL GRADED SAND; yellowish brown (10YR 5/6); fine to coarse (15% fine, 45% medium, 40% coarse); angular; loose; very moist to saturated.		Weak to moderate HCl reaction.
40					13:20					WBr WBr	40-43 feet bgs. CLAYEY SAND; very dark grayish brown; saturated. 40-45 feet bgs. Flowing SAND.		0.020-inch slotted screen 35-50 feet.
										WBr WBr	43-44 feet bgs. WELL GRADED SAND; dark brown (10YR 4/3); 75% coarse, 15% medium, 10% fine; angular; saturated.		Weak to moderate HCl reaction.
45					13:38					WBr	44-45 feet bgs. CLAYEY SAND; dark brown (10YR 4/3); saturated. 45-48.5 feet bgs. POORLY GRADED SAND; dark yellowish brown (10YR 4/4); medium; loose; subangular; moderate to high sphericity; saturated.		
										WBr	48.5-50 feet bgs. GRAVELLY SANDY SILT; dark yellowish brown (10YR 4/4); 85% silt, 10% fine to coarse sand, 5% subrounded gravel at the top of the unit (fragments of max. 1 inch dia.); very moist.		
50													





LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

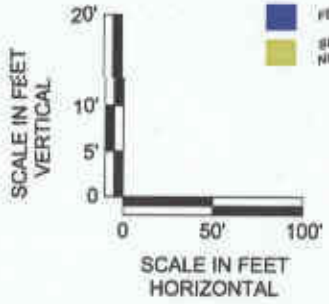
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

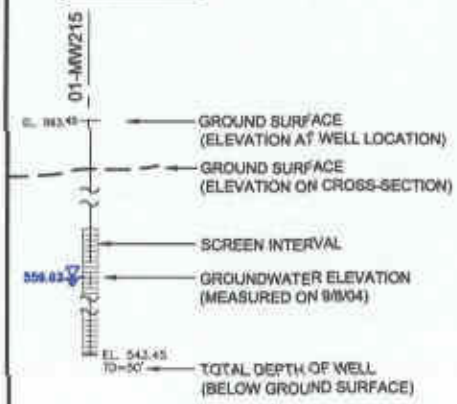
- CL CLAY
- CL-ML SILTY CLAY
- SM SILTY SAND
- SP POORLY GRADED SAND
- SW WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE, DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE, DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON, DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI

01-MW215 INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:54pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW216	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194472.2	*Easting:* 6122619.05	Sheet *1* of *2*
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/16/2004	Total Depth (feet): 50.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/16/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* 32.50	*Static:* 35.16
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 591.62	*Top of Casing:* 593.45
		Logged By: L. Browne	Checked By:

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100	0918					ML	(Top Soil) SILT with SAND; dark gray (10YR 4/1); 85% silt; 15% fine sand; roots; dry; loose.		
5				95	0920					ML	SILT; dark gray (2.5Y 4/1); 80% silt; 10% fine to medium sand; 10% clay; dry; non plastic; massive.		Reacts strongly with HCl ($CaCO_3$ cementation).
10				100	0932					ML	Grades to slightly moist; trace FeO stains.		
15				75	0935					ML	SILT as above.		
										SM	SILTY SAND; brownish yellow (10YR 6/6); 60% fine to medium sand (arkosic); 15% subangular to subrounded gravel; 10% silt; massive; slightly moist.		Reacts throughout with HCl.
20				100	0940					ML	SILT; dark gray (2.5Y 4/1); 80% silt; 10% fine sand; 10% clay; nonplastic.		Bentonite seal from 21-23 feet.
25				100	0945								# 3 Sand from 23-40 feet.
30										SW-SM	SAND with SILT; very pale brown (10YR 8/4); 80% fine to coarse, subangular, arkosic sand;		

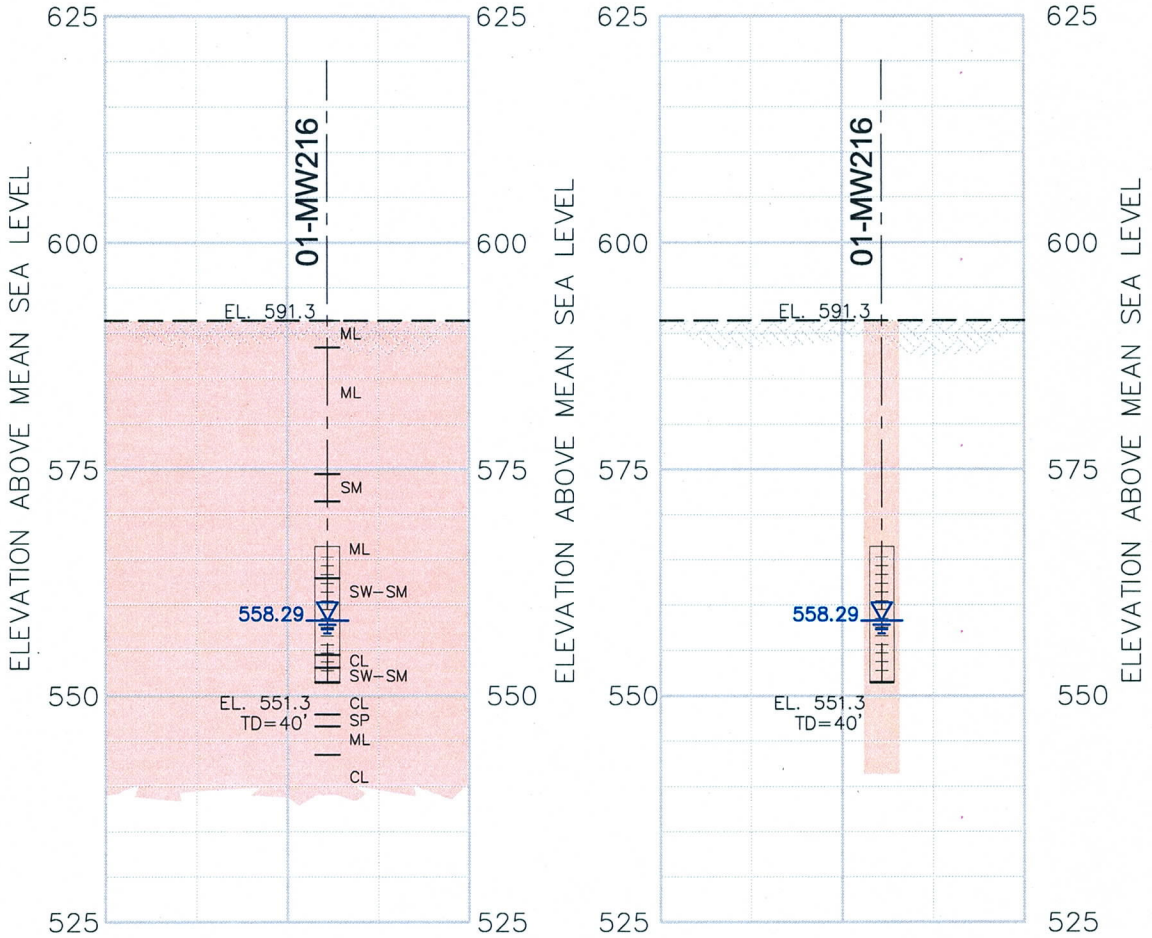
IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW216
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											10% subangular to subrounded gravel; 10% silt; slightly moist; micaceous; no odor.		
											Saturated.		Water producing zone @32.5-40 feet.
35													0.020-inch slotted screen 25-40 feet.
										CL	CLAY; very pale brown (10YR 8/4); 95% clay; 5% sand; wet; nonplastic; no odor.		
										SW-SM	SAND with SILT; very pale brown (10YR 8/4); 80% fine to coarse, subangular, arkosic sand; 10% subangular to subrounded gravel; 10% silt; saturated; micaceous; no odor.		
40										CL	CLAY; olive (5Y 5/3); 85% clay; 10% fine sand; 5% silt (in lenses); moderate plasticity; soft; wet; no odor.		Borehole filled with grout to 40 feet.
										SP	SAND; black (5Y 2.5/1); 95% fine to coarse sand;5% silt; saturated; loose; no odor.		
45										ML	SILT; olive (5Y 5/3); 80% silt; 10% fine sand; 10% clay; wet; nonplastic; no odor.		
										CL	CLAY; black (5Y 2.5/1); 90% clay; 5% sand; 5% silt; very moist; soft; no odor.		
50											Total Depth = 50 feet.		



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

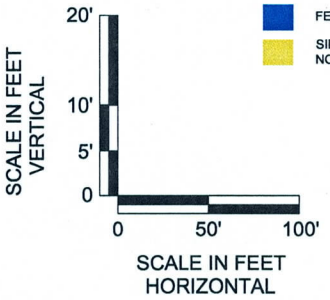
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

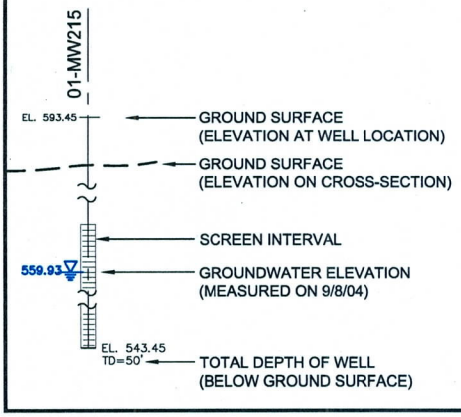
CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI

01-MW216 INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:55pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW217	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196235.05 *Easting:* 6123708.39	Sheet *1* of *3*	
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/10/2004	Total Depth (feet): 70.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/10/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 33.55
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 639.10	*Top of Casing:* 642.15
		Logged By: R. Lopez	Checked By:

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	(Top Soil) SILTY SAND; grayish brown (10YR 4/2); 70% fine to medium sand (mode fine sand), 30% silt; trace medium angular to subangular sand, loose, dry, no odor.		No HCl reaction.
										WBr	SANDSTONE; dark brown (10YR 3/3); 90% to 80% fine to coarse, angular sand; well graded, abundant quartz grains; 10% to 20% clays; increasing clay content with depth; very hard; dry; no odor.		
5					9:35								
10					9:39								
										WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; dark brown (10YR 3/3) with streaks of yellowish brown; 70% fine, angular to subangular sand; poorly graded; 30% clays; increasing clay content with depth, disturbed laminations; firm; damp to moist; no odor.		No HCl reaction.
15					9:42								Easy drilling, soft conditions.
										WBr	SANDSTONE; light brownish gray (10YR 6/2) with yellowish tint; 98% fine to coarse, angular sand, well graded, abundent quartz grains; 2% clays; hard; damp to moist; no odor.		No HCl reaction.
20					9:47					WBr	SANDSTONE; grayish brown (10YR 5/2); 98% fine to medium sand, well graded, subangular to subrounded, composition (70% quartz, 30% others mica, feldspars), 2% clays; trace fine coarse sand, some iron oxidation staining, large white clasts (very soft - calcium carbonate rich); hard; moist; no odor.		No HCl reaction.
25					10:09								Slightly harder drilling.
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW217
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					10:25					WBr	SANDSTONE; white (10YR6/1) to light gray; 100% fine sand, poorly graded, angular to subangular, composition (55%-80% highly weathered feldspars, 10%-30% quartz, 10%-15% mica); strong HCl reaction; hard; moist; no odor.		Very easy drilling (no rotation required). No HCl reaction.
35					10:48					WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; white (10YR6/1) to light gray; 100% fine, angular to subangular sand, poorly graded; hard; dry to damp; no odor.		No to weak HCl reaction.
										WBr	SANDSTONE; pale brown (10YR6/3) to light gray; 100% fine, angular to subangular sand, poorly graded, hard; dry; no odor.		Strong HCl reaction.
40										WBr	SANDSTONE; pale brown (10YR6/3); 100% fine to medium, angular to subangular sand; poorly graded; abundent mica; hard; dry; no odor.		Strong HCl reaction.
45					10:31					WBr	SANDSTONE; white (10YR6/1) to light gray; 100% fine, angular to subangular sand, poorly graded; very micaceous, hard; dry to damp; no odor.		No to weak HCl reaction.
					13:30					WBr	SANDSTONE; white (10YR6/1); 100% fine to coarse, angular to subangular sand (fluctuating grain size), well graded; some mica; hard; dry to damp; no odor.		No HCl reaction.
50										WBr	SANDSTONE as above.		Bentonite seal from 51-53 feet.
													#3 Sand from 53-70 feet.
55					15:15					WBr	SANDSTONE; white (10YR6/1); 100% fine to medium, angular to subangular sand, poorly graded, composition (60% feldspar, 30% quartz, 5% mica); some mica, trace coarse sand; hard; damp to moist; no odor.		No HCl reaction.
60					15:48								0.020-inch slotted screen 55-70 feet.
65													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

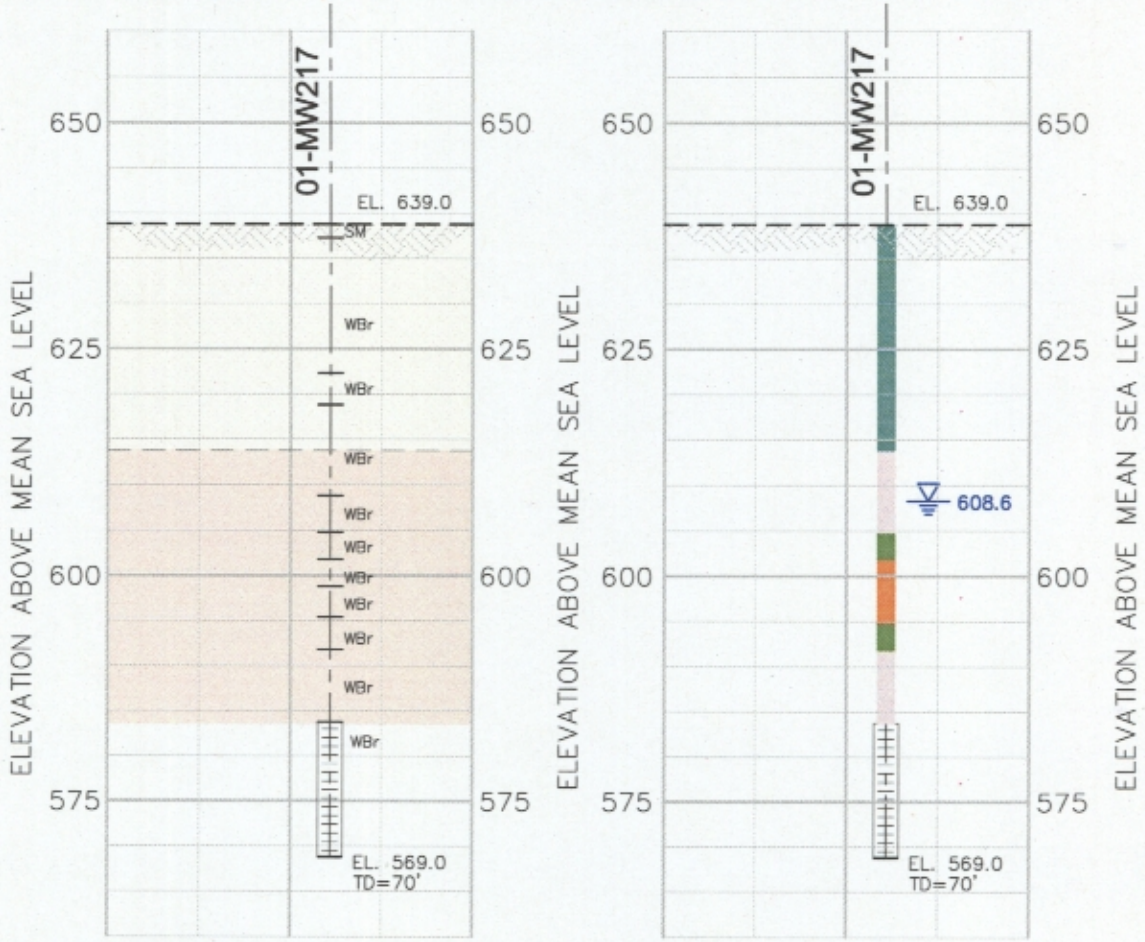
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW217
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					16:08					WBr	Same as above.		
										WBr	Same as above.		
70													Slow hard drilling.
											Total Depth = 70 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

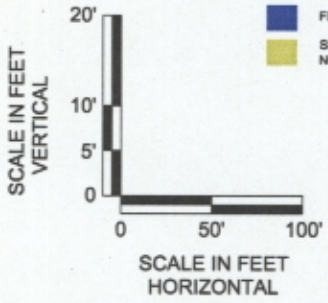
NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

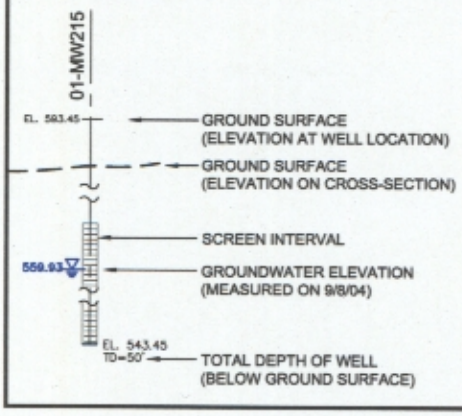
- CL — CLAY
- CL-ML — SILTY CLAY
- SM — SILTY SAND
- SP — POORLY GRADED SAND
- SW — WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI

01-MW217 INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:56pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW218	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196589.52 *Easting:* 6123842.41	Sheet *1* of *2*	
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/9/2004	Total Depth (feet): 60.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/9/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 48.80
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 669.80	*Top of Casing:* 671.60
		Logged By: R. Lopez	Checked By:

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	(Top Soil) SILTY SAND; grayish brown (10YR 4/2); 70% fine to medium sand; 30% silt; trace medium, angular to subangular sand; loose; dry; no odor.		Very slow and hard drilling the entire length of borehole. No HCl reaction.
					7:30					WBr	SANDSTONE; pale brown (10YR6/3), light olive brown (5Y 6/3) to white (10YR 6/1); highly weathered; 98% fine to medium, angular sand, poorly graded, dominantly feldspathic composition; 2% silt; brittle; dry; no odor.		
5					7:35					WBr	SANDSTONE; pale brown (10YR 6/3); highly weathered; 98% fine to medium, angular sand, poorly graded; 2% silt; brittle; massive; dry to damp between 7-9 feet bgs; no odor.		Strong HCl reaction between 5-7 and 9-10 feet below ground surface.
10					7:55					WBr	SANDSTONE; pale brown (10YR 6/3); highly weathered; 98% fine to medium, angular to subangular sand, poorly graded; 2% silt; trace mica; brittle; some lamination (horizonal) of silt, brown (10YR 4/3); dry; no odor.		Strong HCl reaction
15					8:25					WBr	SANDSTONE; pale brown (10YR 6/3); highly weathered; 98% fine to medium, angular to subangular sand, poorly graded; 2% silt; some mica (increasing with depth); brittle; dry; no odor.		Strong HCl reaction.
					9:00					WBr	SANDSTONE; pale brown (10YR6/3); highly weathered; 98% fine, angular to subangular sand, poorly graded, composition (60% feldspar, 30% quartz, 10% mica); 2% silt; some mica (increasing with depth), trace medium and coarse sand; very brittle; dry; no odor.		Weak to no HCl reaction.
20					9:34					WBr	SANDSTONE; pale brown (10YR 6/3); highly weathered; 98% fine, angular to subangular sand, poorly graded, composition (60% feldspar, 30% quartz, 10% mica); 2% silts; some mica; trace medium and coarse sand; portion of sample is pulverized; very brittle; dry; no odor.		Moderate HCl reaction.
25					10:11					WBr	SANDSTONE; pale brown (10YR 6/3); highly weathered; 98% fine to medium, angular to subangular sand (mode-medium), poorly graded, composition (60% feldspar, 30% quartz, 10% mica); 2% silt; abundant mica; some very thin beds to lamination of silt; dry to damp (moisture appearing in sample bag); no odor.		Moderate HCl reaction in silts and none to weak HCl in sandstone.
					12:30								
30					12:54					WBr	SANDSTONE interbedded with SILTSTONE;		Strong HCl reaction.

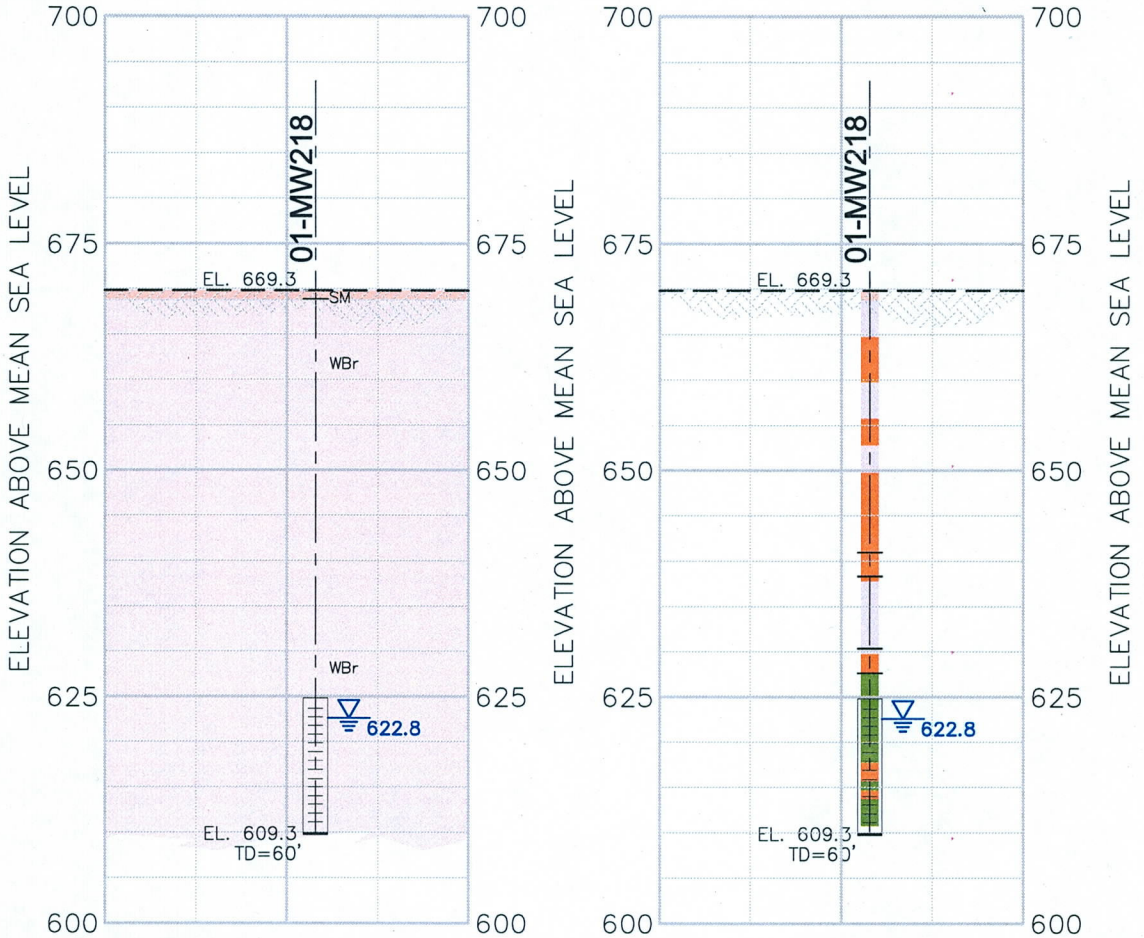
IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW218
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											grayish brown (10YR 4/3); 98% fine to medium, angular to subangular sand, poorly graded,		
										WBr	composition (60% feldspar, 30% quartz, 10% mica); 2% silts; abundent mica; 30% siltstone - darker color; pulverized; very brittle; dry; no odor.		Weak to moderate HCl reaction.
											SANDSTONE; pale brown (10YR 6/3); 98%		
										WBr	medium, angular to subangular sand, poorly graded; 2% silts; abundant mica; brittle (platy-possible lamination); dry to damp; no odor.		Weak to moderate HCl reaction.
35					13:16						SANDSTONE; light grayish brown; 98% fine to coarse, subangular to subrounded sand (alternating grain size); 2% silt; abundant mica; some clay/silt laminations; brittle (platy-possible lamination); dry; no odor.		
40					13:52					WBr	SANDSTONE interbedded SILTSTONE; grayish brown (10YR 4/3); 98% fine to medium, angular to subangular sand (mode-medium), poorly graded,		Strong HCl reaction in siltstones and moderate HCl reaction in sandstone.
										WBr	composition (60% feldspar, 30% quartz, 10% mica); 2% silts; abundant mica; 50% siltstone - darker color; pulverized; damp; no odor.		Bentonite seal from from 41-43 feet.
											SANDSTONE; pale brown (10YR 6/3); 98% medium, angular to subangular sand, poorly		Weak to moderate HCl reaction.
45					14:20					WBr	graded; 2% silt; abundant mica; moist; no odor.		#3 Sand from 43-60 feet. No to weak HCl reaction.
											SANDSTONE; pale brown (10YR 6/3); 98% fine to coarse, angular to subangular sand, well graded; 2% silts; abundant mica; trace lamination of dark grayish brown clay/silt lenses; brittle (platy); moist to very moist at 48.5 feet bgs; no odor.		
50					15:04								0.020-inch slotted screen 45-60 feet.
										WBr	SANDSTONE; pale brown (10YR 6/3); 98% fine to medium, angular to subrounded sand, poorly graded; 2% silt; abundant mica; dry; no odor.		Strong HCl reaction.
										WBr	SANDSTONE; pale brown (10YR 6/3); 98% medium, angular to subangular sand, poorly		None to weak HCl reaction.
55					15:53					WBr	graded; 2% silt; abundant mica; moist; no odor.		Strong HCl reaction.
											SANDSTONE; pale brown (10YR6/3); 98% fine to medium, angular to subrounded sand, poorly		
										WBr	graded; 2% silt; abundant mica; dry; no odor.		None to weak HCl reaction.
											SANDSTONE; pale brown (10YR 6/3); 98% fine to medium, angular to subrounded sand, poorly graded; 2% silt; abundent mica; some clay/silt laminations; trace coarse sand; dry; no odor.		
60											Total Depth = 60 feet.		



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

NOTE:

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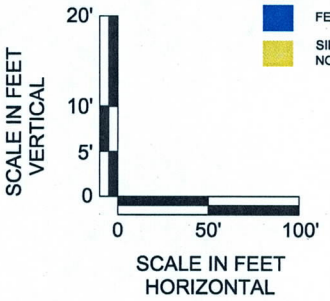
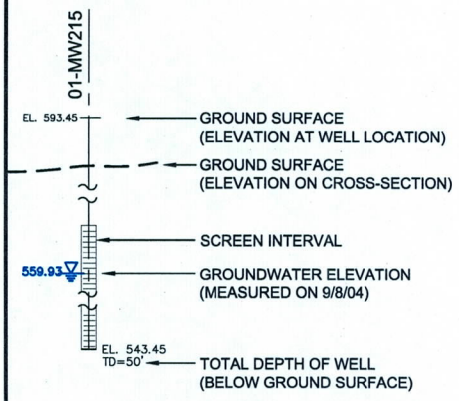
CL	CLAY
CL-ML	SILTY CLAY
SM	SILTY SAND
SP	POORLY GRADED SAND
SW	WELL GRADED SAND

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



WELL LEGEND:



Phase II RI

01-MW218
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:57pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW219	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196867.46 *Easting:* 6123959.16	Sheet *1* of *3*	
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/5/2004	Total Depth (feet): 70.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/6/2004	Depth to Bedrock (feet): 5.0
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 53.61
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.	Elevation (feet MSL): *Ground:* 676.23	*Top of Casing:* 678.30	
	Logged By: O. Taban	Checked By: S. Williams	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100	0730					SM	SILTY SAND: very dark grayish brown (10Y R3/2); 85% fine to medium, subrounded, quartz/feldspar/mica sand; 15% low plasticity silt; very dense; dry to slightly moist; organic-rich.		0-5 feet organic rich soil and fluvial sand.
										SP	SAND; very pale brown (10YR 7/3); 90% fine to coarse, subangular, quartz/feldspar sand; 10% fine, angular rock fragment gravel; very dense; dry to slightly moist.		
5				100	0801					WBr	SANDSTONE; light gray (5Y 1/2), 100% fine subrounded; quartz/feldspar sand; medium dense; dry to slightly moist; no carbonate cementation, weak cementation.		Bedrock Sandstone.
10				100	0810					WBr	Grading to medium grained SANDSTONE; slightly weathered; moist.		
										WBr	Grading to SILTY SANDSTONE; 85% fine, subrounded, quartz/feldspar sand; 15% low plasticity silt; very dense; dry.		
15				100	0830					WBr	Grading to SANDSTONE; white (10YR 8/1), 100% medium subrounded quartz/feldspar sand; loose; moist; at 19 feet grading to weak cementation.		
20					0915					WBr	SANDSTONE; same as above; loose, weak carbonate cementation, very moist.		Moisture starts at 20 feet.
25					0925					WBr	Grading to SANDSTONE; 95% medium subangular quartz/feldspar sand; trace fine angular rock fragments and gravel; weak cementation; medium dense; loose; no carbonate; very moist; less weathered.		
					0935					WBr	Grading to SILTY SANDSTONE; light gray (5Y 7/2), 85% fine to coarse subangular quartz/feldspar sand; 15% low plasticity silt; weak		28.5-30 feet correlates with the same lithology unit at
30										WBr			

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW219
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					0945					WBr	to moderate carbonate cementation; very moist.		58.0-58.5 feet in borehole 01-BH02.
										WBr	Grading to SANDSTONE; very pale brown (10Y R7/4), 100% medium to coarse; angular; quartz/feldspar sand; medium dense to loose, very moist; moderate carbonate cementation; concretions; overal weak carbonate cementation.		
										WBr	Grading to SANDSTONE; color change to white (10YR 8/1), 90% fine to medium sand; 10% fine angular; quartz rock fragments and gravel; medium dense to loose; weak carbonate cementation; very moist.		33.5-35 feet possible groundwater zone, very moist.
35					1005								35-40 feet very poor groundwater zone, if any.
											Grading to SILTY SANDSTONE; white (10YR 8/1), 85% fine subangular; quartz/feldspar sand; 15% low plasticity silt; strong carbonate cementation; dry.		Bentonite seal from 36-38 feet.
													# 3 Sand from 38-55.5 feet.
40					1035					WBr	Grading to SANDSTONE; 100% medium to coarse; subangular; quartz/feldspar sand; medium dense; very moist; no carbonate cement.		40-45 feet moist.
											Grading to SILTY SANDSTONE; 85% fine subangular; quartz/feldspar sand; 15% low plasticity silt; medium dense; moist; no carbonate cement.		
45					1105					WBr	Grading to strong carbonate cementation, moist.		45-50 feet very moist.
													0.020-inch slotted screen 40-55 feet.
50										WBr	Grading to very dense, dry; strong carbonate cementation.		50-53 feet dry, strong carbonate cement; core pulverized.
										WBr	Grading to SANDSTONE; 100% fine to medium sand; moist.		Moisture.
										WBr	Grading to SILTY SANDSTONE; moist to dry; very dense.		54-55 feet dry.
55					1335						Dry; strong carbonate cementation.		55-57 feet dry strong carbonate cemented; core pulverized.
										WBr	Grading to SANDSTONE; weak carbonate cementation; very moist; medium to coarse sand.		57-60 feet very moist.
60					1405					WBr	Grading to SILTY SANDSTONE; very light olive gray (5Y 6/2), 85% fine; subrounded; quartz/feldspar/mica sand, 15% low plasticity silt; very moist to saturated; very dense.		60-61 feet very moist to saturated.
										WBr	Grading to SILTY SANDSTONE; color changes to white (10YR 8/1), 85% fine to coarse; angular; quartz/feldspar/mica sand; 15% low plasticity silt, moist; very dense.		61-70 feet moist.
65													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

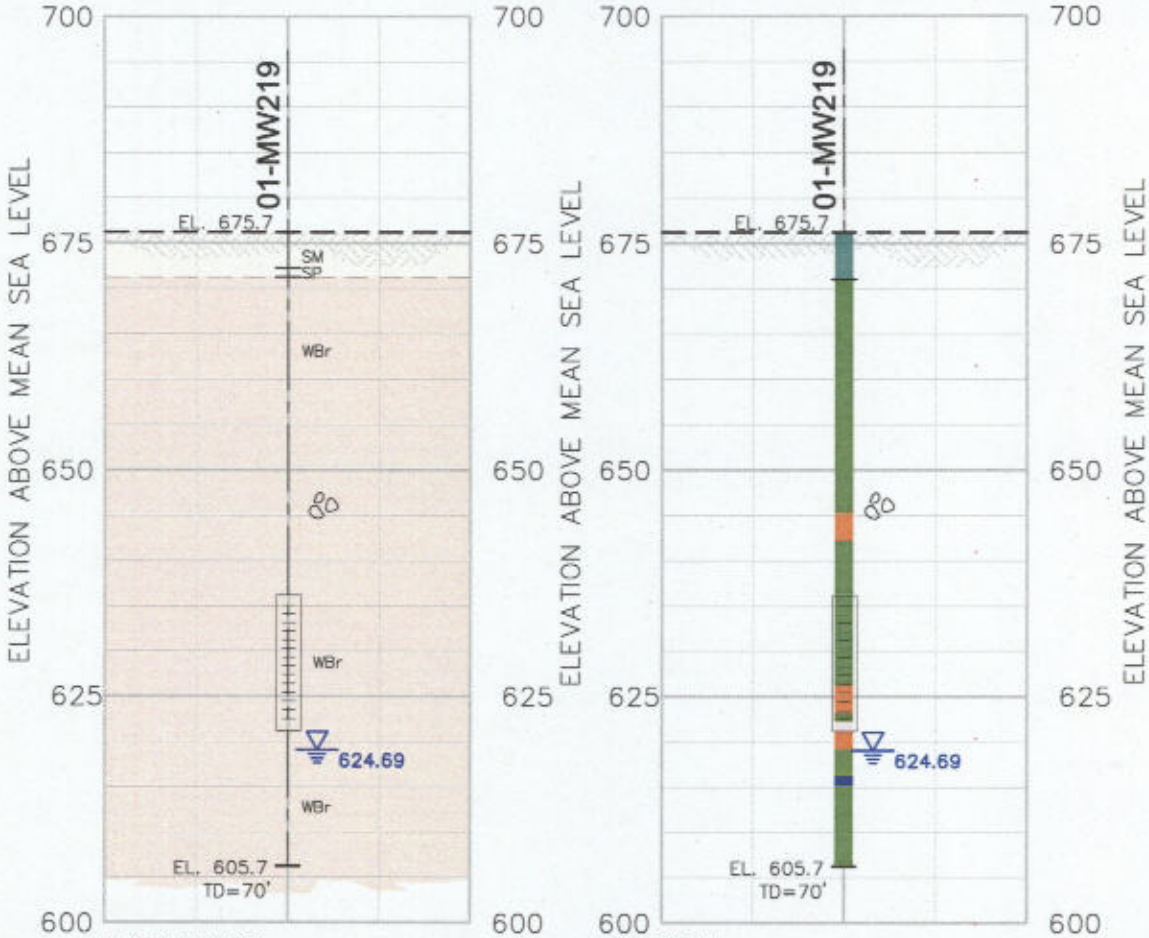
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW219
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					1515					WBr	SILTY SANDSTONE; white (10YR 8/1), 85% fine to coarse; angular; quartz/feldspar/mica sand; 15% low plasticity silt, moist; very dense.		
										WBr	SILTY SANDSTONE as above.		
70											Total Depth = 70 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097



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CL	CLAY
CL-ML	SILTY CLAY
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LEGEND:

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- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
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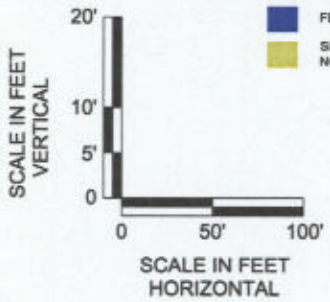

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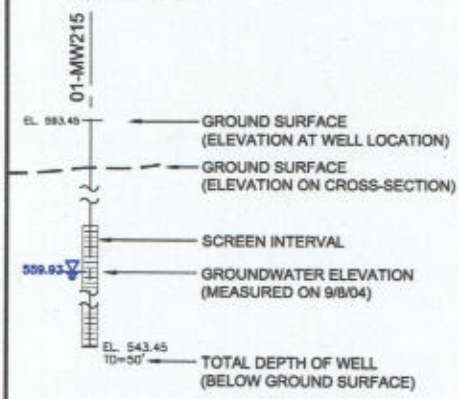

Phase II RI

01-MW219
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 05-05	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

File: L:\work\36097\cad\Site 1 RI\Draft Final\well log comparison 03 JAW.dwg Time: Oct 20, 2005 - 1:59pm

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW220	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196553.27 *Easting:* 6124552.52	Sheet *1* of *4*	
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 8/11/2004	Total Depth (feet): 110.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 8/13/2004	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:* .	*Static:* 78.38
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.		Elevation (feet MSL): *Ground:* 710.69	*Top of Casing:* 712.77
		Logged By: R. Lopez	Checked By:

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					10:00					SM	(Top Soil) SILTY SAND: dark brown (10YR 3/3); 70% fine to medium, angular to subangular sand; 30% silt; loose; dry; no odor.		Grab sample.
										WBr	SANDSTONE; white (10YR 8/1) to light pale brown (10YR 6/2); highly weathered, well graded, angular to subangular sands (40% coarse, 30% medium, 30% fine sand); weathers to clay due to high feldspar content; plastic; hard; dry; no odor.		No HCl reaction.
										WBr	SANDSTONE; white (10YR 8/1); highly weathered, well graded, angular to subangular sands (40% coarse, 30% medium, 30% fine sand), composition (85% feldspar, mica and others, 15% quartz); hard; dry; no odor.		No HCl reaction.
5					10:16								
10					10:25								
					10:36								
15										WBr	SANDSTONE; white (10YR 8/1); highly weathered, well graded; angular to subangular sands (40% coarse, 30% medium, 30% fine sand), composition (85% feldspar, mica and others, 15% quartz); hard; dry; no odor.		No HCl reaction.
20					10:56					WBr	SANDSTONE; light grayish brown (10YR 6/2); well graded, angular to subangular sands, fine to coarse (alternating grain size); trace coarse sand and carbonaceous sand grains; hard; dry; no odor.		Strong HCl reaction.
25										WBr	SANDSTONE: white (10YR 8/1); well graded sands (40% coarse, 30% medium, 30% fine sand), composition (85% feldspar, mica and others, 15% quartz); angular to subangular; hard, dry, no odor.		No HCl reaction.
					11:15					WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; grayish brown (10YR 5/2); 60% fine, angular to subangular sand, poorly		No to weak HCl reaction.
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW220
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											graded; 40% clay/silt; breaks easily; dry to damp; no odor.		
					12:42					WBr	SANDSTONE; white (10YR8/1); well graded, angular to subangular sands (40% coarse, 30% medium, 30% fine sand), composition (85% feldspar, mica and others, 15% quartz); hard; dry; no odor.		No HCl reaction.
35										WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; grayish brown; 60% fine, angular to subangular sand, poorly graded; 40% clay/silt; breaks easily; dry to damp; no odor.		None to weak HCl reaction.
					13:10					WBr	SANDSTONE; white (10YR8/1); well graded, angular to subangular sands (40% coarse, 30% medium, 30% fine sand), composition (85% feldspar, mica and others, 15% quartz); hard; dry; no odor.		No HCl reaction.
40					13:24					WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; grayish brown (10YR 5/2); 60% fine, angular to subangular sand, poorly graded; 40% clay/silt; breaks easily; dry to damp; no odor.		No to weak HCl reaction.
45					15:12					WBr	SANDSTONE; white (10YR 8/1); well graded, fine to medium, angular to subangular sand, composition (80% feldspar and others, 15% quartz, 5% mica); trace coarse sand; massive; micaceous; brittle; damp to dry; no odor.		Strong HCl reaction.
50					15:35					WBr	SANDSTONE; white (10YR 8/1); well graded, fine to medium, angular to subangular sand (mode-fine sand), < 1% quartz; trace coarse sand; massive; micaceous; brittle; damp to dry; no odor.		Strong HCl reaction.
55					16:050					WBr	SANDSTONE; white (10YR 8/1); well graded sands, fine to medium, angular to subangular sand (mode-fine sand), < 1% quartz; trace coarse sand; massive; micaceous; brittle (crumbles); dry; no odor.		None to weak HCl reaction.
60					16:25					WBr	SANDSTONE interbedded with SILTSTONE/CLAYSTONE; grayish brown (10YR 5/2) to light gray (10YR6/2); 60% fine, angular to subangular sand, poorly graded; 40% clay/silt; breaks easily; dry; no odor.		Strong HCl reaction.
65										WBr	SANDSTONE; white (10YR 8/1); well graded, fine to medium, angular to subangular sand (mode-fine sand), <1% quartz; trace coarse sand;		No to weak HCl reaction.

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW220
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											massive; micaceous; brittle (crumbles), dry; no odor.		
										WBr	SILTSTONE/CLAYSTONE; gray (10YR 5/3); pulverized (dusty); disorted beds; dry; no odor.		
										WBr	SANDSTONE; white (10YR 8/1); well graded, fine to medium, angular to subangular sand (mode-fine sand), <1% quartz; trace coarse sand; massive; micaceous; brittle (crumbles); dry; no odor.		No to weak HCl reaction.
70					7:55					WBr	SANDSTONE; white (10YR8/1); fine to medium, angular to subangular sand (mode-fine sand); massive; micaceous; brittle (crumbles); dry; no odor.		No HCl reaction.
					9:30								
75													
80					10:25					WBr	SANDSTONE; white (10YR8/1); fine to medium, trace coarse grains, angular to subangular sand (mode-fine sand); micaceous; dmp; no odor.		
85					10:50								
90					11:41					WBr	SANDSTONE; white (10YR 8/1); fine sand; some medium sand; angular; massive; micaceous; damp to moist; no odor.		No HCl reaction.
95					13:40								
										WBr	SANDSTONE; pale yellow (5Y 7/3); fine to medium, angular sand, moderate spherocity; massive; micaceous; moist; no odor.		Moderate to strong HCl reaction. ~~Bentonite seal from 96-98 feet.~~
										WBr	SANDSTONE; white (10YR 8/1); fine sand; some medium sand; angular; thick bedding; micaceous; saturated, no odor.		~~No HCl reaction.~~ # 3 Sand from 98-110 feet.
100													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW220
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					14:22					WBr	SANDSTONE; pale yellow (5Y 7/3); fine to medium, angular sand, moderate spherocity; thick bedding; micaceous; saturated; no odor.		Moderate to strong HCl reaction.
105										WBr	SANDSTONE as above.		0.020-inch slotted screen 100-110 feet.
110											Total Depth = 110 feet.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

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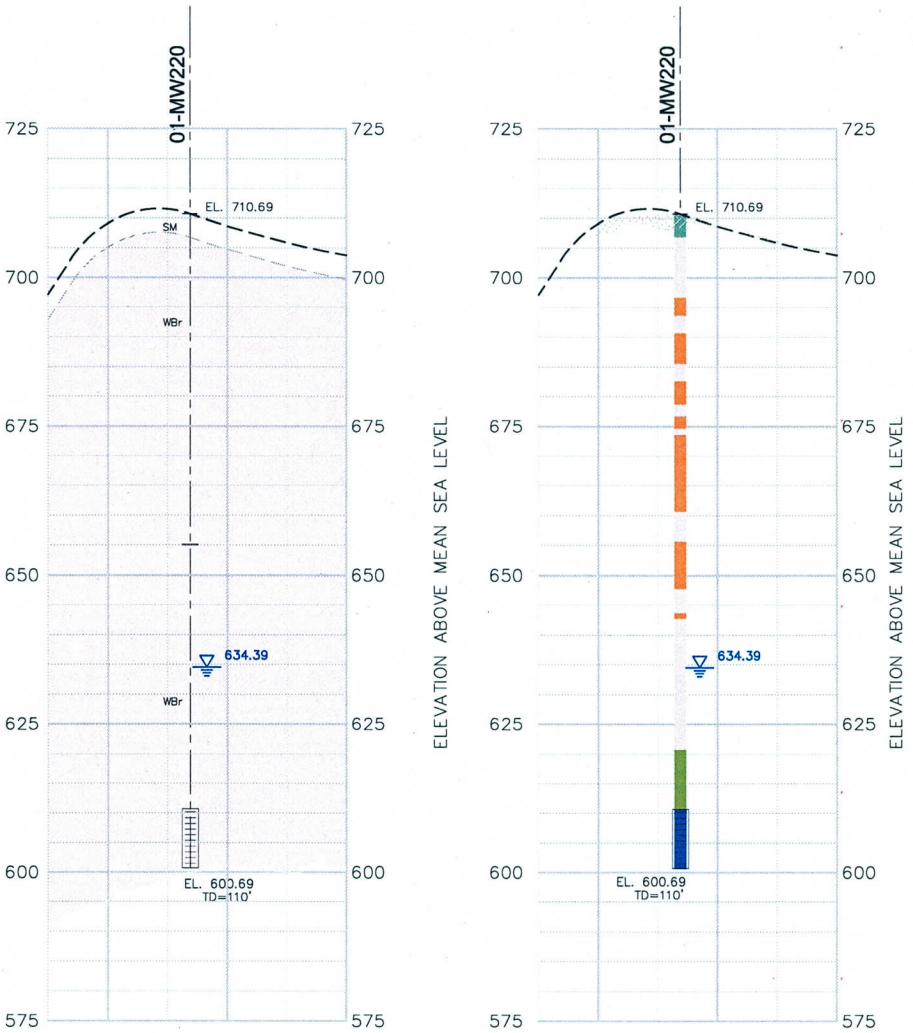


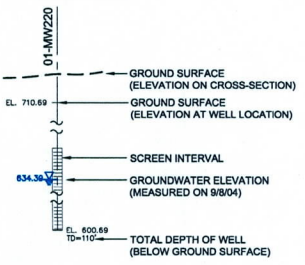
LITHOLOGIC LEGEND:

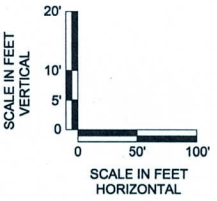
- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)

WELL LEGEND:





Phase II RI

01-MW220
INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW221	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197662.75	*Easting:* 6124472.09	Sheet *1* of *3*
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Rotary Sonic Drill Rig	Date Started: 7/26/2004	Total Depth (feet): 80.0	
Drilling Method: Rotary Sonic	Number of Samples: 0	Date Finished: 7/28/2004	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 31.76
Completion Information: Completed as a 4 inch SCH 40 PVC monitoring well.	Elevation (feet MSL): *Ground:* 710.36	*Top of Casing:* 712.45	
	Logged By: O. Taban	Checked By: S. Williams	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										WBr	SANDSTONE; light gray (10YR 7/2), 95% fine to coarse; angular; quartz/feldspar sand; mostly fine sand; trace low plasticity silt; medium dense; weakly cemented; dry.		0-17 feet organic rich soil/sand and fluvial sand interlayered.
										WBr	Color changes to light brownish gray (10YR 6/2).		
5				90	1445					WBr	Gray (10YR6/1), grading to mostly medium sand; mostly weak; some strong cemented.		
										WBr	Color changes to grayish brown (10YR 5/2), grading to 95% fine to medium sand silt; trace coarse; subangular to subrounded quartz/feldspar sand; medium dense; dry; weakly cemented.		
										WBr			
10				90	1508					WBr			
											Color changes to gray (10YR 6/2), 95% fine sand; trace low plasticity silt.		
				90	0758					WBr	Grading to SILTY SANDSTONE; dark grayish brown (10YR 4/2), 80% fine to medium subangular; quartz/feldspar sand; 15% low plasticity silt; trace medium plasticity clay; moist; loose to medium dense; weakly cemented.		Reasumed coring on 7/27/04
										WBr			
15										WBr			
										WBr	Color changes to light gray (10YR 7/1), grading to fine sand; weakly cemented, medium dense clay; dry.		
				95	0813					WBr	Grading to very hard.		Bedrock Sandstone starts at 17 feet.
										WBr	Grading to SANDSTONE; light gray (5Y 7/2), 95% fine to medium; subangular; quartz/feldspar sand; trace low plasticty silt; loose; moist; very weakly cemented.		
				95	0834					WBr			
20											Grading to SILTY SANDSTONE; light olive gray (5YR 6/2), 85% fine subangular; quartz/feldspar sand; 15% low plasticity silt; very dense; slightly moist.		
				75	0900					WBr			
				95	0913					WBr	Grading to SANDSTONE; white (10YR 8/1), 95% fine; subangular to subrounded; quartz/feldspar sand; trace silt; weak carbonate cementation.		
25				95	0951					WBr	Grading to SILTY SANDSTONE; light olive gray (10YR 6/2), 85% fine to medium sand; 15% low plasticity silt; very dense; moist; weak to moderate carbonate cementation.		
										WBr			
				95	1004					WBr	Grading to SANDSTONE; white (10YR 8/1), 95% medium to coarse; subangular; quartz/feldspar sand; trace low plasticity silt; medium dense; moist; weak carbonate cementation.		27- 30 feet groundwater zone.
30											SILTY SANDSTONE; lifgt olive gray (10YR 6/2),		

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW221
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

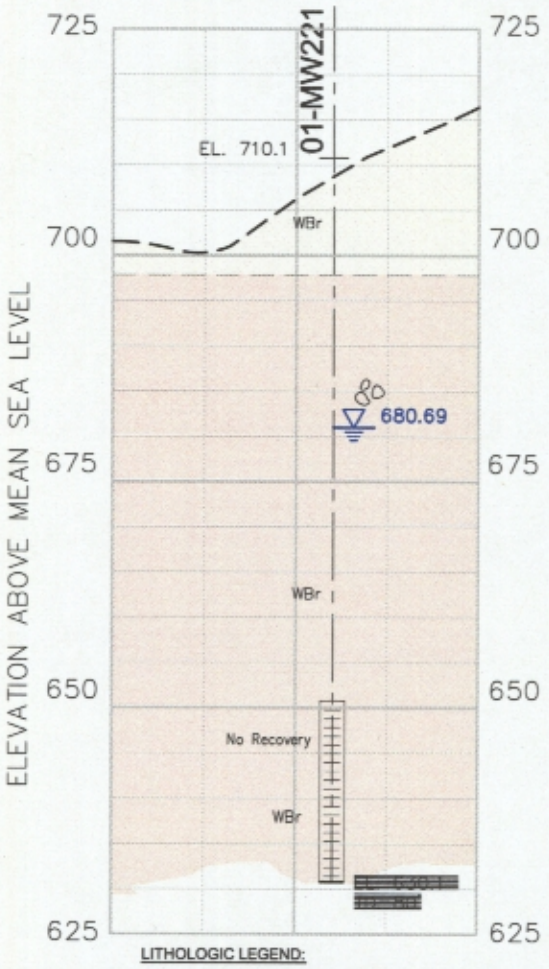
Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				90	1015					WBr	85% fine subrounded; quartz/feldspar/mica sand; 15% low plasticity silt; medium dense; moist; weak carbonate cementation.		
											Same as above, weak carbonate cementation.		Possible groundwater producing zone between 29 and 39 feet above the confining layer between 39 and 40 feet.
											Grading to CLAYEY SANDSTONE; olive gray (5Y 4/2), 75% fine; subangular; quartz/feldspar/mica sand; 10% low plasticity silt; 15% medium plasticity clay; very moist; medium to very dense;		
35				90	1135					WBr	caliche concretions; weak to moderate carbonate cementation.		35-37 feet clay rich layer.
											Same as above, except, no caliche concretions; less carbonate cementation; and dry.		37-39 feet groundwater zone.
											Grading to SANDSTONE; color changes to white (10YR 8/1), 95% fine to medium; angular to		
				90	1346					WBr	subrounded; quartz/feldspar sand; trace silt; no carbonate cementation; very moist, medium		39-40 feet confining layer, dry.
40										WBr	dense.		40-72 feet groundwater producing zone below the confining layer.
				90	1400					WBr	Same as above.		
											Grading to CLAYEY SANDSTONE; very dark grayish brown (10YR 3/2), 70% fine to medium; subrounded; quartz/feldspar/mica sand; 30% medium plasticity clay; very dense; very moist.		
											Grading to SANDSTONE; 95% fine to medium with some coarse; angular to subangular; quartz/ feldspar sand; trace low plasticity silt; medium		
45				90	1431					WBr	dense; moist; weak cementation and no carbonate; gradually silt content increases to silty sandstone.		
											Grading to SILTY SANDSTONE; light olive gray (10YR 6/2), 85% fine; subrounded; quartz/feldspar/mica sand; 15% low plasticity silt; medium dense; dry; weak carbonate cementation.		
50				90	1503					WBr	Grading to SANDSTONE, same as 37 and 39 feet.		Groundwater level measurements.
											SANDSTONE; 95% fine to coarse; angular to subrounded; quartz/feldspar sand; very moist.		1530; 48.5 feet bgs
											Color changes to light olive gray (10YR 6/2), 95% fine to coarse; angular; quartz/feldspar sand; trace low plasticity silt; very moist.		1536; 47.1 feet bgs
											SANDSTONE as above.		1614; 43.1 feet bgs
55				85	1516					WBr	SANDSTONE as above.		1625; 42.2 feet bgs
													1646; 41.4 feet bgs
													Bentonite seal from 56-58 feet.
													# 3 Sand from 58-80 feet.
60					0700						No core attempted between 60 feet and 70 feet.		Coring resumed on 7/28/04; no core attempted. Driller reamed the borehole to 70 feet instead of 60 feet. Borehole caved to 59 feet overnight.
65													

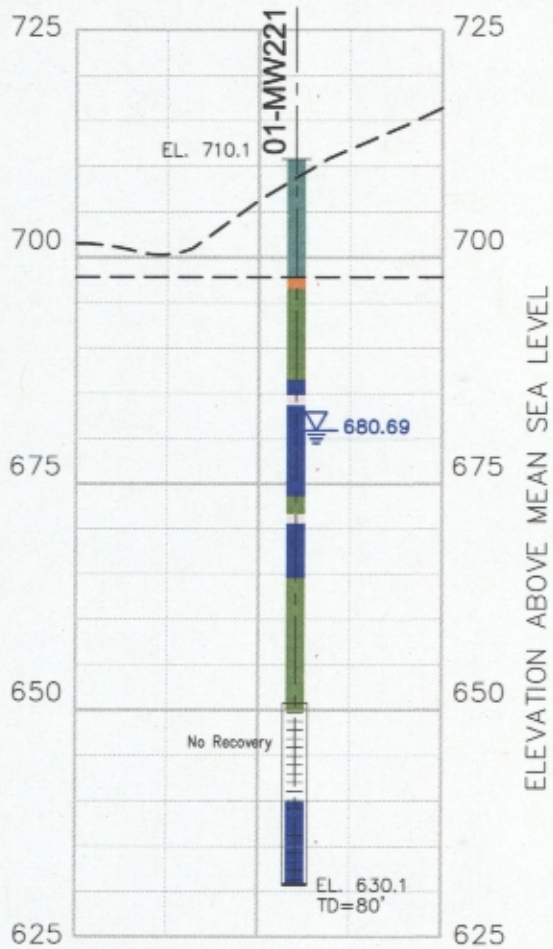
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW221
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
													60 to 70 feet drilling described by drillers as soft might indicate as the same lithologic unit between 40 and 60 feet which is very moist sandstone. 0.020-inch slotted ~~screen 60-80 feet.~~
70				90	0840					WBr	Grading to SANDSTONE; light olive gray (10YR 6/2), 90% fine to coarse; angular; quartz/feldspar/mica sand; 10% low plasticity silt; medium to very dense; moist, weak carbonate cementation.		70-72 feet carbonate cement, dry.
										WBr	Grading to SILTY SANDSTONE; light olive gray (10YR 6/2), 80% fine to medium; angular; quartz/feldspar/mica sand; 15% low plasticty clay; very dense; very moist; no carbonate but rich in silt.		72-75 feet poor groundwater zone; highly weathered feldspar.
75				90	0833					WBr	Grading to SANDSTONE; same as 40 to 60 feet except less weathered; very moist.		75-80 feet good groundwater producing zone; less weathered feldspar.
80											Total Depth = 80 feet.		



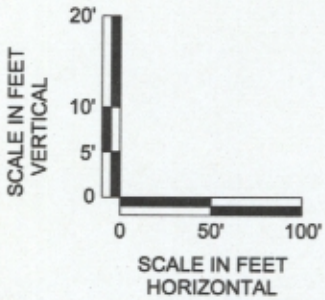


LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)



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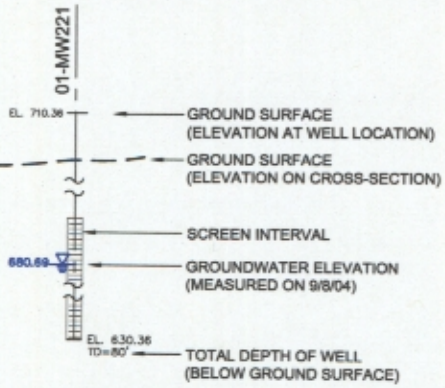

Phase II RI

01-MW221 INTERPRETIVE LOG

Remedial Investigation, Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech — A Tyco International Ltd. Company

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number:	01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196810.86	*Easting:* 6124194.19	Sheet *1* of *6*
Drilling Agency: Resonant Sonic International	Driller: Valentine Godoy		
Drilling Equipment: Sonic Drill Rig	Date Started: 2/29/2004	Total Depth (feet):	190.0
Drilling Method: Sonic Drilling	Number of Samples: 0	Date Finished:	Depth to Bedrock (feet): 30.0
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water (feet): *Drilling:*	*Static:* 41.96
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well with Well ID 01-MW222	Elevation (feet MSL): *Ground:* 666.31	*Top of Casing:* 664.48	
	Logged By: O. Taban	Checked By: S. Williams	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100	1315					SM	SILTY SAND; very dark grayish brown (10YR3/2); 85% fine to coarse, subangular quartz/feldspar sand; 15% low plasticity silt; medium dense; dry; very organic-rich.		
5				95	1321					SMG	SILTY SAND with GRAVEL; very dark grayish brown (10YR3/2); 70% fine to medium, subangular quartz/feldspar sand; 15% fine, angular quartz gravel; 15% low plasticity silt; very dense; slightly moist; organic-rich.		5-10 feet organic rich, recent soil, dry.
10					1332						@ 10 feet: grading medium dense to loose; slightly moist.		
15				95	1345						@ 15 feet: grading to medium dense.		
										SM	SILTY SAND; gray (10YR 6/1); 85% fine to coarse, angular to subrounded quartz/feldspar/mica sand; 15% low plasticity silt; dry; loose.		Fluvial sand, very moist.
										SMG	GRAVELLY SILTY SAND; grayish brown (10YR5/2); 70% fine to coarse, angular quartz/feldspar sand; 15% silt; 15% fine, angular quartz gravel; very moist; medium dense.		16-20 feet ancient soil, dry.
20				100	1352					SP	SAND; grayish brown (10YR5/2); 95% fine to medium, angular quartz/feldspar sand; trace low plasticity silt; very dense; moist.		Fluvial sand, very moist.
					1145					SM	SILTY SAND with GRAVEL; olive gray (5Y 5/2); 70% fine to coarse, subangular quartz/feldspar/mica sand; 15% low plasticity silt; 15% fine, angular rock fragment gravel; very moist; medium dense; plant roots and rare carbon fragments; organic-rich.		20.5-21.0 feet ancient soil, dry. 21.5-24 feet fluvial sand, very moist.
25				100	1150					SP	SAND; gray (10YR6/1); 95% fine to medium, subrounded quartz/feldspar sand; trace low plasticity silt; loose; very moist.		24-25.5 feet ancient soil, dry. 25.5-30 feet fluvial sand, very moist.
30										SM	SILTY SAND with GRAVEL; grayish brown (10YR5/2); 75% fine to medium, subrounded		

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 6

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										WBr	quartz/feldspar/mica sand; 15% low plasticity silt; 10% medium plasticity clay; plant roots; very dense; very moist.		Bedrock - sandstone starts at 30 feet.
											Color change to gray (10YR 6/1); grading to 85% fine to coarse, angular quartz/feldspar/mica sand; 15% low plasticity silt; very dense; very moist.		30-33 feet dry zone.
				100	1312					WBr	SANDSTONE; white (10YR8/1); 95% fine, subrounded quartz/feldspar/mica sand; trace low plasticity silt; medium dense; very moist; weakly cemented; no carbonate cement; highly weathered.		33-35 feet moist.
35											Weakly cemented with carbonate.		35-40 feet dry zone.
				100	1316					WBr	Carbonate concretions; highly weathered; strongly cemented with carbonate.		
40										WBr	Less weathered; fine to medium; weakly cemented; no carbonate; very dense; very moist; rare coarse, angular quartz sand.		40-45 feet poor groundwater zone, very dense.
45				100	1325					WBr	@ 45 feet: grading to fine SANDSTONE; highly weathered; very moist; weak carbonate cement; grading to 90% sand; 10% low plasticity silt due to weathering of feldspar to silt.		45-50 feet dry, highly weathered, weak carbonate cementation.
50				100	1340					WBr	Gray (10YR7/1); 95% medium to coarse, angular quartz/feldspar/mica sand; trace low plasticity silt; medium dense; weakly cemented; no carbonate cement; observed horizontal wet fracture surfaces between 50 and 50.5 feet.		50-54 feet very gw. zone, very moist, weakly cemented.
										WBr	Fine grained sand; highly weathered with carbonate cement; dry.		54-55 feet dry, carbonate cement.
55				100	1401					WBr	Medium to coarse sand grains.		55-62 feet good groundwater zone, very moist, weak cement, no carbonate.
										WBr	Color changing to very pale brown (10YR7/4); 100% medium to coarse, angular quartz/feldspar sand; medium dense; very moist.		
60										WBr	Color changing to gray (5Y6/1); 95% fine to coarse, angular sand; trace low plasticity silt; medium dense; very moist; no carbonate cementation.		
				100	1455					WBr	Color changing to white (10YR8/1); 90% fine subrounded quartz/fedlspar/mica sand; trace low plasticity silt; dry; very dense; weak to moderate carbonate cementation.		62-65 feet poor groundwater zone, dry.
65										WBr			

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 6

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											With no carbonate; weak cementation; very moist.		65-78 feet poor groundwater zone.
				100	1601					WBr	Fine; weak to moderate carbonate cementation; dry.		
70				100	0701					WBr	Fine to medium; highly weathered; rich in feldspar that is weathering to silt; very moist; very dense.		
75													
				100	0730					WBr	White (10YR8/1); fine grained sand; highly weathered; strongly cemented with carbonate, including concretions; dry; very dense.		78-79 feet good groundwater zone.
										WBr			
										WBr	Gray (5Y6/1); fine to medium grained sand; less weathered; very moist; no carbonate cement.		79-95 feet dry zone.
80				75	0810					WBr	90% fine, angular quartz/feldspar/mica sand; 10% silt from feldspar weathering; no carbonate; very dense.		
											Fine sand; strong carbonate cementation; carbonate concretions; dry.		
										WBr	90% medium sand; highly weathered; 10% silt due to feldspar weathering; moist.		
										WBr			
85										WBr	Fine sand; strong carbonate cementation. Medium sand; highly weathered; moist.		
				95	0950					WBr	Fine sand; strong carbonate cementation; dry.		
90										WBr	Medium sand; highly weathered; weak carbonate cementation; moist.		
				90	1035					WBr	Fine sand; weak carbonate cementation; dry.		
95										WBr	Fine to medium sand; highly weathered; no carbonate cement; very moist; silt-rich.		95-100 feet poor groundwater zone.
100													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 6

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				100	1110					WBr	Very fine sand; strong carbonate cementation with concretions; dry.		
										WBr			
										WBr	Brownish yellow (10YR6/5); 100% medium, subrounded quartz/feldspar sand; medium dense; very moist; loose to weakly cemented.		102-104 feet good groundwater zone.
										WBr	Gray (10YR6/1); 95% fine to medium subangular quartz/feldspar/mica sand; trace low plasticity silt; very moist.		104-109 feet dry, very poor groundwater zone.
105										WBr	White (10YR8/1); 90% fine sand; 10% silt; strong carbonate cementation; dry.		
											SILTY SANDSTONE; fine to medium; gray (10YR6/1); highly weathered; highly compacted; moist to very moist; very dense.		
										WBr	SANDSTONE; medium; loose to medium dense; very moist; weakly cemented; no carbonate cement.		109-110 feet very good groundwater zone.
110				95	1155					WBr			
					1530						Fine, with silt; very moist; highly weathered; highly compacted.		110-115 feet very poor groundwater zone.
115										WBr	SILTY SANDSTONE; olive gray (5Y 5/2); 85% fine, subrounded quartz/feldspar/mica sand; 15% low plasticity silt; very moist; medium dense; loose to weakly cemented.		115-117 feet very good groundwater zone.
				100	1604					WBr	Olive gray (5Y 5/2); 70% fine, subrounded quartz/feldspar sand; 30% low plasticity silt; very dense; dry.		Starting at 117 feet sediments become finer and clay starts with organic rich sediments, dry.
120													
										WBr	SANDSTONE; medium grained; loose to medium dense; saturated to wet.		121-122 feet very good groundwater zone.
					1620					WBr	CLAYEY SANDSTONE; olive gray (5Y 5/2); 85% fine, subrounded quartz/feldspar/mica sand; 15% medium plasticity clay; medium dense; very moist; organic-rich.		122-124 feet confining layer; clayey sandstone/siltstone.
					0725				× × × ×	WBr			
125										WBr	CLAYEY SILTSTONE; light olive gray (5Y6/2); 60% low plasticity silt; 30% medium plasticity clay; 10% fine, subrounded, quartz/mica sand; medium plasticity; very moist.		124-127 feet dry; silty sandstone. Bentonite seal from 107-112 feet.
										WBr	SILTY SANDSTONE; white (10YR 8/1); 85% fine, subrounded quartz/feldspar sand; 15% low plasticity silt; dry; strong carbonate cement with concretions.		127-135 feet poor groundwater zone. # 3 Sand from 112-152 feet.
				90	0940				× × × × × × × × × × × ×	WBr	Olive gray (5Y5/2); 85% fine, subrounded quartz/feldspar/mica sand; 15% low plasticity silt; medium dense; very moist.		
130										WBr	SANDY SILTSTONE; light gray (5Y7/1); 60% medium plasticity silt; 40% fine, subrounded, quartz/feldspar sand; loose; dry.		
											SILTY SANDSTONE; 70% fine to medium, subangular quartz/feldspar/mica sand; 30% low		
135													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 5 of 6

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											plasticity silt; weak cementation; no carbonate; medium dense to loose; less weathered; rich in mica.		
140				95	1110					WBr	SILTY SANDSTONE; olive gray (5Y6/2); 85% fine, subrounded quartz/feldspar sand; 15% low plasticity silt; very dense; moist; highly compacted.		140-142 feet semiconfining layer; clayey sandstone.
										WBr	CLAYEY SANDSTONE; olive gray (5Y5/2); 85% fine, subrounded quartz/feldspar/mica sand; 15% medium plasticity clay; medium dense; very moist; organic-rich.		142-144 feet poor groundwater zone; silty sandstone.
145										WBr	SILTY SANDSTONE; olive gray (5Y6/2); 85% fine sand; 15% low plasticity silt; very moist; medium dense.		144-147 feet semiconfining layer; clayey sandstone.
										WBr	CLAYEY SANDSTONE: as between 140 and 142 feet.		147-149 feet good groundater zone; silty sandstone.
										WBr	SANDSTONE; olive gray (5Y6/1); 95% fine, subangular, quartz/feldspar/mica sand; trace low plasticity silt; medium dense to loose.		149-155 feet poor groundwater zone; silty sandstone.
150				95	1315					WBr	SILTY SANDSTONE; fine sand; very dense; well compacted; no carbonate; dry.		0.020-inch slotted screen 115-130 feet.
										WBr	SILTY SANDSTONE; olive gray (5Y5/2); 85% fine, subangular, quartz/feldspar/mica sand; 15% low plasticity silt; very moist; medium dense.		
										WBr	SANDY SILTSTONE and SILTY SANDSTONE; strong carbonate cement; moist to dry.		Borehole backfilled with grout to 152 feet.
155				95	1428					WBr	SANDSTONE; fine; very moist; medium dense.		
										WBr	SANDSTONE: medium; very moist; medium dense; no silt.		155-156 feet good groundwater zone; silty sandstone.
										WBr	SILTY SANDSTONE; 80% fine, subangular, quartz/mica/feldspar sand; 20% low plasticity silt; medium dense; very moist; weak cementation to loose.		156-165 feet poor groundwater zone; silty sandstone.
									× × × × × ×	WBr	SANDY SILTSTONE; light gray (5Y7/1); 60% low plasticity silt; 40% fine, subrounded, quartz/mica sand; very dense; dry.		
160				25	1538 0730					WBr	Interpreted as SANDY SILTSTONE and SILTY SANDSTONE; very dense; strong carbonate cement; moist to dry.		Poor recovery (1 foot) from 160 to 165 feet bgs.
165				20						WBr	Interpreted as CLAYEY SANDSTONE: olive gray (5Y5/2); 85% fine, subangular quartz/mica sand; 15% medium plasticity clay.		165-170 feet semiconfining layer; clayey sandstone; organic rich.
170													Poor recovery (2 feet) from 165 to 170 feet bgs.

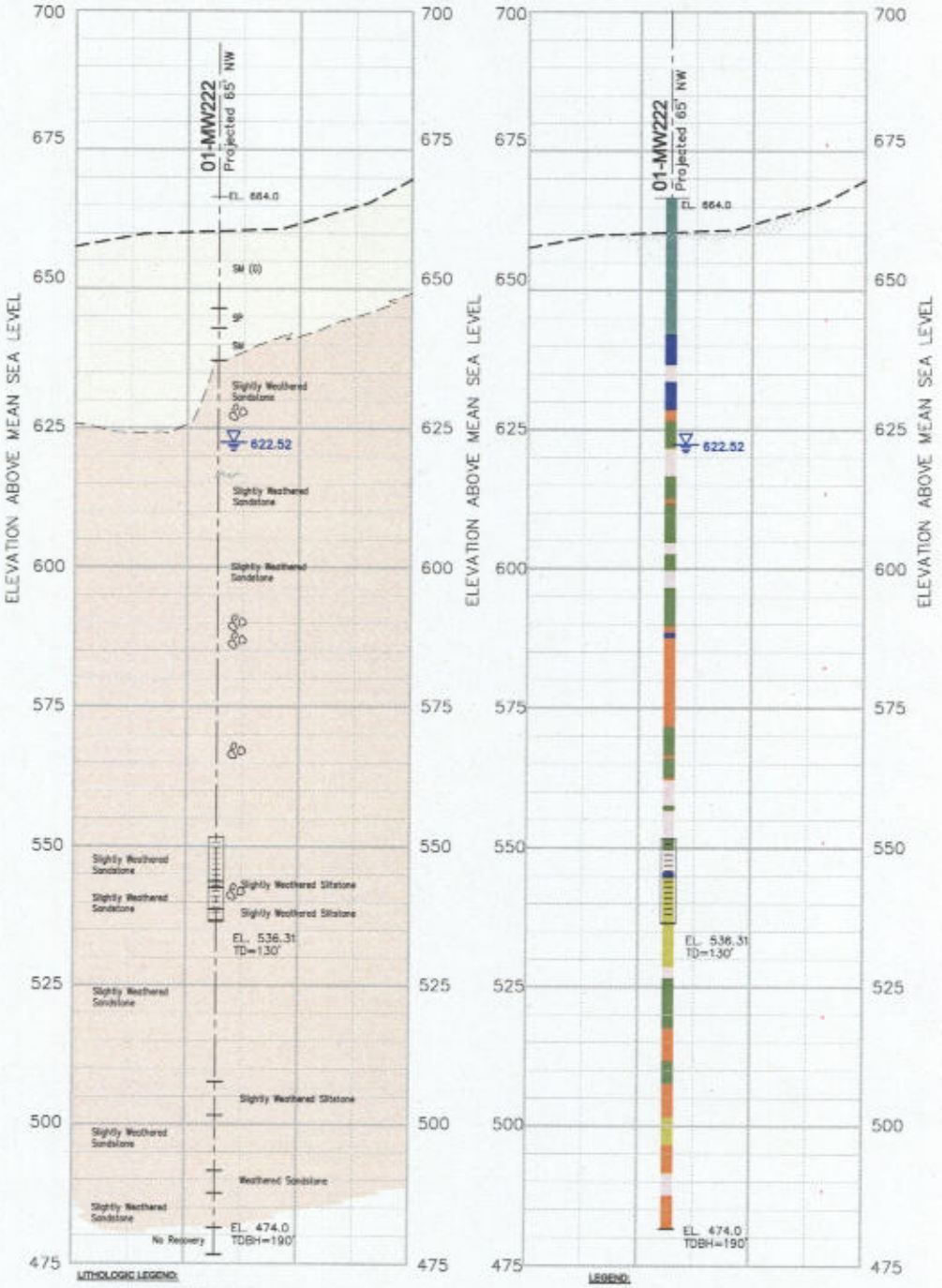
EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-BH02/01-MW222
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 6 of 6

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				90	0815					WBr	SILTY SANDSTONE and SANDSTONE; white (10YR8/1); 85% fine, subrounded, quartz/feldspar sand; 15% low plasticity silt; strong carbonate cementation with concretions; very dense; dry.		170-174.5 feet dry; silty sandstone.
175					0940					WBr WBr	SILTY SANDSTONE; olive gray (5Y5/2); 85% fine, subangular, quartz/mica sand; 15% low plasticity silt; very moist; medium dense to loose; no carbonate cement. Grading to moist to dry; highly weathered; silt-rich; no carbonate.		174.5-175 feet saturated silty sandstone. 175-179 feet moist to dry; poor groundwater zone.
180										WBr	SILTY SANDSTONE; white (10YR8/1); 80% fine, subrounded, quartz/feldspar sand; 20% low plasticity silt; dry; very dense; strong carbonate cement.		179-185 feet dry; silty sandstone.
185				0	1027						No recovery below 185 feet bgs.		
190											Total Depth = 190 feet.		

File: L:\work\36097\cad\Site 1 RI\Draft Final\FIGURE 3-3.dwg Time: Oct 20, 2005 - 1:12pm



LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- FRACTURE
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

NOTE:

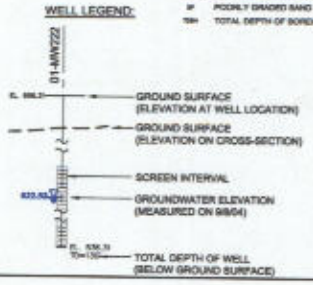
UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

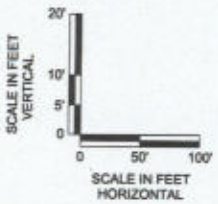
- SM SILTY SAND
- SM (G) SILTY SAND WITH GRAVEL
- SP POORLY GRADED SAND
- TDBH TOTAL DEPTH OF BOREHOLE

LEGEND:

- ALLUVIUM
- FEL0939-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FEL0939-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FEL0955-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FEL0939-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FEL0955-B-W ("B" HORIZON, WET, NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)

WELL LEGEND:





Phase II Remedial Investigation

01-MW222
INTERPRETIVE LOG

Site 1 - EOD Range

Date: 01-06	Former MCAS El Toro
Project No. 36097	EarthTech

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW223	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195359.438527 *Easting:* 6123320.755648	Sheet *1* of *3*	
Drilling Agency: Water Development Corp.	Driller: Miguel Alvarado		
Drilling Equipment: CME 75	Date Started: 3/22/2005	Total Depth (feet): 76.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 3/23/2005	Depth to Bedrock (feet): 75.0
Drilling Fluid: None	Borehole Diameter (in): 11	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well.	Elevation (feet MSL): *Ground:* 617.74	*Top of Casing:* 619.87	
	Logged By: L. Browne	Checked By: B. McClenney	

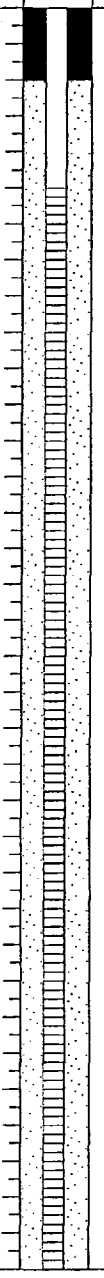
Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
5													
10													
15											No sampling prior to 65' bgs.		
20													
25													
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW223
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
35													
40													
45											No sampling prior to 65' bgs.		
50													
55													
60													
65													



EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW223
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP-SM	POORLY GRADED SAND WITH SILT; Pale brown (10YR 6/3), 90% medium to fine sand, 10% silt, trace coarse sand, wet, no odor.		
70										SM	SILTY SAND WITH CLAY; Grayish brown (10YR 5/2), 60% medium to fine sand, 30% silt, 10% clay occuring as stringers, wet, no odor.		
											NO RECOVERY - LOST SAMPLER DOWN HOLE. RECOVERED IN AUGERS BUT UNABLE TO EXPOSE SAMPLE.		
75										WBr	FELDSPATHIC SANDSTONE; Pale Yellow (2.5Y 8/4), high clay content, very moist, <5% quartz content, >15% clay content.		

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW224	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2192922.332587 *Easting:* 6121906.242407	Sheet *1* of *3*	
Drilling Agency: Water Development Corp.	Driller: Miguel Alvarado		
Drilling Equipment: CME 75	Date Started: 3/21/2005	Total Depth (feet): 91.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 3/25/2005	Depth to Bedrock (feet): 90.0
Drilling Fluid: None	Borehole Diameter (in): 11	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Completed as a 4-inch SCH 40 PVC monitoring well.	Elevation (feet MSL): *Ground:* 553.40	*Top of Casing:* 555.49	
	Logged By: L. Browne	Checked By: B. McClenney	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
													Begin drilling at 0920
5													
10													
15											No sampling prior to 75' bgs.		
20													
25													
30													

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW224
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
35													
40													
45											No sampling prior to 75' bgs.		
50													
55													0940 add water to hole, heaving
60													
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-MW224
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											No sampling prior to 75' bgs.		
70													
75				0	1117						NO RECOVERY - SAMPLE FELL OUT OF CORE BARREL SAMPLER ON RETRIEVAL. DRILLER REPORTS IT WAS A FINE SAND.		1000 switch to continuous core sampling
80				70	1210					SW	WELL-GRADED SAND; Dark gray (5Y 5/1), 95% coarse to fine sand, 5% silt, trace subrounded gravel, wet, no odor.		
				0						GW	Grades to GRAVEL; dark bluish gray (GLEY 5B 4/1); 80% subangular to subrounded cobbles/gravel; 15% fine to coarse sand; 5% silt; wet		
85				20	1330						NO RECOVERY - Advanced auger through cobbles		
										SM	SILTY SAND; dark gray (5Y 5/1); 60% fine sand; 40% silt; very moist; micaceous; no odor; fines are slightly plastic		
90				100	1430					WBr	SILTSTONE; dark gray (5Y 5/1); moist; fine laminations		Augers won't advance past 91 ft bgs

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW57	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195599.83	*Easting:* 6123657.35	Sheet *1* of *3*
Drilling Agency: Beylik Drilling	Driller:		
Drilling Equipment: CME 750	Date Started: 9/21/1992	Total Depth (feet): 93.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 9/22/1992	Depth to Bedrock (feet): 70.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:*	*Static:* 58.10
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 632.70	*Top of Casing:* 633.18
		Logged By: S. Terentieft	Checked By:

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	From 0 to 10 ft. Cuttings Silty Sand with Gravel (SM), gravel up to 11/2-inch max. observed size		Borehole Log generated from CH2MHILL Soil Boring Log MW-57, 9/22/92
5													
10	1-C		5 9 16 20	100		0.6				SM	Silty Sand (SM), light brown, dry, medium dense, trace limestone near top of sample, yellowish-orange Sandy Silt (ML), at tip of spoon		Color change noted in cuttings from light to dark brown at about 8 ft.
										ML	From about 10 to 20 ft. Cuttings: Sandy Silt (ML)		
15													
20	2-C		10 11 20 28	75		1.0				CL-ML	Sandy Lean Clay (CL), yellowish orange, dry to moist, hard, very sandy		
25										CL-ML	Cuttings: Sandy Lean Clay (CL), dark brown		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW57
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	3-C		11 13 20 36	100		20.0				SC	Clayed Sand (SC), light gray, dry to moist, medium dense, medium to coarse, subrounded, note11/2-inch diameter silty calcareous concretion reacts with HCl		
35													
40	4-C		12 25 30 40	75		26.0				SC	Clayed Sand (SC), similar to above		
										CL-ML	Silty Clay (CL-ML), light gray-brown, moist stiff, note well-graded light gray sand lense at 41ft.		
										SW	Well-Graded Sand (SW), light gray, moist very dense, noted similar circular concretion in sand as noted in sample 3-C		
45													
50	5-C		12 19 22 42	100		8.2				ML	Sandy Silt (ML), dark brown, moist to wet, very stiff Sandy Silt (ML), yellowish-orange with greenish-gray motting, moist to very stiff		
55										CL-ML	Cuttings: Lean Clay (CL), yellowish-orange	▼	Driller notes material change to yellowish-orange lean clay at 55 ft.
60	6-C		15 25 30 32	40		15.0							
										CL-ML	Sandy Lean Clay (CL), dark brown, moist, very stiff bottom: Silt with Sand (ML), yellowish-green, moist, hard		
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW57
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
70	7-C	☒	100/6	100		0.8				Br	Sandstone (Br), bluish-white, wet, fine to medium grained, well graded, friable, very soft, (Capistrano Formation- Oso Member)		
													Added 5 gal. of water (to prevent heaving)
75													Noted dak gray-brown to olive-gray siltstone cuttings from approx. 75 ft. to 90 ft. when pulling augers out. Added additional 5 gal. of water
80													Driller notes dark gray-brown clayey silt at bottom of retrievable plug
85													Added additional 5 gal. of water
	8-C	☒	30 32	100		2.5				Br	Clayey Siltstone with Sandstone Interbeds (Br), olive- gray to dark gray brown, soft, sand is fine and poorly graded, (Monterey Formation)		Sample 8-C dropped 12 inches, driller notes it is probably slough
90													Driller notes very hard drilling at 93 ft.

IRP Site 1, MCAS El Toro\MCAS El Toro RF/FS Phase I\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW58	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195751.9	*Easting:* 6123489.06	Sheet *1* of *3*
Drilling Agency: Beylik Drilling	Driller:		
Drilling Equipment: CME 750	Date Started: 9/16/1992	Total Depth (feet): 86.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 7	Date Finished: 9/17/1992	Depth to Bedrock (feet): 31.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 58.50	*Static:* 52.90
Completion Information: Completed as a 4 inch PVC monitoring well		Elevation (feet MSL): *Ground:* 624.30	*Top of Casing:* 624.80
		Logged By: S. Terentieft	Checked By:

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										ML	Cuttings from 0 to 9 ft. Sandy Silt (ML), light brown		Borehole Log generated from CH2MHILL Soil Boring Log MW-58, 9/17/92
5													
										SM	Cuttings: Silty Sand (SM), dark gray brown		
10	1-C	X	16 26 26	50		1.2							
										SM	Silty Sand (SM), dark gray, moist, very dense, medium to coarse sand, at top of sample, Well-Graded Sand (SW), fine to medium, at bottom of sample		
										CL	Cuttings: Sandy Lean Clay (CL)		
15													
20	2-C	X	14 45 60	50		18					Sandy Lean Clay (CL), light brown, dry, very stiff, trace organics, interbedded with olive green Siltstone, dry to moist, very soft, interbedded with white to yellowish gray Calcareous Siltstone, highly weathered, rust colored when broken up, reacts with HCL, noted thin olive-green siltstone interbed at 20.5 ft		
25													Driller notes color change to lighter colored, white silt at
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW58
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	3-C		8 10 50/2	100		0.8				ML	Top: Silt (ML), white with trace orange-green, dry, hard Bottom: Sandstone, yellowish to orange-gray, dry, friable, very soft, noted soft sandy siltstone at tip of spoon		28 ft. depth
	4-C		28 60/3	100						Br	Sandy Siltstone, light gray, dry friable, very soft, highly weathered with reddish coloring when broken up, very sandy		
35													
40	5-C		30 50/2	100		1.2				Br Br	Sandstone, white to bluish white, friable, very soft, sand is well graded from fine to coarse, Capistrano Formation, Oso Member? Cuttings: Sandstone, well graded		
45													
50	6-C		60/5	25						Br	Sandstone, similar to above		Recovery not sufficient for headspace sample
55													Driller notes consistant drilling conditions-well graded sand cuttings First encountered groundwater table at approximately 58.5 ft. depth
60	7-C		10 85 180/4	100		0.8				Br Br	Sandstone, white to bluish-white, friable, very soft, sand is well graded from fine to coarse, Capistrano Formation, Oso Member? Cuttings: Sandstone, well graded, white to bluish-white		Measured depth to water at approximately 56 ft depth prior to resuming drilling
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 01-DGMW58
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
													Driller notes similar cuttings from 60 to 86 ft, with relatively easy drilling conditions
70													
75													
80													Driller added total of approx. 30 gallons of water to prevent heaving
85													Driller notes approximately 3 ft. of heave inside augers, from 83 to 86 ft bgs
													Total Depth 86 ft.

IRP Site 1, MCAS El Toro\MCAS El Toro RF/FS Phase I\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 18-BGMW24	
Borehole Location: Site 18	*Northing:* 2194852.94 *Easting:* 6123662.32	Sheet *1* of *2*	
Drilling Agency: Beylik Drilling	Driller:		
Drilling Equipment: CME 75	Date Started: 8/15/1992	Total Depth (feet): 61.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 6	Date Finished: 8/25/1992	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:*	*Static:* 44.70
Completion Information: Completed as a monitoring well	Elevation (feet MSL): *Ground:* 617.50	*Top of Casing:* 618.13	
	Logged By: R.Heller	Checked By:	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	Silty Sand (SM), dark brown, fine sand, with minor gravel and coarse sand, both subrounded, some clay, medium density, some organics		Borehole log generated from CH2MHILL, Soil Boring Log MW-57, 9/21/92
5													
10	1-C		9 22 32	100			2.1						
15													
20	2-C		15 30 31	100			4.4			SP-SM	Poorly Graded Sand with Silt (SP-SM), dark brown, moist, fine to coarse sand with minor subrounded gravel		
25													Driller notes hard drilling at 25 ft. noted gray-brown sandy lean clay cuttings, visibly contaminated
30													

Site 18\MCAS El Toro RF/FS Phase I\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro RF/FS Phase I	Project Number: 36097	Borehole Number: 18-BGMW24
Borehole Location: Site 18		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
	3-C		10 33 55	100			2.0			ML	Sandy Silt (ML), dark brown, fine sand, with minor gravel and coarse sand, both subrounded, some clay, medium dense, some organics		
35													
40	4-C		33 60 >60	75			2.3			SM	Silty Sand (SM), greenish-white, moist, fine to medium sand, well graded, with large percentage of mica flakes		Very hard drilling - spoon bounces
45													
50	5-C		60 >60	50			0.8			SM	Silty Sand (SM), as above		Very hard drilling - spoon bounces, driller said this is common in this area
55													
60	6-C		10 22 40	100						SM	Silty Sand (SM), yellowish green, wet, fine sand, coarse minor gravel, well graded		

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ01	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2198038.83	*Easting:* 6124520.64	Sheet *1* of *4*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/13/2003	Total Depth (feet): 100.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 10	Date Finished: 1/13/2003	Depth to Bedrock (feet): 1.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 80.00	*Static:* 66.83
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 753.97	*Top of Casing:* 755.90
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										AF	Topsoil, brown, wet		
										SP	SANDSTONE, weathered bedrock, hard, yellowish white, fine to medium sand, non-plastic, moist.		
5													
10		X	60/6		0910						SANDSTONE, weathered bedrock, as above.		
15											SANDSTONE, weathered bedrock, as above (from cuttings).		
20		X	50/6		0925		0			SP	SANDSTONE, bedrock, white, very hard, fine to medium sand, non-plastic, slightly moist.		
25											SANDSTONE, bedrock, as above (from cuttings).		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ01
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	90/6		0945		0				SANDSTONE, bedrock, white, very hard, fine to medium sand, non-plastic, moist.		
35													
40		X	100/5		0958						SANDSTONE, bedrock, white, very hard, indurated, fine to medium, quartz grains with some biotite, non-plastic, dry.		
45											SANDSTONE, bedrock (cuttings).		
50		X	100/6		1020		0				SANDSTONE, bedrock, as above.		
55											SANDSTONE, bedrock, as above, but moist.		
60		X	100/5		1040						SANDSTONE, bedrock, as above.		
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ01
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											SANDSTONE, bedrock, as above.		
70			100/5		1110		0				SANDSTONE, bedrock, white, very hard, fine to medium quartz grains, with some biotite, non-plastic, moist.		
75													
80			100/6		1125						SANDSTONE, bedrock, as above, but wet.		
85													
90			100/6		1155						SANDSTONE, bedrock, light gray, very hard, fine- to medium-grained sand, non-plastic, moist.		
95													
100											SANDSTONE, bedrock, as above.		

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ01
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	90/6		1235								

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ02	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197584.3	*Easting:* 6124144.06	Sheet *1* of *3*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/14/2003	Total Depth (feet): 90.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 9	Date Finished: 1/16/2003	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 68.49
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 731.65	*Top of Casing:* 733.39
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											SANDSTONE, weathered bedrock, light gray, fine-grained sand, non-plastic, moist.		
5											SANDSTONE, weathered bedrock, as above.		
10		X	39 60/6		1010		0				SANDSTONE, weathered bedrock, light gray, hard, fine-grained sand, non-plastic, moist.		
15											SANDSTONE, weathered bedrock, as above.		
20		X	80/6		1020		0				SANDSTONE, bedrock, light gray to white, very hard, fine- to medium-grained sand, with trace biotite, non-plastic, moist.		
25											SANDSTONE, bedrock, as above (from cuttings).		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ02
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			100/6		1029		0				SANDSTONE, bedrock, light gray, very hard, fine- to medium-grained sand, non-plastic, moist.		
35											SANDSTONE, bedrock, as above (from cuttings).		
40			70/6		1050						SANDSTONE, bedrock, light gray, very hard, fine- to medium-grained sand, low plasticity fines, moist.		
45			100/6		1100		0				SANDSTONE, bedrock, white, very hard, indurated, fine to medium quartz grains with some biotite, non-plastic, dry.		
50			100/6		1112						SANDSTONE-SILTSTONE, bedrock, olive gray, very hard, fine- to medium- grained sand, with medium plasticity fines, moist.		
55			80/6		1118						SANDSTONE, bedrock, light gray, hard, fine- to medium-grained sand, non-plastic, moist.		
60			100/5		1118						SANDSTONE, bedrock, as above.		
65													

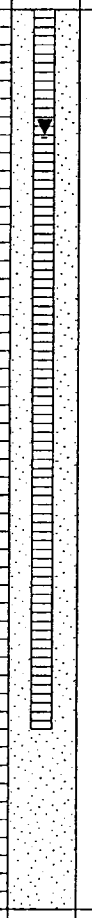
IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ02
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	90/6		1145		0				SANDSTONE, bedrock, as above.		
70											SANDSTONE, bedrock, light gray, hard drilling, fine- to medium-grained sand, with some low-plasticity fines, moist.		
75											SANDSTONE, bedrock, as above.		
80											SANDSTONE, bedrock, as above.		
85											SANDSTONE, bedrock, as above (from cuttings).		
90											SANDSTONE, bedrock, as above (from cuttings).		



IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ03	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197411.52 *Easting:* 6124609.41	Sheet *1* of *2*	
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/15/2003	Total Depth (feet): 60.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 7	Date Finished: 1/15/2003	Depth to Bedrock (feet): 10.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:* 40.17
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 719.02	*Top of Casing:* 721.12
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	TOPSOIL, silty sand, dark brown, low plasticity, silt, medium to fine sand, moist.		
5		X	29 55/6		1105		0			SP	SAND, yellowish brown, poorly graded, fine to coarse sand, non-plastic, moist.		
10		X	50/6		1119		0			WBr	SANDSTONE, weathered bedrock, white, very hard, fine- to coarse-grained sand, non-plastic, moist.		
15										WBr	SANDSTONE, weathered bedrock, as above.		
										CBr			
20		X	100/6		1125					CBr	SANDSTONE, bedrock, yellowish white, very hard, fine- to medium-grained sand, non-plastic, moist.		
25										CBr	SANDSTONE, bedrock, as above (from cuttings).		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ03
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			70/6		1200		0			CBr	SANDSTONE, bedrock, light gray to white, very hard, fine- to coarse-grained sand, non-plastic, slightly moist.		
35										CBr	SANDSTONE, bedrock, as above (from cuttings).		
40			100/6		1330					CBr	SANDSTONE, bedrock, as above, but wet.		
45										CBr	SANDSTONE, bedrock, as above (from cuttings).		
50			100/6		1340		0			CBr	SANDSTONE, bedrock, as above, but light gray in color. Wet.		
55										CBr	SANDSTONE, bedrock, as above (from cuttings).		
										CBr	SANDSTONE, bedrock, as above.		
60			100/6		1400								

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ04	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197334.58 *Easting:* 6124157.87	Sheet *1* of *2*	
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/14/2003	Total Depth (feet): 60.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 7	Date Finished: 1/15/2003	Depth to Bedrock (feet): 12.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 50.00	*Static:* 36.03
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 692.49	*Top of Casing:* 693.99
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	TOPSOIL (SILTY SAND), dark brown to black, fine to coarse sand, low plasticity silt, moist.		
5		X	7 10 12		1415		0			SM	SILTY SAND, brown, fine to medium sand, with low plasticity silt, wet.		
10		X	25 50/6		1419		0			SM	SILTY SAND, as above, but moist.		
										SP	SANDSTONE, weathered bedrock, yellowish white, hard, coarse- to fine-grained sand, non-plastic, moist.		
15		X	80/6		1425		0			SP	SANDSTONE, weathered bedrock, as above.		
20		X	100/6		1430					SP	SANDSTONE, bedrock, white, very hard, fine- to medium-grained sand, non-plastic, slightly moist.		
25										SP	SANDSTONE, bedrock, as above (from cuttings), but olive gray in color.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ04
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	90/6		1440		0			SP	SANDSTONE, bedrock, light gray, very hard, very fine- to fine-grained sand, interbedded with olive sandstone, low plasticity, moist.		
35										SP	SANDSTONE, bedrock, as above (from cuttings).		
40		X	70/6		1500					SP	SANDSTONE, bedrock, as above.		
45										SP	SANDSTONE, bedrock, as above (from cuttings).		
50		X	100/6				0			SP	SANDSTONE, bedrock, white, very hard, fine- to medium-grained sand, non-plastic, moist to wet.		
55										SP	SANDSTONE, bedrock, as above.		
60										SP	SANDSTONE, bedrock, as above (from cuttings).		

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ05	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2197126.69	*Easting:* 6124643.46	Sheet *1* of *4*
Drilling Agency: Cascade Drilling Co.	Driller: Jamie Moore /Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/6/2003	Total Depth (feet): 105.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 10	Date Finished: 1/7/2003	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 70.00	*Static:* 64.91
Completion Information: Completed as a monitoring well		Elevation (feet MSL) : *Ground:* 739.27	*Top of Casing:* 740.33
		Logged By: C. Wong	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP			
5													
10		X	60/6		1040		0			SP	SANDSTONE, dry, white, well indurated, medium grains of quartz and biotite in a fine white matrix, salt & pepper texture similar to tuff or granite. Matrix is mostly fine sand with silt, non plastic.		
15													
20		X			1050		0			SP	SANDSTONE, as above, but with a hint of moisture, brighter white, slightly more coarse.		
25													
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ05
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	70/6		1103		0			SP	SANDSTONE, as above, but with a trace of coarse quartz grains.		
35													
40		X			1121		0			SP	SANDSTONE, bedrock, as above.		
45													
50		X			1140		0			SP	SANDSTONE, bedrock, as above.		
55													
60		X	50 70		1200		0			SP	SANDSTONE, bedrock, as above.		
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ05
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
70		X			1222		0			SP	SANDSTONE, bedrock, as above.		
75													
80		X			1245		0			SP	SANDSTONE, bedrock, as above.		
85													
90		X			1355		0			SP	SANDSTONE, bedrock, as above, but with more moisture.		
95													
100													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ05
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 4 of 4

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X			1418		0			SP	SANDSTONE, bedrock, as above. Drilling is slow.		
105													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ06	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196884.86	*Easting:* 6124590.31	Sheet *1* of *3*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/7/2003	Total Depth (feet): 85.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 1/8/2003	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 65.00	*Static:* 67.04
Completion Information: Completed as a monitoring well	Elevation (feet MSL): *Ground:* 731.25	*Top of Casing:* 732.77	
	Logged By: R. Lazo	Checked By: C. Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, weathered bedrock, yellowish white, soft; cuttings, fine to medium sand, moist.		
5													
10										SP	SANDSTONE, weathered bedrock, as above.		
15										SP	SANDSTONE, bedrock, light gray to white, fine to coarse sand, moderately hard, slightly moist.		
20													
25										SP	SANDSTONE, bedrock, as above.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ06
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, bedrock, light gray, fine to medium sand with some low plasticity silt, moderately hard, slightly moist.		
35													
40										SP	SANDSTONE, bedrock, as above.		
45													
50										SP	SANDSTONE, bedrock, as above.		
55										SC	SANDSTONE, bedrock, light gray, fine- to medium-grained sand, clayey sand, hard, slightly moist.		
60		X	100/6		1340		0			SP	SANDSTONE, bedrock, white, fine to medium grains of quartz, trace biotite, salt & pepper texture, hard, moist, non-plastic.		
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ06
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, bedrock, as above (from cuttings).		
70			100/6		1400		0			SP	SANDSTONE, bedrock, white, fine to medium quartz grains, trace biotite, hard, compact, moist, non-plastic.		
75			100/6		1430					SP	SANDSTONE, bedrock, as above.		
80										SP	SANDSTONE, bedrock, as above.		
85										SP	SANDSTONE, bedrock, as above.		

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ07	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196739.31	*Easting:* 6124011.72	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/10/2003	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 11	Date Finished: 1/10/2003	Depth to Bedrock (feet): 4.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 37.60
Completion Information: Completed as a monitoring well	Elevation (feet MSL): *Ground:* 662.00	*Top of Casing:* 663.28	
	Logged By: R. Lazo	Checked By: C. Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), dark brown, fine to medium sand, low plasticity silt, moist to wet.		
5			50/6		0750					SP	SANDSTONE, weathered bedrock, yellowish white, fine to coarse sand, non-plastic, moist.		
10			60/6		0800		0			SP	SANDSTONE, bedrock, light gray to white, fine to coarse sand, hard, uniform matrix, non-plastic, slightly moist.		
15			70/6		0804					SP	SANDSTONE, bedrock, as above.		
20			75/6		0813		0			SP	SANDSTONE, bedrock, yellowish white, fine to medium sand, hard, with some low plasticity silt, moist.		
25			90/6		0819		0			SP	SANDSTONE, bedrock, interbedded with 1/2 inch siltstone. Very hard, fine to medium sand with some low plasticity silt, moist.		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ07
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	100/6		0830		0			SP	SANDSTONE, bedrock, indurated, white, fine to medium quartz sand with some biotite, non-plastic, very hard, slightly moist to dry.		
35		X	100/6		0840					SP	SANDSTONE, bedrock, white, very hard, fine to medium sand, non-plastic, moist.		
40		X	100/6		0845					SP	SANDSTONE, bedrock, as above, but light gray in color.		
45		X	100/6		0855					SP	SANDSTONE, bedrock, as above.		
50		X	100/6		0906		0			SP	SANDSTONE, bedrock, as above, but wet.		
										SP	SANDSTONE, bedrock, as above, but saturated.		
55													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ08	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196682.5	*Easting:* 6124539.4	Sheet 1 of 3
Drilling Agency: Cascade Drilling Co.	Driller: Kurt Magee		
Drilling Equipment: CME 95	Date Started: 1/8/2003	Total Depth (feet): 80.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 1/10/2003	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 74.04
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 720.29	*Top of Casing:* 722.13
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, weathered bedrock (from cuttings), yellowish white, fine to coarse sand, non-plastic, moist.		
5										SP	SANDSTONE, weathered bedrock, as above.		
10										SP	SANDSTONE, weathered bedrock, as above.		
15										SP	SANDSTONE, bedrock, yellowish white, hard, fine to medium sand, medium plasticity silt, moist.		
20													
25										SP	SANDSTONE, bedrock, as above.		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ08
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, bedrock, light gray, hard, fine to medium sand, with low plasticity silt, slightly moist.		
35													
40										SP	SANDSTONE, bedrock, as above.		
45										SP	SANDSTONE, bedrock, as above.		
50			50/6		1040		0			SP	SANDSTONE, bedrock, white, hard, fine to medium quartz sand spotted with biotite, with low plasticity silt, slightly moist.		
55													
60			13 30 55		1100		0			SP	SANDSTONE, bedrock, as above.		
65													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ08
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, bedrock, as above.		
70		X	17 48 50		1110		0			SP	SANDSTONE, bedrock, white, hard, fine to medium quartz grains with non-plastic fines, slightly moist.		
75		X	20 40 48		1120		0			SP	SANDSTONE, bedrock, as above, but moist.		
										SP	SANDSTONE, bedrock, as above, but saturated.		
80													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ09	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196595.2	*Easting:* 6123946.53	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/9/2003	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 11	Date Finished: 1/9/2003	Depth to Bedrock (feet): 5.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 33.99
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 656.32	*Top of Casing:* 658.09
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), dark brown, root zone, wet.		
										SM	SILTY SAND, brown, fine to medium sand, with non-plastic silt, moist.		
5		X	29 50		1355		0			SP	SANDSTONE, weathered bedrock, white, fine to medium sand, non-plastic, moist.		
10		X	60/6		1400		0			SP	SANDSTONE, weathered bedrock, as above.		
15		X	60/6		1403					SP	SANDSTONE, weathered bedrock, as above.		
										SP	SANDSTONE, bedrock, yellowish white, hard, fine to coarse sand, low plasticity, moist.		
20		X	100/6		1412								
25		X	100/6		1418		0			SP	SANDSTONE, as above, but interbedded with 1/2-inch beds of SILTSTONE, gray in color, non-plastic to low plasticity, moist.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ09
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	100/5		1423					SP	SANDSTONE, bedrock, yellowish white, hard, fine to medium sand with some biotite, non-plastic, moist.		
35		X	80/5		1427		0			SP	SANDSTONE, bedrock, as above.		
40		X	100/6		1432					SP	SANDSTONE, bedrock, light gray, hard, very fine- to fine-grained, interbedded with 1/2-inch SILTSTONE, low plasticity, moist.		
45		X	100/6		1440					SP	SANDSTONE, bedrock, as above.		
50										SP	SANDSTONE, bedrock, as above.		
55										SP	SANDSTONE, bedrock, as above.		

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ10	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196511.88	*Easting:* 6124038.04	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/9/2003	Total Depth (feet): 50.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 10	Date Finished: 1/9/2003	Depth to Bedrock (feet): 40.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 39.81
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 650.60	*Top of Casing:* 652.76
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), dark brown, fine- to medium-grained sand with low plasticity silt, moist.		
5										SM	SILTY SAND, brown, fine- to coarse-grained sand, with non-plsatic silt, slightly moist.		
10										SM	SILTY SAND, as above, but with low plasticity silt.		
15										SP-SM	SILTY SAND to SAND, light brown, fine to medium sand, with some low plasticity silt, moist.		
20										SC	CLAYEY SAND, olive brown, mixture of fine sand with medium plasticity clay, moist.		
25										SC	CLAYEY SAND, as above.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ10
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND, grayish brown, fine to coarse sand with low plasticity silt, moist.		
35										SM	SILTY SAND, as above.		
40										SP	SANDSTONE, weathered bedrock, light gray to white, fine to medium sand, hard, non-plastic, moist.		
45										SP	SANDSTONE, weathered bedrock, as above, but wet.		
										SP	SANDSTONE, weathered bedrock, as above.		
50													

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ11	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196454.78	*Easting:* 6124176.55	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Shannon Meyers		
Drilling Equipment: CME 95	Date Started: 1/16/2003	Total Depth (feet): 65.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 1/16/2003	Depth to Bedrock (feet): 1.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 43.01
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 662.91	*Top of Casing:* 664.92
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL).		
										SP	SANDSTONE, weathered bedrock.		
5		X	40 60/6		0950		0			SP	SANDSTONE, weathered bedrock, light gray, to white, hard, fine- to coarse-grained sand, non-plastic, moist.		
10		X	20 56/6		1000					SP	SANDSTONE, weathered bedrock, as above.		
15		X	30 50/6		1005		0			SP	SANDSTONE, bedrock, white, hard, fine- to medium-grained sand, non-plastic, moist.		
20		X	70/5		1012					SP	SANDSTONE, bedrock, as above, but very hard.		
25										SP	SANDSTONE, bedrock, as above (from cuttings).		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ11
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	70/6		1030		0			SP	SANDSTONE, bedrock, yellowish brown, very hard, fine- to medium-grained sand, with traces of rust-like oxidation stains, non-plastic, moist.		
35										SP	SANDSTONE, bedrock, as above (from cuttings).		
40		X	60/6		1050					SP	SANDSTONE, bedrock, light gray, very hard, fine- to medium-grained sand, with trace biotite, non-plastic, moist.		
45										SP	SANDSTONE, bedrock, as above.		
50		X	70/6		1110					SP	SANDSTONE, bedrock, as above.		
55										SP	SANDSTONE, bedrock, as above (from cuttings).		
60		X	70/6		1200		0			SP	SANDSTONE, bedrock, as above.		
65										SP	SANDSTONE, bedrock, as above (from cuttings).		

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ12	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2196505.61	*Easting:* 6124437.63	Sheet *1* of *3*
Drilling Agency: Cascade Drilling Co.	Driller: Kurt Magee		
Drilling Equipment: CME 95	Date Started: 1/8/2003	Total Depth (feet): 100.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 1/17/2003	Depth to Bedrock (feet): 0.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:* 85.93
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 713.92	*Top of Casing:* 715.39
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, weathered bedrock, yellowish white (from cuttings), fine- to medium sand, non-plastic, moist.		
5													
10							0			SP	SANDSTONE, weathered bedrock, as above.		
15							0			SP	SANDSTONE, bedrock, yellowish brown (from cuttings), moderately hard, fine to coarse sand, non-plastic, slightly moist.		
20													
25										SP	SANDSTONE, bedrock, as above.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ12
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
							0			SP	SANDSTONE, bedrock, light gray (from cuttings), hard, fine to medium sand with low plasticity silt, slightly moist.		
35													
40		X	28 48		1240		0			SP	SANDSTONE, bedrock, as above, but light gray to white in color.		
45										SP	SANDSTONE, bedrock, as above.		
50		X	50/6		0745		0			SP	SANDSTONE, bedrock, light gray to white (from cuttings), hard, fine to medium sand with some low plasticity silt, slightly moist.		
55													
60		X	100/6		0810		0			SP	SANDSTONE, bedrock, light gray, hard, very-fine to fine-grained sand with some low plasticity silt, slightly moist.		
65													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ12
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SP	SANDSTONE, bedrock, as above, very hard.		
70		X	100/6		0840		0			SP	SANDSTONE, bedrock, white, very hard, indurated, fine to medium quartz grains with some subrounded to subangular coarse brown grains of sand. Non-plastic, dry.		
75							0			SP	SANDSTONE, bedrock, white, very hard, very fine- to fine-grained sand, non-plastic, moist.		
80										SP	SANDSTONE/SILTSTONE, bedrock, olive-gray, very hard, indurated, fine to medium sand with medium plasticity silt, moist.		
85										SP-SM	SANDSTONE/SILTSTONE, bedrock, as above.		
90							0			SP	SANDSTONE, bedrock, light gray to white, very hard, fine- to medium-grained sand, non-plastic, slightly moist.		
95										SP	SANDSTONE, bedrock, as above (from cuttings).		
100										SP	SANDSTONE, bedrock, as above (from cuttings).		

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ13	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195718.87 *Easting:* 6123182.33	Sheet *1* of *2*	
Drilling Agency: Cascade Drilling Co.	Driller: Steve Huston		
Drilling Equipment: CME 75	Date Started: 1/24/2003	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 11	Date Finished: 1/24/2003	Depth to Bedrock (feet): >55
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:* 47.07
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 617.99	*Top of Casing:* 619.89
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), dark brown, root zone.		
										SM	SILTY SAND, olive yellow, very fine- to fine-grained sand with some low plasticity silt, slightly moist.		
5		X	6 7 8		1130		0						
10		X	15 18 23		1134		0			SM	SILTY SAND, as above, but olive brown in color.		
15		X	20 23 28		1137					SM	SILTY SAND, as above.		
20		X	22 50/6		1142		0			SP	POORLY GRADED SAND, brown, fine- to medium-grained sand, medium dense, moist.		
25		X	22 25 27		1145					SP	POORLY GRADED SAND, as above.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ13
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	21 27 30		1150		0			SM	SILTY SAND, olive brown, fine to medium sand with low plasticity silt, moderately dense, moist.		
35		X	22 23 25		1156					SM	SILTY SAND, as above, but moist to wet.		
40		X	25 27 31		1200					SM	SILTY SAND, olive yellow, very fine- to fine-grained sand, moderately dense with some low plasticity silt, very moist.		
45		X	32 50/6		1207					SM	SILTY SAND, as above, but saturated.		
50		X	20 50/6		1212		0			SM	SILTY SAND, yellow, fine- to medium-grained sand, medium dense, with some non-plastic fines, saturated.		
										SM	SILTY SAND, as above.		
55		X	24 50/6		1220								

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ14	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195500.26	*Easting:* 6123055.79	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Steve Huston		
Drilling Equipment: CME 75	Date Started: 1/23/2003	Total Depth (feet): 50.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 10	Date Finished: 1/23/2003	Depth to Bedrock (feet): >50
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:* 42.08
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 610.72	*Top of Casing:* 613.26
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), brown, moist.		
										SM	SILTY SAND, brown, fine-grained sand with low plasticity silt, moist.		
5		X	8 10 15		0915		0						
10		X	12 13 14		0922					SM	SILTY SAND, olive brown, fine- to medium-grained sand, with medium plasticity silt, moist.		
15		X	14 15 18		0926		0			SM	SILTY SAND, yellowish brown, fine to medium sand, with some low plasticity silt, loose, moist.		
20		X	10 12 15		0933					SM	SILTY SAND, as above.		
25		X	17 50/6		0937					SP	POORLY GRADED SAND, yellow, fine to coarse sand, medium dense, trace angular,gravel up to 1/4 inch, slightly moist.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ14
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	22 50/6		0940		0			SP	SAND, yellow, fine- to coarse-grained sand, medium dense, trace of subangular gravel, up to 1/4 inch, slightly moist.		
35		X	50/6		0945					SP	SAND, as above, but moist to wet.		
40		X	50/6		0950		0			SP	POORLY GRADED SAND, brown, fine- to medium-grained sand, very dense, saturated.		
45		X	50/6		0956					SP	POORLY GRADED SAND, as above.		
										SP	POORLY GRADED SAND, as above.		
50		X	50/6		1004								

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ15	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2194620.46	*Easting:* 6122321.03	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Steve Huston		
Drilling Equipment: CME 75	Date Started: 1/23/2003	Total Depth (feet): 40.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 1/23/2003	Depth to Bedrock (feet): >40
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 25.00	*Static:* 23.87
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 579.58	*Top of Casing:* 581.75
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), brown, moist.		
										SM	SILTY SAND, dark brown, fine- to medium-grained sand with some low plasticity silt, moist.		
5		X	7 7 8		1240		0			SM	SILTY SAND, olive, fine- to medium-grained sand, with some gravel up to 1/4 inch, subrounded, low plasticity silt, moist.		
10		X	10 12 17		1245								
										SM	SILTY SAND, olive brown, fine to medium sand, with low plasticity silt, moist.		
15		X	13 16 20		1250		0						
20		X	16 17 21		1255					SM	SILTY SAND, olive brown, gravel-sand mixture, with medium plasticity clay, moist.		
25		X	30/6		1400					SM	SILTY SAND, as above, but wet.		
30													

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ15
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	16 20 23		1404		0			ML	SANDY SILT, olive, low plasticity silt with very fine-grained sand, firm, moist.		
35		X	20 39/6		1410					SM	SILTY SAND, olive green, very fine- to fine-grained sand, medium dense, with some low plasticity silt, saturated.		
										SM	SILTY SAND, as above.		
40		X	16 20 25		1415								

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole/Well Construction Log

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ16	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2193710	*Easting:* 6122066.77	Sheet *1* of *2*
Drilling Agency: Cascade Drilling Co.	Driller: Steve Huston		
Drilling Equipment: CME 75	Date Started: 1/24/2003	Total Depth (feet): 40.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 1/24/2003	Depth to Bedrock (feet): >40
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 20.00	*Static:* 20.50
Completion Information: Completed as a monitoring well		Elevation (feet MSL): *Ground:* 562.25	*Top of Casing:* 564.13
		Logged By: R. Lazo	Checked By: C. Wanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (TOPSOIL), olive brown, fine sand with low plasticity silt, moist.		
										SC	CLAYEY SAND, olive brown, fine-grained sand with medium plasticity clay, soft, moist.		
5		X	4 5 5		0905								
10		X	7 9 11		0910		0			SC	CLAYEY SAND, as above.		
15		X	7 7 9		0918					SC	CLAYEY SAND, as above.		
20		X	12 18 21		0925		0			SC	CLAYEY SAND, as above, with trace subangular gravel up to 1/4 inch, saturated.		
25		X	11 12 15		0931					SC	CLAYEY SAND, as above, with no gravel, saturated.		
30													

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: Piezometer Installation	Project Number: 36097	Borehole Number: 01PZ16
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
		X	12 15 18		0935		0			SP	POORLY GRADED SAND, olive, fine- to medium-grained sand, loose, with some non-plastic fines, saturated.		
35		X	12 16 18		0940					SP	POORLY GRADED SAND WITH GRAVEL, olive brown, fine- to coarse-grained sand, coarse gravel up to 3/4 inch, loose, saturated.		
										SP	POORLY GRADED SAND WITH GRAVEL, as above, saturated.		
40		X	17 18 23		0945		0						

IRP Site 1, MCAS El Toro\Piezometer Installation\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA1	
Borehole Location: Site 1	*Northing:* 2194930.29	*Easting:* 6122763.83	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/25/2005	Total Depth (feet): 48.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 1/25/2005	Depth to Bedrock (feet): 44.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 34.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 600.12	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND; very dark grayish brown (10YR 3/2); 70% very fine sand; 30% silt; roots Increasing silt content with depth	Hand auger to 5 ft bgs
					0915					SM	Grading to 40% silt; 60% very fine sand SILTY SAND; dark grayish brown (10YR 4/2); 20% silt; 10% clay; 70% very fine sand; trace mica; roots Color change to olive brown (2.5Y 4/3); mottled; roots	
5										SM	Fine sand lens from 7.5-7.7'; pale yellow (2.5Y 8/2); large rounded pebbles	
					0922					SP-SM		
										SC	SILTY SAND as above; olive brown (2.5Y 4/3); trace gravel SAND with SILT; yellowish brown (10YR 5/6); 90% very fine sand; 10% silt CLAYEY SAND; dark grayish brown (10YR 4/2); 75% very fine sand, trace coarser sands; 25% clay; roots; calcareous veins throuhgout	
10					0926						CLAYEY SAND; brown (10YR 4/3); 60% very fine sand; 40% clay; calcareous veins	
15										SP-SC	SAND with CLAY; brown (10YR 5/3); 90% very fine sand; 10% clay; trace mica Increasing clay with depth Rock fragments	
					0934					SC	CLAYEY SAND; brown (10YR 4/3); 85% very fine sand; 15% clay; trace silt; trace gravel Color change to brown (10YR 5/3)	
20										SP	Grading to fine SAND; trace gravel; rock fragments	
					0942					SC-SM	SILTY, CLAYEY SAND; dark brown (10YR 3/3); 30% clay; 20% silt; 50% very fine sand; white veins Increasing clay content; less silt; color change to brown (10YR 5/3)	Soil Sample LE543 collcted at 1230 at depth of 23.5 ft bgs
25					0950					SC	CLAYEY SAND; light brownish gray (2.5Y 6/2); 75% very fine sand, trace coarse sand; 25% clay;	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA1
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											trace mica	
											Color change to brown (10YR 5/3)	
										CLS	Grading to SANDY CLAY; 60% clay; 40% very fine sand	
					1011							
35										SP	Poorly graded SAND; light brownish gray (10YR 6/2); very fine sand; clean; moist	
											Grain size coarsening; very moist	
										SC	Grading to CLAYEY SAND; medium to coarse sand; 20% clay	
										CLS		
					1030					SC	Grading to SANDY CLAY; 60% clay; 40% fine sand	Water on shoe. Alluvium HP sample screened from 34-38 ft bgs
40										CLS	CLAYEY SAND; grayish brown (10YR 5/2); 80% fine to coarse sand; 20% clay; saturated	GW sample LE537 collected at 1045
											grading to SANDY CLAY; 60% clay; 40% medium to coarse sand; soft; saturated	GW sample LE538 (Dup) at 1050
											Grading to 80% clay; 20% very fine sand; color change to dark grayish brown (10YR 4/2); soft; very moist	
					1106					WBr	Rock fragments and pebbles	
45											Weathered transition in to (BEDROCK) SILTSTONE; pale olive (5Y 6/4); very moist	
										CBr	Competent BEDROCK; fine grained SILTSTONE as above; saturated	Bedrock HP sample screened from 48.5-50 ft bgs
												GW sample LE542 collected at 1220

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA2	
Borehole Location: Site 1	*Northing:* 2194983.77	*Easting:* 6122909.48	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/31/2005	Total Depth (feet): 70.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 2/1/2005	Depth to Bedrock (feet): 67.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:*
Completion Information:Cement bentonite grout to surface		Elevation (feet MSL) : 604.60	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	Grass at surface SILTY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 10% clay, 30% silt; moist.	Hand auger to 5 ft bgs
5				60	1537							
										ML	SILT with SAND; brown (10YR 4/3); 50% silt; 30% very fine sand; 20% clay; moist.	
										SM	SILTY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 30% silt; 10% clay; moist.	
10				100	1542							
										CL	SANDY CLAY; 40% clay; 30% silt; 30% very fine sand; moist.	
										ML	SANDY SILT; brown (10YR 4/3); 50% silt; 30% very fine sand; 20% clay. White veining; moist.	
15				100	1547							
										ML	SANDY SILT; dark yellowish brown (10YR 4/4); 60% silt, 30% very fine sand, 10% clay. White veining; moist.	
20				90	1553							
										SM	SILTY SAND; dark grayish brown (10YR 4/2); 70% fine to coarse sand; 30% silt, moist.	
										ML	SANDY SILT; brown (10YR 4/3); 60% silt; 30% very fine sand; 10% clay; moist. Decreasing silt at 23.5' bgs.	
										ML	10YR 4/3; 50% silt; 30% very fine sand; 20% clay; moist.	
25				70	1557							
										ML	SANDY SILT; 10YR 4/3; 60% silt; 30% very fine sand; 10% clay; moist.	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA2
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				50	1603					SM	SILTY SAND; pale brown (10YR 6/3); 60% very fine sand, 30% silt; 10% clay; moist.	Soil sample LE574 collceted at1623 at a depth of 30 ft bgs
35					1610					SM	SILTY SAND; grayish brown (10YR 5/2); 50% very fine sand; 40% silt; 10% clay; moist.	
										SM	SILTY SAND; grayish brown (10YR 5/2); 70% very fine to fine sand, trace coarse sand; 30% silt; moist.	
40					1616					SM ▽ CL	SILTY SAND; grayish brown (10YR 5/2); 80% very fine to medium sand; 20% silt; very moist.	Rinsate sample LE575 collected at 1626
										SM	SANDY CLAY; very pale brown (10YR 7/3); 70% clay; 30% very fine to medium sand; wet.	
										CL SC	SILTY SAND; grayish brown (10YR 5/2); 60% very fine sand; 30% silt; 10% clay. Sand coarsening downward; wet.	Alluvium HP sampler screened 45-49 ft bgs
45				40	800					CL	CLAY; grayish brown (10YR 5/2); 90% clay; 10% very fine sand; trace mica; wet.	GW sample LE576 collected at 1643
											CLAYEY SAND; grayish brown (10YR 5/2); 80% medium to coarse sand 20% clay; wet.	
											CLAY; grayish brown (10YR 5/2); 90% clay; 10% very fine sand; wet.	
50				100	807					SM	SILTY SAND; light brownish gray (10YR 6/2); 70% very fine to medium sand, trace coarse sand; 20% silt; 10% clay; trace well rounded gravel; wet.	
										CL	CLAY; very dark grayish brown (10YR 3/2); 90% clay; 10% very fine sand.	
										SM CL	SILTY SAND; grayish brown (10YR 5/2); 80% fine to coarse sand; 20% silt; wet.	
										CL	CLAY; black (7.5YR N2/0); 90% clay; 10% very fine sand; stiff; possible remnants from fire.	
55				90	819					SC	Decreasing clay at 54' bgs. 10YR 3/1; 75% clay; 25% fine to medium sand; wet.	Gradational contact
										CL SC	CLAYEY SAND; grayish brown (10YR 5/2); 70% very fine to medium sand; 30% clay; wet.	
										SP-SM	CLAY; very dark gray (10YR 3/1); 90% clay; 10% very fine sand; stiff; wet.	
60				40	831					SM	CLAYEY SAND; grayish brown (10YR 5/2); 70% medium to coarse sand; 30% clay; fining downward.	
											SAND with SILT; light gray (10YR 7/2); 90% medium to very coarse, poorly graded sand; 10% silt; wet. Interbedded 3 clay layer at 59'.	
											SILTY SAND; grayish brown (10YR 5/2); 80% very fine to medium sand; 20% silt; wet.	
65										SM	Coarsening downward to medium to very coarse	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA2
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
					840					SC	sand w/ 10% silt; light brownish gray (10YR 6/2). Interbedded 3 clay layer at 64'.	Driller noted hard drilling
											SILTY SAND; light brownish gray (10YR 6/2); 70% fine to medium sand; 20% silt; 10% clay; wet.	
										WBr	CLAYEY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 40% clay; wet. Trace coarse sand at 67'.	
70											Degraded (BEDROCK) SANDSTONE; pale yellow (5Y 7/4); sandstone underlain by gravel to 3 diameter.	Driller added water to reduce heaving sands. No additional hydropunch samples were collected

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	**Borehole Number:**	**01-HPA3**
Borehole Location: Site 1	*Northing:* 2194951.13	*Easting:* 6123067.09	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/31/2005	Total Depth (feet):	86.5
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/31/2005	Depth to Bedrock (feet): 86.3
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static: 38.9*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 605.32	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											Asphalt and road base	
										SM	SILTY SAND; dark grayish brown (10YR 4/2); 60% very fine sand, 20% clay, 20% silt; moist.	Hand auger to 5 ft bgs.
5				80	827							
10				100	830					SM	SILTY SAND; brown (10YR 4/3); 70% sand, 20% silt, 10% clay; moist.	
15				25	838					CL	SANDY CLAY; dark grayish brown (10YR 4/2); 40% clay, 30% silt, 30% very fine sand; moist.	
20				80	846					SM	SILTY SAND; dark grayish brown (10YR 4/2); 70% sand, 20% silt, 10% clay; moist.	
25				60	852					CL-ML	SILTY CLAY; very dark grayish brown (10YR 3/2); 60% clay, 30% silt, 10% very fine sand; moist.	Soil Sample LE570 collected at 0925 at a depth of 28 ft bgs
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA3
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				40	859					SP-SM	SAND with SILT; very pale brown (10YR 7/3); 90% fine to coarse sand, 10% silt; moist; trace mica.	
35				50	907					SM	SILTY SAND; light yelloiwish brown (10YR 6/4); 80% fine to medium sand, 20% silt; interbedded with 90% fine to coarse sand, 10% silt. Gravel lenses at 34.5, 37 and 38 feet; subangular to subrounded 3/4 to 2 diameter. Wet at 40' bgs.	
40				60	921					SM	SILTY SAND; 50% very fine sand, 30% silt, 20% clay.	
										SP-SM	SAND with SILT; pale brown (10YR 6/3); 90% fine to coarse sand, 10% silt; wet.	
45				60	1007					SW	Well Graded SAND; light yelloiwish brown (10YR 6/4); very coarse sand to fine gravel; wet.	Alluvium HP sampler screened 45-49 ft bgs
										SM	SILTY SAND; grayish brown (10YR 5/2); 50% very fine sand, 40% silt, 10% clay; wet.	GW sample LE569 collected at 0942
50				70	1024					SM	SILTY SAND; grayish brown (10YR 5/2); 80% fine to medium sand, 20% silt, trace subrounded gravel; wet.	DTW 38.9 ft bgs after sampling
										SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% medium to coarse sand, 10% silt; wet. Grading to coarse to very coarse sand with trace gravel at 52'. Sandy clay lens at 54.5. Oxidation staining at base.	
55				80	1029					CL-ML	SILTY CLAY; grayish brown (10YR 5/2); 90% clay, 10% silt; wet.	
										SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% medium to coarse sand, 10% silt; wet.	
										CL-ML	SILTY CLAY; 'black (2.5Y N2/0); 90% clay, 10% silt increasing to 20% coarse sand at base; wet.	
60				70	1047					SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% coarse to very coarse sand, trace fine gravel, 10% silt; wet.	Graditional contact
										SP	SAND; grayish brown (10YR 5/2); 95% coarse sand, 5% silt; wet; clean sand. Increasing silt to 10%, from 62.5 to 64' bgs.	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA3
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				90	1103					SM	SILTY SAND; very dark gray (10YR 3/1); 60% fine sand, 40% silt; wet.	
										SM	SILTY SAND; very dark gray (10YR 3/1) 80% fine sand, 20% silt; wet.	
										SM	SILTY SAND; black (2.5Y N2/0); 60% fine sand, 40% silt; wet. Gradational transition from 68.5 to 69' bgs.	
										SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% coarse to very coarse sand, trace fine gravel, 10% silt; wet. Medium sand from 70 to 72' bgs.	
70				90	1132							
										SM	SILTY SAND; very dark grayish brown (10YR 3/2); 60% very fine sand, 30% silt, 10% clay; wet.	
75										SM	SILTY SAND; grayish brown (10YR 5/2); 70% very fine to coarse sand, 30% silt; wet.	Add water
80												
85										SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% medium to very coarse sand, 10% silt; wet.	Driller noted drilling into more solidified soils
										WBr	Degraded SANDSTONE; very dark grayish brown (10YR 3/2); 70% fine sand, 30% silt; laminations; transitional sand underlain by degraded sand with a base of sandy gravel; pale brown (10YR 6/3).	Refusal in gravel Driller added water to reduce heaving sands. No additional HP samples were collected.

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA4	
Borehole Location: Site 1	*Northing:*	*Easting:*	Sheet *1* of *3*
Drilling Agency: Water Development Corp.		Driller: Paul Almanez	
Drilling Equipment: CME 85		Date Started: 2/1/2005	Total Depth (feet): 70.0
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 2/1/2005	Depth to Bedrock (feet): 69.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static: 42.91*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL) :	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
											Grass at surface	
										SM	SILTY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 30% silt; 10% clay; moist. At 8', trace gravel.	Hand auger to 5 ft bgs.
5				70	1142							
										ML	SANDY SILT; dark grayish brown (10YR 4/2); 50% silt; 30% very fine sand; 20% clay; moisst	
										SM	SILTY SAND; dark brown (10YR 4/3); 60% very fine sand; 30% silt; 10% clay; moist	
10				100	1147							
										CL	SANDY CLAY; dark grayish brown (10YR 4/2); 40% clay; 30% fine to medium sand; 30% silt; moist.	
										SM	SILTY SAND; brown (10YR 5/3); 60% very fine sand; 30% silt; 10% clay; moist.	
15				50	1154							
										SM	SILTY SAND; very pale brown (10YR 7/4); 70% very fine sand; 20% silt; 10% clay; moist.	
20				50	1159							
										SM	SILTY SAND; brownish yellow (10YR 6/8); 80% fine sand; 20% silt. Grading to medium to coarse sand at 25' bgs; moist.	
25				40	1206							
										SW	Well Graded SAND; very pale brown (10YR 7/3); 75% medium to very coarse sand; 15% fine to medium subrounded gravel to 2.5 diameter; 10%	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA4
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				60	1213					SC	silt; moist; loose. CLAYEY SAND; brown (10YR 5/3); 60% very fine sand, 30% clay, 10% silt; moist.	Soil sample LE584 collected at 1313 at a depth of 30 ft bgs
35				50	1219					SM	SILTY SAND; light gray (10YR 7/2); 90% fine to coarse sand; 10% silt; trace gravel at 38 and 39' bgs; moist; loose.	
40				40	1225					▽	Wet at 40' bgs	
										CL	SANDY CLAY; dark grayish brown (10YR 4/2); 90% clay; 10% very fine sand; wet	
45				60	1357					SP	SAND; light brownish gray (10YR 6/2); 95% fine to medium sand; 5% silt; increasing silt with depth and grading to medium to very coarse sand.	
										CL	SANDY CLAY; light olive brown (2.5Y 5/3); 80% clay, 20% fine to medum sand; wet. Gradational contact, transition sandy clay to clayey sand at 49' bgs.	
50				60	1417					SM	SILTY SAND; brown (10YR 5/3); 70% very fine to fine sand; 20% silt; 10% clay; wet.	
										SM	SILTY SAND; light brownish gray (10YR 6/2); 90% very fine to fine sand; 10% silt; wet. Coarsening downward to fine to coarse sand. Oxidation at 54.5' bgs.	
55				60	1428					SC	CLAYEY SAND; grayish brown (10YR 5/2); 80% very fine sand; 20% clay; laminations; wet.	
										SP-SM	SAND with SILT; light brownish gray (10YR 6/2); 90% fine to medium sand; 10% silt.	
										CL	SANDY CLAY; very dark grayish brown (10YR 3/2); interlayered clay and 80% fine to medium sand; 20% clay; wet	
60				50	1444					SC	CLAYEY SAND; very dark grayish brown (10YR 3/2); 70% fine to medium sand; 20% clay; 10% silt. Grading to medium to very coarse sand at 60' bgs.	
65										SP-SM	SAND with SILT; light brownish gray (10YR 6/2); 90% very fine to fine sand; 10% silt; wet. Coarse sands and increased silt at 65' bgs.	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA4
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				50	1500							
70										WBr	Degraded (BEDROCK) SANDSTONE with gravel up to 2 diameter.	

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA5	
Borehole Location: Site 1	*Northing:* 2194727.58	*Easting:* 6123539.58	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Gary Whitley	
Drilling Equipment: CME 85		Date Started: 1/25/2005	Total Depth (feet): 48.5
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 1/26/2005	Depth to Bedrock (feet): 16.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 48.50	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 615.12	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND; very dark grayish brown (10YR 3/2); 80% very fine sand; trace medium sand (<1%); 20% silt; roots; faintly moist	Hand auger to 5 ft bgs
5											Color change tp brown (10YR 5/3); 85% very fine sand; 15% silt; trace coarse snd; trace subrounded pebbles; trace mica; roots	
										SC	Grading to CLAYEY SAND; 85% very fine sand; 15% clay	
											Color change to dark grayish brown (10YR 4/2)	
10											Increasing clay content; 80% very fine sand; 20% clay	
											Color change to dark brown (10YR 3/3); trace coarse sand (<1%)	
											Calcareous veins; reacts strongly with HCl	
											CLAYEY SAND; brown (10YR 4/3); 70% fine to coarse sand; 30% clay; trace gravel; trace rounded pebbles	
15										WBr	Transition into sandstone; mottled; coarse, subangular sand grains; dark yellowish brown (10YR 4/4)	
										WBr	More competent SANDSTONE; pale yellow (2.5Y 8/2); fine to medium grains; mainly feldspars; trace mafic minerals	
20											Same as above; fractures observed in rock; slight weathering	
										CBr	Competent SANDSTONE; white (5Y 8/10; fine to medium, subangular to subrounded grains; 10% biotite; arkosic sandstone, plagioclase-rich	
25												
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA5
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											SANDSTONE as above; very fine grained sand; little to no quartz; dry	Soil sample LE556 collected at 1600 at a depth of 38 ft bgs
35											Increase in biotite grains; increasing grainsize (~4mm); trace subrounded pebbles and cobbles (weathered);	
											Small biotite grains	
40											Large lens of biotite; along fracture; could be a result of water moving through fractures in substrate	
											Some laminar structure at 43'	
45											Grading to 20% biotite; moist	Bedrock GW sample LE548 collected at 0810 Duplicate GW sample LE544 at 0820 Rinsate sample LE545 at 0900
										▽	Moist	
												Set Bedrock HP sampler overnight Screened from 48.5-50 ft bgs

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA6	
Borehole Location: Site 1	*Northing:* 2195514.5	*Easting:* 6123250.32	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 2/7/2005	Total Depth (feet): 65.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 2/7/2005	Depth to Bedrock (feet): 60.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 50.00	*Static: 47.83*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 618.28	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
											Grass at surface	
										SM	SILTY SAND; olive brown (2.5Y 4/3); 80% very fine sand; 20% silt; very moist.	Hand auger to 5 ft bgs.
5				50	1007							
										SM	SILTY SAND; olive brown (2.5Y 4/3); 60% very fine sand; 20% silt; 20% clay; very moist.	
										SM	SILTY SAND; olive brown (2.5Y 4/3); 80% very fine sand; 20% silt; very moist.	
10				100	1011					CL	SANDY CLAY; black (5Y 2.5/2); 50% clay; 40% very fine sand; 10% silt; very moist.	
										SC	CLAYEY SAND; black (5Y 2.5/2); 60% very fine sand; 40% clay; very moist.	
										CL	SANDY CLAY; black (5Y 2.5/2); 60% clay; 40% very fine to medium sand; very moist.	
15				80	1017							
										SC	CLAYEY SAND; yellowish brown (10YR 5/4); 60% very fine sand; 40% clay; very moist.	
20				80	1025							
										SP-SM	SAND with SILT; brown (10YR 5/3); 90% fine to medum. trace coarse sand; 10% silt; very moist.	
										CL	Gradational contact from 23 to 23.5' bgs. SANDY CLAY; dark grayish brown (10YR 4/2); 60% clay; 40% very fine to medium sand; very moist.	
25				100	1035					SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 40% clay; very moist.	Gradational color change from 25 to 30 ft bgs
										SC	CLAYEY SAND; light yellowish brown (2.5Y 6/3); 80% very fine to fine sand; 20% clay; very moist.	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA6
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				80	1045					SM	SANDY SILT; light yellowish brown (2.5Y 6/3); 80% very fine to fine sand; 20% silt; very moist.	
										SP-SM	SAND with SILT; light yellowish brown (2.5Y 6/3); 90% very fine sand; 10% silt; very moist; laminations.	
35				80	1053						Grading to 40% silt; 40% very fine to fine sand; 20% clay at 37' bgs.	Soil sample LE617 collected at 1155 at a depth of 37 ft bgs
										SM	SILTY SAND; light yellowish brown (2.5Y 6/3); 70% very fine sand; 30% silt; very moist.	
40				100	1104					CL	SANDY CLAY; very dark grayish brown (2.5Y 3/2); 60% clay; 40% fine sand; very moist.	
										SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 60% very fine to fine sand; 40% clay; very moist.	
45				80	1112					SM	SILTY SAND; brown (10YR 5/3); 70% very fine sand; 20% silt; 10% clay; very moist. Interlayers of sandy silt.	
											Wet but not completely saturated at 49.5'	
50				100	1124					CL	SANDY CLAY; dark brown (10YR 3/3); 60% clay; 40% coarse sand; wet. Sand fining downwards.	Rinsate sample LE615 collected at 1127
										SC	CLAYEY SAND; dark brown (10YR 4/3); 70% fine to medium sand; 30% clay; wet.	
55				40	1135						Grading to medium to coarse sand; brown (10YR 5/3).	Alluvium HP sample screened 55-59 ft bgs
60				100	1329					WBr	Degraded (BEDROCK) SANDSTONE; pale yellow (2.5Y 8/3). Color change to pale yellow (5Y 7/3).	GW sample LE616 collected at 1150
65												

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA7	
Borehole Location: Site 1	*Northing:* 2195344.48	*Easting:* 6123329.3	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 2/4/2005	Total Depth (feet): 75.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/4/2005	Depth to Bedrock (feet): 72.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 45.00	*Static: 46.9*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 617.71	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
											Grass at surface	
										SM	SILTY SAND with gravel; gravel rounded to subrounded; moist.	Hand auger to 5 ft bgs.
5				80	1136					SM	SILTY SAND; brown (10YR 5/3); 60% very fine to fine sand; 30% silt; 10% clay; moist. Interbed of 80% sand at 8.5' bgs.	
10				100	1140					CL	SANDY CLAY; brown (10YR 5/3); 60% clay; 40% very fine sand; moist.	
										ML	SANDY SILT; brown (10YR 5/3); 40% silt; 40% very fine sand; 20% clay; moist.	
15				100	1144					SM	SILTY SAND; brown (10YR 5/3); 60% very fine to fine sand; 30% silt; 10% clay; moist. Color change to very pale brown (10YR 7/3) at 16' bgs.	
20				100	1149					SP-SM	SAND with SILT; very pale brown (10YR 7/3); 90% very fine to coarse sand; 10% silt; moist; loose.	
										SC	CLAYEY SAND; very pale brown (10YR 7/3); 60% very fine sand; 40% clay; moist. Grading to fine to medium, trace coarse, sand at 29.5' bgs.	
25				100	1154							
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA7
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
					1159					SC	SAND with CLAY; light gray (10YR 7/2); 90% fine to very fine, trace medium sand; 10% clay; moist. Interbedded with clay to sandy clay.	
35				90	1204							Soil sample LE612 collected at 1335 at a depth of 36 ft bgs
40				80	1211					SM	SILTY SAND; light gray (10YR 7/2); 80% very fine to fine sand; 20% silt; moist; laminations. Interbedded with clay to sandy clay. Color change to very dark gray (10YR 3/1) at 40.5' bgs.	Rinsate sample LE610 at 1255
										SC	CLAYEY SAND; very dark gray (10YR 3/1); 60% medium to coarse sand; 40% clay; moist.	
45				70	1220					SM	SILTY SAND; very dark gray (10YR 3/1); 80% very fine to fine sand; 20% silt; wet. Interbedded clay layers at 49' bgs.	Alluvium Hp sampler screened at 45-49 ft bgs GW sample LE611 collected at 1330
50				40	1356					SM	SILTY SAND; very dark gray (10YR 3/1); 80% very fine to medium sand; 20% silt; wet.	
										CL	SANDY CLAY; very dark gray (10YR 3/1); 60% clay; 40% very fine sand; wet.	
55					1410					CL	CLAY with SAND; very dark gray (10YR 3/1); 80% clay; 20% very fine sand; wet. Grading to 80% very fine to medium sand; 20% clay at 61' bgs. Interbedded sands with clay from 61' bgs; color change to brown (10YR 5/3).	
60					1438							
										SC	CLAYEY SAND; brown (10YR 5/3); 70% fine sand; 30% clay; wet. Grading to 40% very fine sand; 60% clay at 64.5' bgs; color chagne to 10YR 3/3.	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA7
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				80	1445					CL	SANDY CLAY; very dark grayish brown (10YR 3/2); 60% clay; 40% very fine to fine sand; wet.	
										SP-SM	SAND with SILT; light brownish gray (10YR 6/2); 90% fine to medium, trace coarse sand; 10% silt; wet. 2" clayey sand at 69' bgs.	
70				100	1455					WBr	Degraded SANDSTONE; dark grayish brown (2.5Y 4/2); Transition/gradational zone from overlying alluvium to degraded Sandstone bedrock.	Bedrock HP sampler screened 75-79 ft bgs
										WBr	pale yellow (5Y 7/3); (BEDROCK) Degraded SANDSTONE.	GW sample LE613 collected at 1528
75												Driller had added a small amount of water during drilling. Since we were in bedrock, went ahead and collected hydropunch at 75' bgs.

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA8	
Borehole Location: Site 1	*Northing:* 2195996.86	*Easting:* 6123746.93	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 2/4/2005	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 2/4/2005	Depth to Bedrock (feet): 24.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static: 31.05*
Completion Information:Cement bentonite grout to surface		Elevation (feet MSL) : 631.43	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
											Grass at surface	Boring cleared by UXO expert prior to start of drilling. Hand auger to 5 ft bgs.
										SM	SILTY SAND; wet. Wet surface likely due to thick vegetation and recent rains.	
5				80	817					SC	CLAYEY SAND; very dark grayish brown (10YR 3/2); 70% fine to medim sand; 30% clay; very moist.	
10				100	821					SC	CLAYEY SAND; very dark grayish brown (10YR 3/2); 55% fine to medium sand; 45% clay; very moist. Interbedded 60% clay; 40% sand; color change to dark grayish brown (10YR 4/2) at 11' bgs.	
15				50	827					SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 70% fine to medium sand; 30% clay; very moist.	
										SP-SM	SAND with SILT; grayish brown (10YR 5/2); 90% fine to medium sand; 10% silt; very moist. Color change to very pale brown (10YR 7/3) at 18.5; bgs.	
20				100	835					SC	CLAYEY SAND; grayish brown (10YR 5/2); 60% very fine to medium sand; 40% clay; very moist.	Soil sample LE618 collected at 1200 at a depth of 20 ft bgs
25				100	842					Wbr	Degraded (BEDROCK) SANDSTONE; light brownish gray (2.5Y 6/2); very moist. Gradational contact at 24' bgs. Feldspathic SANDSTONE; white (5Y 8/1); very moist; friable; degraded to clay at 25' bgs. Highly reactive to HCL from 25 to 26.5' bgs; soft; abundant mica; massive;	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA8
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				100	850							
35				70	858						Alternating zones of HCl reactivity. Mostly fracture filled not pore space filled Wet. High angle (45 degrees) fracture at 35' bgs.	
40				80	913						Color change to brownish gray (10YR 6/2); grading from very fine to fine sand. Color change to very pale brown (10YR 8/2); wet; massive; micaceous; fracture fill reacts with HCl.	
45				100	925						Color change to light brownish gray (10YR 6/2); non-reactive to HCl; highly friable.	
50											Color change to very pale brown (10YR 8/2); fracture fill reactive to HCl; saturated along fractures; low porosity.	GW sample LE614 collected from open borehole at 0815
55												Stopped drilling as per Bill McClenney to let water recharge over weekend. Left auger in borehole.

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA9	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195519.66	*Easting:* 6123445.55	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Miguel Alvarado		
Drilling Equipment: CME 75	Date Started: 3/23/2005	Total Depth (feet): 75.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 3/23/2005	Depth to Bedrock (feet): 71.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 46.00	*Static:*
Completion Information:	Elevation (feet MSL) :		
	Logged By: V. Diep	Checked By: W. McClenney	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				50	1135					SM	Topsoil; brown (10YR 4/3); root fibers thoughout	
										SM	SILTY SAND; light olive brown (2.5Y 5/3); 80% fine to medium sand; 20% silt; trace subangular to subrounded gravel	
5				80	1140							
											SILTY SAND; dark grayish brown (10YR 4/2); 75% fine to medium sand; 20% silt; 5% clay; low to moderate density; moist	
10				20	1145							
15				100	1150						SILTY SAND; very dark grayish brown (10YR 3/2)	
											$CaCO_3$ veins at 16-17 feet bgs	
											Grading to 10% clay; color change to yellowish brown (10YR 5/4)	
20				90	1155					SC	CLAYEY SAND; brown (10YR 5/3); 80% fine sand; 20% clay; trace medium sand; low plasticity; moist	
											Trace pebbles at 22.5 feet bgs	
											CLAYEY SAND; dark graysih brown (10YR 4/2); 70% fine to coarse sand; 30% clay; low plasticity; hard; $CaCO_3$ veins	
25				80	1205							
											Grading to 15-20% clay at 26 feet bgs	
											Color change to brown (10YR 5/3); grading to 10-15% clay; low plasticity; slightly moist	
										SP	Poorly graded SAND; fine, trace medium sand; 5% clay; loose; slightly moist	
30												

EARTH TECH

Borehole Log (Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA9
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				75	1215					SW	Well-graded SAND; light brownish gray (10YR 6/2); fine to coarse sand; loose; trace clay; slightly moist Well graded SAND as above	
35				70	1315					SP	Lens of fine sand and clay Grading to poorly graded SAND; fine, trace medium and coarse sand	
40				50	1325						SAND; light gray (10YR 7/2); very fine; loose; slightly moist 2 inch lens of clay at 42 feet bgs	
										CL	CLAY; dark grayish brown (10YR 4/2); moderate plasticity; moist	
45				70	1340					SC SW	CLAYEY SAND; 60% fine to medium, trace coarse sand; 40% clay; slightly moist Well-graded SAND; grayish brown (10Yr 5/2); fine to coarse sand; loose; very moist Saturated at 46 feet bgs; grading to coarse sand; trace medium; loose increasing clay ~5-10%	
50				60	1434						SAND; medium to coarse; 5% clay; saturated; loose Grading to fine to medium sand; trace coarse; 5-10% clay; saturated	
										SW-SC	Grading to SAND with clay; ~10% clay; 90% fine to mdium sand; saturated	
55				100	1440					SC	CLAYEY SAND; very dark grayish brown (10YR 7/2); 70% fine to medium sand; 30% clay; very moist; low plasticity; hard grading to fine to coarse sand; increasing clay to 40-50%; hard	
60				100	1446					CL	SANDY CLAY; brown (10YR 4/3); 35% clay; 45% fine to medium sand; moderate plasticity; hard; moist	
										SC	CLAYEY SAND; grayish brown (10YR 5/2); 60-70% very fine to medium sand; 30-40% clay; moist; trace coarse sand Inceasing clay; 40-50%	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA9
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				100	1458					SC	Clean, medium SAND; trace fine sand CLAYEY SAND; as above; saturated	
											Grading to coarse sand; 30% clay; saturated	
70				90	1505					SW	Grading to medium to coarse sand; 5% clay; saturated	
										WBr	SANDSTONE; medium grained; quartz-rich; trace mafic minerals; saturated	
75												

IRP Site 1, MCAS El Toro\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA10	
Borehole Location: IRP Site 1, MCAS El Toro	*Northing:* 2195756.3	*Easting:* 6123616.33	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Miguel Alvarado		
Drilling Equipment: CME 75	Date Started: 3/24/2005	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 3/24/2005	Depth to Bedrock (feet): 49.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:*
Completion Information:		Elevation (feet MSL) :	
		Logged By: V. Diep	Checked By: W. McClenney

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				80	0809					SM	Topsoil; dark grayish brown (10YR 3/2); rock fragments; root fibers	
										SM	SILTY SAND; 80% fine to medium sand; 20% silt; trace coarse sand; trace root fibers; some CaCO3 veins	
										SP	Grading to SAND; brown (10YR 5/3); 90-95% fine sand; 5-10% silt; loose; dry	
5				60	0812					SC	CLAYEY SAND; brown (10YR 4/30; 80% fine sand; 20% clay; low plasticity; low to moderate density; slightly moist; trace coarse sand; trace root fibers	
10				100	0820					CL	CLAY; very dark gray (10YR 2/2); 70-80% clay; 20-30% fine sand; moderate plasticity; moist SANDY CLAY; 60% clay; 40% very fine sand; low to moderate plasticity; trace medium sand; moderate density; moist Color change to brown (10YR 4/3); trace gravel Color change to black (10YR 2/1); trace root fibers; trace coarse sand; CaCO3 veins; hard	
15				60	0823						SANDY CLAY; dark brown (10YR 3/3); 70% clay; moderate plasticity; 30% fine to medium sand; trace coarse sand; CaCO3 veins; moist; hard Grading to 50-60% clay; medium to coarse sand	
20				90	0830					SC	Grading to very dark grayish brown (10YR 3/2); 60% clay; very hard CLAYEY SAND; 85% fine to medium sand; 15% clay; trace coarse sand; soft; loose; very moist	
25				40	0835					SW-SC	Well graded SAND with CLAY; fine to medium sand; trace coarse sand; 5-10% clay; loose	
										SP-SC	Grading to Poorly Graded SAND with CLAY; fine sand; trace medium; 5-10% clay; loose	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPA10
Borehole Location: IRP Site 1, MCAS El Toro		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				70	0841					SW-SC	Well Graded SAND with CLAY; fine to coarse sand; 5% clay; loose; very moist	
35				40	0848					SW	Well Graded SAND; light brownish gray (10YR 6/2); fine to coarse; loose; moist	
40				90	0855						Increasing to 5% clay Well Graded SAND; fine to medium sand, trace coarse; loose; saturated	
										SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 15% clay	
45				80	0901							
										CL	SANDY CLAY; very dark gray; (10YR 3/1); 65-70% clay; 30-35% fine to medium sand; soft; moderate plasticity; moist to saturated	
50				100	0909					WBr	SILTSTONE; pale olive (5Y 6/3); very fine grained; moderate to high density; hard; slightly moist; FeO staining throughout; highly weathered	
55												

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB1	
Borehole Location: Site 1	*Northing:* 2194013.49	*Easting:* 6122184.9	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/24/2005	Total Depth (feet): 62.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 1/24/2005	Depth to Bedrock (feet): 60.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 25.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 576.71	
		Logged By: R. Lopez	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										CL	CLAY; very dark grayish brown (10YR 3/2); plastic; soft; no odor; moist	Hand auger to 5 ft
5				80	0930					CLS	SANDY CLAY; mottled, brown (10YR 5/3), very dark brown (10YR 2/2), pale brown (10YR 6/3); 20-30% well graded medium sand; soft; crumbles (no dry strength); moist; no odor	
										SW-SM	SAND with SILT; pale brown (10YR 6/3); 15% nonplastic silt; 80% well graded medium sand, fine to coarse; 5% fine, angular to rounded gravel (max = 1" dia.); loose; slight to moderate reaction to HCl; dry to moist	
10				75	0940					SP	Poorly graded SAND; pale brown (10YR 6/2); fine sand, trace medium sand; loose; moist; no odor	
										ML	CLAYEY SILT; brown (10YR 5/3); slightly plastic; soft; laminated; no HCl raction; moist; no odor	
										SM	SILTY SAND; brown (10YR 5/3); 85% well; graded sand; 15% silt	Hard drilling at 13.5 ft bgs
										CL-ML	SILTY CLAY; brown (10YR 5/3); 50% clay (matrix); plastic; soft to firm; 35% silt; 15% fine sand	
15				80	1000					CL-ML	SILTY CLAY; dark grayish brown (10YR 4/2); 50% clay; 35% silt; 15% fine to medium sand; slight to no reaction to HCl; moist	Soil sample LE531 collected at 1415 at a depth of 15 ft bgs
										CLS	SANDY CLAY; dark grayish brown (10YR 4/2) to brown (10YR 5/3); 35% poorly graded, fine sand; 65% clay; slightly plastic; moist; no odor; slight HCl reaction	
20				50	1005					SW	Well graded coarse SAND; pale brown (10YR 6/3); loose; moist; fine to coarse sand; trace rounded gravel; 10% silt	
										SP	Poorly graded, fine SAND; pale brown (10YR 6/3) to brown (10YR 5/3); fine to medium; trace to 10% silt; loose; moist	
25				60	1015					SC	CLAYEY SAND; grayish brown (10YR 5/2); 70% fine to medium sand; 30% clay; loose; saturated	
										CLG	GRAVELLY CLAY; grayish brown (10YR 5/2); 40% angular gravel in clay matrix; heterogeneous; saturated	Alluvium HP sampler screened 28-32 ft bgs
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB1
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				35	1200					SP	Poorly graded, fine SAND; light brownish gray; fine to medium, subangular to subrounded sand; loose; saturated	GW sample LE528 collected at 1155 Duplicate sample LE530 collected at 1210
35				100	1300						Poorly graded medium SAND; light brown; medium, angular to subangular sand grading to fine with depth; saturated; no odor	
40				50	1310							
										SM	SILTY SAND with interbedded SILTY CLAY; Silty sand - 70% fine to medium sand; 30% silt; Silty clay - slightly plastic; saturated; strong organic odor	
45				100	1315					CL	CLAY with interbedded SAND; Clay - firm; dry; highly organic; high plasticity; Sand lenses (15%) - are 1-1.5" thick and gray	
50				100	1330					CL	CLAY; black; highly organic; plastic; some roots; soft; saturated	
										CL	CLAY as above with interbedded medium SAND; loose	
										CLS	SANDY CLAY; black; 20% fine sand; highly organic; saturated	
55				100	1345					SW	SAND with interbedded CLAY; well graded, medium sand; dark greenish gray (2GLEY 4/1); Clay - firm; high plasticity	Hard drilling at 57 ft bgs
										SP	Poorly graded, fine SAND (possibly weathered bedrock surface); feldspathic composition; crumbles with pressure; greenish gray (2GLEY 6/1)	Bedrock HP sample screened 62-62.1 ft bgs
60				75	1430					WBr	(BEDROCK) SANDSTONE; white; poorly graded, fine to medium, angular sand; feldspathic; hard; dry	GW sample LE535 collected at 1600

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB2	
Borehole Location: Site 1	*Northing:* 2194008.79	*Easting:* 6122294.07	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 2/1/2005	Total Depth (feet): 93.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 2/2/2005	Depth to Bedrock (feet): 87.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 27.00	*Static: 29.39*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 577.34	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				60						SM	SILTY SAND; very dark grayish brown (10YR 3/2); 60% very fine sand; 20% silt; trace clay; trace mica; low to moderate density; roots throughout	Hand auger to 5 ft bgs
				40							SILTY SAND; slight moist; low to moderate plasticity	
5										SC	CLAYEY SAND; brown (10YR 4/3); 80% very fine sand; 20% clay; slightly firm; faintly moist	
				40						SW	Well graded SAND; light yellowish brown (10YR 6/4); fine to coarse sand; trace clay; loose	
10										SC	CLAYEY SAND; brown (10YR 4/3); 80% very fine to medium sand; 20% clay; moderate density; nonplastic; faintly moist	Skeletal root structures throughout
											Cobbles	
				60						CLS	SANDY CLAY; brown (10YR 4/3); 60% clay; 40% very fine sand; slightly hard; moderate to high density; faintly moist	
15												Skeletal root structures throughout
											Cobbles	
										SC	CLAYEY SAND; 65% very fine sand; 35% clay; moderate density; dry to faintly moist	
				70						CLS	SANDY CLAY; 55% clay; 45% very fine sand; faintly moist	
20										SC	CLAYEY SAND as above; 60% very fine to medium sand; trace gravel; 40% clay; moist	Soil sample LE587 collected at 1535 at a depth of 20 ft bgs
										CLS	grading to SANDY CLAY; 55% clay; 45% very fine to medium sand; trace gravel	
				30						SP-SC	SAND with CLAY; 90% poorly graded, fine sand; 10% clay;moist; soft; cobbles	
25											saturated; trace coarse sand and gravel	
				75	1554					SW	Well graded SAND; fine to medium sand; trace coarse; trace clay; loose; soft; saturated	Alluvium HP sampler screened from 28.5-32.5
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB2
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
												ft bgs WL at 29.39 ft bgs after sampling GW sample LE586 collected at 1530
				30	1601						Well graded SAND; medium to coarse; trace fine; subrounded to rounded pebbles; saturated	
35										SP	Poorly graded SAND; brown (10YR 5/3); fine sand; trace medium; loose; soft; saturated	
										SW	Well graded SAND as above; trace gravel and pebbles; saturated	
				40	1609					SP	Poorly graded SAND as above; saturated	
40										SW	Well graded SAND; medium to coarse, some fine; loose; saturated	
				30	1620						Subrounded to rounded pebbles	
45											Well graded, clean SAND; medium to coarse, some fine; loose; saturated	
											Grading to coarser sands; subrounded to rounded pebbles; loose; saturated	
50										CLS	SANDY CLAY; black (2.5Y 2/1); 60-70% clay; 30-40% very fine sand, trace medium sand; moderate density; moderate plasticity; sticky; saturated; organic smell	Very dark blackish color, like charcoal
55										SW	Well graded SAND; black; fine to coarse sand (mostly fine); trace mica; loose; saturated	
											Grain size coarsening	
60										SP	Poorly graded SAND; dark gray; fine sand; loose; saturated	
											Grading to medium sands; loose; saturated	
										SW	Well graded SAND; fine to medium sand, trace coarse sand	
					0806					CLS	SANDY CLAY; black; 40% fine sand; hard; saturated	
65										SW	Well graded SAND; gray; fine to coarse; trace	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB2
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											gravel; loose; saturated	
										CLS	SANDY CLAY; black; 60-70% clay; 30-40% very fine sand; soft; low plasticity; saturated	
				80						WBr	Transition into highly weathered (BEDROCK). SANDSTONE; very fine grained; high mica content; very moist to saturated; root material found in fractures; roots look charred and burned; past fire event would explain gray to black color	A couple feet of slough in auger from heaving sands Gradual hardening of lithology. Root structures in shallower zone make contact suspect.
70												
				0							No recovery	
75												
										SW	Fine to coarse SAND; dark gray; trace gravel and pebbles	8-9 feet of heaving sand Core sample could be all slough. Looks similar to SW and SP from above
80												
85										SP	grading to fine SAND	
										WBr	WEATHERED SILTY SANDSTONE; dark olive brown; fine grained; high mica content; slightly moist; moderate density	Hard drilling
90											moist; laminations observed	

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36907	Borehole Number: 01-HPB3	
Borehole Location: Site 1	*Northing:* 2193999.66	*Easting:* 6122447.2	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Gary Whitley	
Drilling Equipment: CME 85		Date Started: 2/1/2005	Total Depth (feet): 63.5
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/1/2005	Depth to Bedrock (feet): 58.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 27.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 578.91	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				30	0945					SM	SILTY SAND; olive brown (2.5Y 4/3); 85-90% very fine sand; 10-15% silt; roots throughout; moderate density; slightly moist Trace pebbles	Hand auger to 5 ft bgs
				80	0949					SP-SM	SAND with SAND; dark grayish brown (2.5Y 4/2); 90% very fine sand; 10% silt; trace mica; low to moderate density; trace roots slightly moist Color change to brown (10YR 4/3); grading to less silt; more clay	
5												
				90	0953					SC	Grading to CLAYEY SAND; dark brown (10YR 3/3); 85-90% fine sand; trace coarse sand; 10-15% clay; soft; low plasticity; faintly moist Increasing in clay content; 20-25% clay; 75-80% very fine to fine sand; trace medium sand; low plasticity; moist	
10												
				90	0958					SP-SC	SAND with CLAY; yellowish brown (10YR 5/4); 90-95% very fine sand, trace medium sand; 5-10% clay; loose; faintly moist	
										SC	CLAYEY SAND as above; 15-20% clay; brown (10YR 5/3)	
15										CLS	Grading to SANDY CLAY; 55% clay; 45% very fine to fine sand; moist	Soil sample LE579 collected at 1020 at a depth of 15 ft bgs
										SC	Grading to CLAYEY SAND; 60% very fine to medium sand; 40% clay; moderate density; slightly moist	
				40	1002					SW	Well graded SAND; pale brown (10YR 6/3); fine to coarse sand; trace gravel; trace subrounded pebbles; loose; moist	
20												
										SW-SC	Grading to well graded SAND with CLAY; brown (10YR 5/3); 5-10% clay; soft; low density; moist	
				30	1010					SW	Well graded SAND; 95% fine to coarse (mostly coarse), subangular to subrounded; loose; trace clay; saturated	
25											∇ grading to clean SAND; no clays; saturated	
				50							Well graded SAND as above; well rounded pebbles; saturated	Alluvium HP sampler screened 28.5-32.5 ft bgs
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36907	Borehole Number: 01-HPB3
Borehole Location: Site I		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SW-SC	Grading to SAND with clay; 90-95% fine to coarse sand; 5-10% clay; low plasticity; stringers of coarse sand throughout; saturated; color changes to light olive brown (2.5Y 5/4)	GW sample LE580 collected at 1030
										SP-SC	Grading to finer sand; very fine to fine; saturated	
				50						SW	Grading to well graded, medium SAND; light yellowish brown (10YR 6/3); fine to coarse sand; loose; saturated	
35											Well rounded pebbles throughout; saturated	Rinsate sample LE581 collected at 1200
				25	1110						Well graded, coarse SAND; some fine and medium sand; loose; saturated	
40										SP	Grading to fine sand; some clay; moderate denisyt; saturated	
										SW	Well graded SAND; medium to coarse sand; black (10YR 2/1); trace gravel; loose; saturated	
				80	1116						Color change to light brownish gray (2.5Y 6/2)	
45										SW-SC	Stringers of higher clay content; fine sands; saturated	
										SW	Grading to coarser sands; trace gravel; saturated; fine sand stringers throughout	
										SC	Grading to CLAYEY SAND; 80% fine to medium sand; 20% clay; saturated	
											CLAYEY SAND; as above; saturated	
50											Coarse sand stringers; saturated	
											Interbedded clays; saturated	
										SW	Grading to well graded SAND; fine to medium, trace coarse sand; 55 clay; loose; saturated	
55										SC	CLAYEY SAND; 65-70% very fine to medium sand; 30-35% clay; moderate density; low plasticity; coarse sand stringers; saturated	
										WBr	Transition into weathered (BEDROCK) SILTY SANDSTONE; olive green; fine grained; hard; FeO stains; very moist	Bedrock HP sampler screened 63.5-66.5 ft bgs
60											Lamination observed at 59'; trace mica	GW sample LE582 collected at 1305

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB4	
Borehole Location: Site 1	*Northing:* 2193989.08	*Easting:* 6122673.49	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/31/2005	Total Depth (feet): 43.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/1/2005	Depth to Bedrock (feet): 35.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 33.00	*Static: 25.2*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 582.89	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				80	1340					SM	SILTY SAND; dark grayish brown (10YR 4/2); 85-90% very fine sand; 10-15% silt; soft; slightly moist; roots throughout; trace organics; no odor	Hand auger to 5 ft bgs
				95	1345						SILTY SAND as above; trace clay; trace roots throughout; faintly moist; low plasticity; moderate density	
5												
				50	1352					SP	Grading to less silt and clay SAND; brown (10YR 5/3); poorly graded fine sand; trace medium sand; 5% silt; trace mica; loose; dry	
10												
										SW	Grading to well graded SAND; fine to medium; trace gravel; trace silt; color change to very pale brown (10YR 7/4); loose; dry	
				55	1356					SW-SC	SAND with CLAY; brown (10YR 5/3); well graded medium sand; fine to coarse; 5-10% clay; low to moderate density; dry	
15												Soil sample LE577 collected at 1650 at a depth of 15 ft bgs
										SC	CLAYEY SAND; brown (10YR 4/3); 80% fine to coarse sand; 20% clay; trace gravel; trace well rounded pebbles; hard; dry	
				60	1403					CLS	SANDY CLAY; very dark brown (10YR 3/2); 70% clay; 30% very fine sand; trace coarse sand; hard; moderate plasticity; moist	
20												
										SC	CLAYEY SAND; yellowish brown (10YR 5/4); 60% very fine sand; trace medium sand; 40% clay; trace mica; trace pebbles; modearte density; slightly moist	Rinsate sample LE572 collected at 1455
				70	1412					CLS	SANDY CLAY; 60% clay; 40% fine to medium sand; low to moderate plasticity; trace mica; very moist	
25											Grading to 65% clay; 35% sand; micaceous; trace gravel; stringers of sand; saturated	
				50						SW	Well graded SAND; brown (10YR 4/3); fine to coarse (mostly coarse), angular to subangular	Alluvium HP sampler screened 28.5-32.5 ft
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB4
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											grains; loose; saturated Trace gravel; trace fines	bgs. No water
				5						∇		Alluvium HP sampler screened 33-35 ft bgs GW sample LE573 collected at 1540 WL at 35 ft bgs after sampling
35										WBr	WEATHERED SANDSTONE; yellowish brown (2.5Y 6/3); very fine grained sand; high in feldspars; FeO staining throughout; trace silt (possibly a weathering product)	
				100	1636						WEATHERED SANDSTONE as above; FeO staining throughout; very moist to saturated	
40												
												Refusal at 43.5 ft; drill rig lifting off ground Bedrock HP sampler screened 43-44 ft bgs; left overnight GW sample LE578 collected at WL at 25.2 ft bgs after sampling

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB5	
Borehole Location: Site 1	*Northing:* 2193956.94	*Easting:* 6122949.02	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/31/2005	Total Depth (feet): 53.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/31/2005	Depth to Bedrock (feet): 46.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 38.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 588.10	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				60	0823					SM	SILTY SAND; brown (10YR 5/3); 85-90% very fine to fien sand; 10-15% silt; loose; trace roots; trace organics; trace mica; dry	Hand auger to 5 ft bgs
				75	0830					SP-SM	Grading to SAND with SILT; brown (10YR 5/3); 10% silt; 5% clay; very fine sand; low density; loose; blocky structure; slightly moist	
5											Increasing clay content; slightly moist	
				80	0835					SC	Grading to CLAYEY SAND; 15% clay; 10% silt; very fine sand; trace mica; yellowish brown (10YR 5/4); moderate density; low plasticity; slightly moist	
10											Grading to CLAYEY SAND; 15% clay; trace gravel; moderate density; blocky structure; dry to faintly moist	
										SP	Grading to SAND; very fine; trace clay; yellowish brown (10YR 6/4)	
				40	0844					SW	SAND; well graded, fine to medium sand; trace coarse sand; trace gravel and cobbles; loose; faintly moist	
15												
				90	0851					SC	CLAYEY SAND; dark yellowish brown (10YR 4/4); 25% clay; 75% fine to coarse sand; hard; low plasticity; moderate to high density; dry	
20											Color change to light yellowish brown (10YR 6/4); grading to finer sands; 10% clay; low to moderate density; nonplastic; dry	
				60	0858							
25										SP-SC	SAND with CLAY; poorly graded fine sand; 5-50% clay; slightly moist; cobbles at 26'	
										SW	Grading to well graded SAND; fine to medium sand; 5% clay; moist	
											Well graded SAND as above; fine to medium; trace coarse; loose; very moist	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB5
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											Grading to well graded SAND; medium to coarse sand, trace fine sand; loose; light yellowish brown (2.5Y 6/4); wet	Soil sample LE568 collected at 0945 at a depth of 20 ft bgs
											Clean SAND; medium to coarse, some fine, subangular to subrounded; loose saturated	
35											Coarse SAND; clean; subrangular to subrounded; loose ; saturated	
					1020					SP-SC	Grading to SAND with CLAY; 90-95% fine sand; 5-10% clay; trace mica; light olive brown (2.5Y 5/3); very moist	Alluvium HP sampler screened 37-41 ft bgs GW sample LE567 collected at 0940
40										SWG	GRAVELLY SAND; coarse sand, trace medium and fine sand; subrounded to rounded gravel, pebbles and cobbles; loose; saturated	
					1033						GRAVELLY SAND as above; no cobbles	
45										SW	Well graded coarse SAND; medium to coarse, trace fine, subangular to subrounded; loose; saturated	Could be slough or heaving sands
					1050					WBr	(BEDROCK) Highly WEATHERED SANDSTONE; fine to medium granined; trace silts; FeO staining throughout; trace biotite; feldspar rich; low quartz; no bedding structures; massive	Contact between alluvium and bedrock could be at 46 ft bgs. Previous auger sample may be mostly slough Bedrock HP sampler screened 53.5-54.5 ft bgs GW sample LE571 collected at 1125
50												

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB6	
Borehole Location: Site 1	*Northing:* 2194595.82	*Easting:* 6121896.21	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Paul Almanez	
Drilling Equipment: CME 85		Date Started: 2/3/2005	Total Depth (feet): 50.0
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 2/3/2005	Depth to Bedrock (feet): 24.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 48.00	*Static: 49.1*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 584.37	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	Grass at surface SILTY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 30% silt; 10% clay; moist.	Hand auger to 5 ft bgs.
5				100	1224					SC	CLAYEY SAND; very pale brown (10YR 7/4); 70% very fine sand; 30% clay; moist.	
										ML	SANDY SILT; dark grayish brown (10YR 4/2); 40% clay; 30% silt; 30% very fine to fine sand; moist.	
										SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 60% very fine sand; 20% clay; 20% silt; moist.	
10				90	1230					SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 70% very fine sand; 30% clay; moist. Grades from 60 to 70% sand.	
15				70	1314						Large clast at base of sampler; 5YR 6/6.	
20				100	1315							
25					1322					WBr	Degraded (BEDROCK) SANDSTONE; 2.5Y 6/3; black at base; few laminations; irregular oxidation with interbeds of very fine sand w/ clay. Color change to pale yellow (2.5Y 7/4); friable crumbly. Color change to light gray (2.5Y 7/2). Material is cohesive; pliable but not in crumbles;	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPB6
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				100	1331						laminations.	
											Brownish yellow (10YR 6/6); 70% very fine sand; 30% matrix; friable crumbly; some laminations.	
35				100	1342						Color change dark grayish brown (2.5Y 4/2); laminations; alternating light gray very fine clean sand with dark gray/black fine clay w/ little very fine sand; to 40' bgs	Soil sample LE605 collected at 1450 at a depth of 38 ft bgs
40				100	1350							Rinsate sample LE603 collected at 1413
											Dark grayish brown (2.5Y 4/2); 50% silt, 30% very fine sand, 20% clay; laminations	
45				80	1359						Degraded sandstone to hardened clay. High angle fracture at 44.5' bgs.	Bedrock HP sampler screened 50-54 ft bgs
											Some sandstone structure present, cohesive; friable.	GW sample LE604 collected at 1440
										∇	Interbedded degraded sand with clay; strong oxidation at contacts.	
50											Degraded sandstone to hardened clay with sad clasts. Clasts look greasy with uneven curved surfaces, not fracture or abrasion surfaces; wet.	

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC1	
Borehole Location: Site 1	*Northing:* 2193412.84	*Easting:* 6121748.42	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Gary Whitley	
Drilling Equipment: CME 85		Date Started: 1/28/2005	Total Depth (feet): 43.5
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 1/28/2005	Depth to Bedrock (feet): 22.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 563.90	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				40	1144					SM	SILTY SAND; dark brown (10YR 3/3); 80-90% fine sand; 10-20% silt; trace mica; roots throughout; soft; faintly moist	Hand auger to 5 ft bgs
					1156					SC	Grading to CLAYEY SAND; very fine sand; ~10-15% clay; slightly moist Same as above; 10-20% clay; moist; color change to brown (10YR 4/3); trace rounded pebbles and cobbles Increasing clay (20-30%); hard; moist	
5												
				80	1203					GWS	CONGLOMERATIC SAND; fine to coarse, well graded sand; subangular to subrounded pebbles and rounded cobbles	
10										SC	CLAYEY SAND; strong brown (7.5YR 4/6); fine to coarse, subangular to subrounded sand; 20-30% clay; hard; trace cobbles Rock fragments CLAYEY SAND as above; medium to coarse sand; trace gravel; hard	
				75								
15												
					1213					SP	Poorly graded, fine SAND; light yellowish brown (2.5Y 6/4); trace medium sand; loose; dry	
20												
										WBr	(BEDROCK) WEATHERED SANDSTONE; pale yellow (5Y 7/3); mottling shows fowmer water levels; fine grained; feldspar rich; felspars have weathred almost to clay; structure is platy; FeO staining throughout; dry	
25												
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC1
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										WBr	Highly weathered SANDSTONE as above; FeO staining throughout; dry	
35											Fine grained, weathered SANDSTONE; light FeO staining throughout; dry	
40											Fine grained SANDSTONE; FeO staining throughout; dry	No sample collected due to lack of groundwater

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC2	
Borehole Location: Site 1	*Northing:* 2193391.65	*Easting:* 6121864.7	Sheet *1* of *2*
Drilling Agency: West Hazmat Drilling Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 2/3/2005	Total Depth (feet): 53.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/3/2005	Depth to Bedrock (feet): 42.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 30.00	*Static: 35*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 561.44	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				60	0834					SM	SILTY SAND; very dark grayish brown (10YR 3/2); 85-90% very fine sand; 15-20% silt; low to moderate density; fainly moist; roots throughout	Hand auger to 5 ft bgs
											Increasing silt content	
				95	0840						SILTY SAND; brown (10YR 5/3); very fine sand; 15-20% silt; trace clay; slightly moist	
5										SC	CLAYEY SAND; brown (10YR 4/3); fine to coarse sand; 20-30% clay; moderate density; slightly moist	
										CLS	SANDY CLAY; 60% clay; 40% fine sand; trace gravel; slightly moist	
				60						SC	CLAYEY SAND; brown (10YR 4/3); 60-70% very fine to fine sand; 30-40% clay; low to modereate density; dry	
10											Trace subangular gravel and pebbles	
										SP-SM	Poorly graded SAND with clay; light yellowish brown (10YR 6/4); 90-95% very fine sand; 5-10% clay; loose; dry	
				80	0850					CLS	SANDY CLAY; yellowish brown (10 YR 5/6); 55% clay; 45% very fine to fine sand; dry; hard; low plasticity	
15												
				75						SC	CLAYEY SAND; brown (10YR 5/3); 55-60% very fine to fine sand; trace coarse sand and gravel; 40-45% clay; moderate to high density; dry; hard	
20												
				60						SP-SC	Poorly graded SAND with CLAY; 90-95% very fine sand; 5-10% clay; loose; dry	
25										SP	Poorly graded SAND; fine sand; loose; dry	Soil sample LE600 collected at 1010 at a depth of 25 ft bgs
				70						SW	Well graded SAND; very pale brown (10YR 7/3); fine to coarse sand; loose; moist	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC2
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SC	CLAYEY SAND; 55% very fine to medium sand; 45% clay; saturated	
										CLS	Color change to brown; (10YR 4/3):grading to SANDY CLAY; saturated	
				25						SC	CLAYEY SAND as above; loose; very saturated	Alluvium HP sampler screened 33-37 ft bgs
35												GW sample LE599 collected at 1000
											Grading to less clay; 20-30% clay	WL at 35 ft bgs
				25	1028							
40										SW-SC	Well graded SAND with CLAY; brown (10YR 5/3); 90-95% fine to coarse sand; 5-10% clay; loose; saturated	Rinsate sample LE601 collected at 1055
										SC	CLAYEY SAND; dark grayish brown (10YR 4/2); 75-80% fine to medium sand; 20-25% clay; trace well rounded pebbles and cobbles; moderate plasticity; saturated	
				100	1036					WBr	Transition into (BEDROCK) WEATHERED CONGLOMERATIC SANDSTONE; pale yellow (2.5Y 7/4); fine to medium grained sands; trace mica; saturated; motteld; FeO staining throughout	
45												
				95	1045							Bedrock sampler screened 53.5-54.5 ft bgs
50												GW sample LE602 collected at 1120

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC3	
Borehole Location: Site 1	*Northing:* 2193363.28	*Easting:* 6122048.61	Sheet *1* of *3*
Drilling Agency: Water Development Corp.		Driller: GAry Whitley	
Drilling Equipment: CME 85		Date Started: 2/3/2005	Total Depth (feet): 88.5
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/4/2005	Depth to Bedrock (feet): 87.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 31.00	*Static:*
Completion Information:Cement bentonite grout to surface		Elevation (feet MSL) : 561.56	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				60						SM	SILTY SAND dark grayish brown (10YR 4/2); 85-90% very fine to medium sand; 10-15% silt; trace clay; dry; loose; roots throughout	Hand auger to 5 ft bgs
				70	1431						Grading to 15-20% silt; slightly moist; trace clay	
5												
										SC	SAND with CLAY; brown (10YR 4/3); 85-90% very fine sand; 10-15% clay; dry; soft; moderate density	
				65	1435					SP-SC	Color change to olive brown (2.5Y 4/3); grading to 40% clay; very fine to fine sand; slightly moist	
10											Color change to light olive brown (2.5Y 5/4); grading to 15-20% clay; very fine sand; dry; moderate density	
											Color change to olive brown (2.5Y 4/3); grading to 30-40% clay; hard	
15										CLS	SANDY CLAY; 55-60% clay; 40-45% very fine to fine sand; hard; dry; skeletal root structures; white veins; trace gravel	
										SC	Grading to CLAYEY SAND; olive brown (2.5Y 4/3); 40% clay; dry; moderate density	
				65						CLS	Grading to SANDY CLAY; 60-65% clay; dry; hard	
20												Soil sample LE 607 collected at 1540 at a depth of 20 ft bgs
										SW	Well graded SAND; fine to medium, trace coarse sand; trace gravel; trace cobbles and pebbles	
										SC	CLAYEY SAND as above; fine to medium sand; 30% clay; soft; loose; dry	
				70								
25										CLS	SANDY CLAY; 60% clay; 40% fine to medium sand; trace gravel; moist	
										SC	CLAYEY SAND; 60-65% fine to coarse sand; 35-40% clay; very moist to saturated; moderate density	
										SW	Cobbles and pebbles	
				30								
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC3
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											Well graded SAND; fine to coarse (mostly coarse); trace clay; trace well rounded pebbles throughout; saturated	
										SW-SC	Increasing clay content ~ 5-10%	
				60	1550					SW	Well graded SAND; fine to coarse (mostly coarse), clean; saturated; loose	Alluvium HP sampler screened 33-37 ft bgs
35											trace rounded pebbles	GW sample LE606 collected at 1535
				95	1610					SP	grading to finer sands; Pooly graded SAND; 95% very fine to fine sand; trace clay; saturated; loose	
40											Grading to no clay; clean fine sand	
										SW	Medium sand; loose; saturated; Well graded SAND; fine to medium; loose; saturated	
				65	1620					SW-SC	grading to 5-10% clay; loose; saturated	
										SW	6" lense of sand with pebbles; Well graded SAND; fine to coarse; rounded gravel and pebbles; trace rounded cobbles; loose; saturated	
45										SC	Coarse CLAYEY SAND; high in organics; color change to dark brown (7.5YR 3/4)	
										SW-SC	Well graded SAND with CLAY; dark yellowish brown (10YR 4/6); fine to medium sand; 5-10% clay; loose; saturated	
				60	1636					SP	Poorly graded SAND; light yellowish brown (2.5Y 6/3); fine sand; loose; saturated	
50										SW	Well graded SAND; fine to medium sand; trace clay; loose; saturated	
										SWG	GRAVELLY SAND; black (5Y 2.5/2); trace cobbles; trace pebbles	
				30	1640					SW	Well graded SAND; gray (2.5Y 5/1); fine to coarse; trace subrounded to rounded gravel; loose; saturated	
55											Clay stringers; Trace cobbles	
				15	1650					SP	Poorly graded SAND; very fine to fine; loose; saturated	
60											Grading to fine sand; trace medium	
				0	1700						No Recovery	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC3
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				0	0725						No Recovery	
70												Driller believes a rock is stuck in bit which is restricting recovery; drilling still soft
				70	0758					SP	Poorly graded SAND; dark gray (2.5Y 4/1); very fine to fine sand; loose	
75											grading to fine sand; loose; saturated	
										SW	Well graded SAND; fine to medium sand, trace coarse sand; trace rounded gravel; loose; saturated	
				15	0818						Large well rounded cobbles	
80												Rinsate sample LE608 collected at 0900
											Rock fragments (quartzite)	
										SP	Grading to finer sands; trace clay Poorly graded SAND; fine sand; loose; very moist	
85										SW	Well graded SAND; fine to coarse sand; trace gravel; loose; very moist	Bedrock HP sample screened 87-87.5 ft bgs GW sample LE609 collected at 0910
											Grading to medium to coarse SAND; trace gravel and pebbles	
										WBr	(BEDROCK) WEATHERED SANDSTONE; fine grained; micaceous; fractures observed. No reaction to HCl	

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC4	
Borehole Location: Site 1	*Northing:* 2193323.02	*Easting:* 6122238.52	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Gary Whitley	
Drilling Equipment: CME 85		Date Started: 2/2/2005	Total Depth (feet): 58.5
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/2/2005	Depth to Bedrock (feet): 45.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 30.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 565.02	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				90	1405					SM	SILTY SAND; dark brown (10Yr 3/3); 85% very fine sand; 15% silt; loose; faintly moist; soft; moderate density; roots thoughout; trace rock fragments	Hand auger to 5 ft bgs
				80	1410						SILTY SAND; brown (10Yr 4/3); 85-90% very fien sand; 15% silt; roots; organics; faintly moist; rock fragments	
5											Color change to very dark graysih brown (10YR 3/2); increase in silt (15-20%); moderate density; faint to slight moisture; trace roots	
				10	1417							
10											Well rounded cobble	Rock in shoe; poor recovery
				80						SC	Grading to CLAYEY SAND; brown (10YR 4/3); 85% well graded, fine to coarse sand; 15% clay; dry to faintly moist; moderate density	
15											Color change to brown (10YR 5/3); grading to 10-15% clay; fine to medium sand; trace coarse sand	
										SW		
										SC	6" lense of Well graded SAND; fine to coarse; loose; dry	
										CLS	CLAYEY SAND; 35-40% clay; very fine to medium sand; moderate density; dry to faintly moist; trace gravel	
				30						SC		
20										SW	CLAY lense; 55-65% clay; hard; dry to faintly moist	Soil sample LE596 collected at 1510 at a depth of 20 ft bgs
											CLAYEY SAND as above	
											Well graded SAND; brown (10YR 5/3); fine to coarse (mostly medium) sand; loose	
										CLS	Trace subrounded to rounded gravel; some pebbles	
				30	1429					SC	SANDY CLAY; dark yellowish brown (10YR 3/4); 55-60% clay; fine sand; hard; dry; skeletal root structures	
25										SW	CLAYEY SAND; fine to medium sand; 30-35% clay; high mica content; trace gravel	Rinsate sample LE592 collected at 1435
										SC	Well graded SAND; 90-95% fine to medium sand; trace coarse sand; 5-10% clay	
											Grading to CLAYEY SAND; 20% clay; trace gravel; some rock fragments	
30											Increasing clay content; 35-45% clay; fine to	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC4
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											medium sand; trace coarse sand; trace rock fragments and gravel; saturated	
				70	1513					SW	Well graded SAND; fine to coarse sand; trace subangular to angular gravel; trace pebbles; loose; saturated	Alluvium HP sampler screened 33-37 ft bgs GW sample LE593 collected at 1455
35										SP-SC	Poorly graded SAND; fine sand; 5-10% clay; moderate density; saturated	
										SW	Well graded SAND; fine to coarse sand; trace subangular to angular gravel; trace pebbles; loose; saturated	
				95	1519					CLS	SANDY CLAY; dark brown (10YR 33); 65% clay; 35% very fine sand; moderate plasticity; moderate to high density; very moist ot saturated	
40											grading to 55-60% clay; low to moderate plasticity; very moist to saturated	
				60							Color change to dark grayish brown (2.5Y 4/2); 55-60% clay; very fine sand; low to moderate plasticity; very moist to saturated	
45										WBr	(BEDROCK) Transitional contact between alluvium and bedrock; highly weathered SILTSTONE; olive brown (5Y 5/3); Color change to greenish gray (10GY 4/1); very fine grained; very moist to saturated	
				60								
50										CBr	Moving into more competent bedrock; bedding structures observed; alternating beds of fine SANDSTONE and SILTSTONE; SANDSTONES slightly lighter in color; saturated	Alternating SANDSTONE and SILTSTONE beds
				100								
55												Bedrock HP sampler screened 58.5-59.6 ft bgs GW sample LE597 collected at 1615

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC5	
Borehole Location: Site 1	*Northing:*	*Easting:*	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Gary Whitley	
Drilling Equipment: CME 85		Date Started: 1/24/2005	Total Depth (feet): 58.5
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/24/2005	Depth to Bedrock (feet): 52.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 22.00	*Static: 21.8*
Completion Information:Cement bentonite grout to surface		Elevation (feet MSL) :	
		Logged By: D. Van der Kolk	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				45	1010					SM	SILTY SAND; light olive brown (2.5Y 5/6); 70% fine sand, trace medium; 30% silt; loose; moist; no odor; rootlets	Hand auger to 5 ft bgs
				60	1045							
5												
				85	1052					CLS	Fine to medium SANDY CLAY; very dark graysih brown (10YR 3/2); 40% fine sand, 20% medium; 40% clay; soft; moist; nonplastic; no odor	
10												Soil sample LE533 collected at 1455 at a depth of 12 ft bgs
				100	1100						Color change to graysih brown (10YR 3/2)	
15											Increase in clay and fine sand (50% fine sand, 5% medium sand; 45% clay; hard; nonplastic	
				55	1110					SM	SILTY SAND; light olive brown (2.5Y 5/4); fine to coarse sand, 20% coarse, 30% medium, 35% fine; 15% silt; wet; no odor	
20										▽		
				100	1125					CLS	Fine to medium SANDY CLAY; light olive brown (2.5Y 5/4); 28% fine sand, 20% medium; 52% clay; wet; nonplastic; no odor	
25											Coarse sand lenses (~1")	
				100	1210							Alluvium HP sampler screened 28.5-32.5 ft bgs GW sample LE529
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPC5
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
												collected at 1205
										SM	SILTY SAND; light olive brown (2.5Y 5/4); 30% fine, 40% medium sand; 30% silt; wet; no odor	
				95	1300					CLS	SANDY CLAY; pale olive brown (2.5Y 5/4); 33% fine sand, 15% medium; 52% clay; wet; nonplastic; no odor	
35										SM	SILTY SAND; pale olive brown (2.5Y 5/4); 30% fine sand, 40% medium; 33% silt; trace gravel	
				100	1315							
40										CLS	SANDY CLAY; pale olive brown (2.5Y 5/4); 30% fine sand; 70% clay; wet; nonplastic; no odor	
										SM	SILTY SAND; pale olive brown (2.5Y 5/4); 52% fine sand; 15% medium sand; 33% silt; wet; no odor	
				100	1330					CLS	SANDY CLAY; pale olive (5Y 6/3); 52% clay; 48% fine sand; wet; nonplastic; no odor	
45												
				100	1345							
50												
				100	1350					CBr	(BEDROCK) SILTSTONE; olive (5Y 4/3); hard; weak; laminated	
55												
										CBr	SANDSTONE; pale olive (5Y 6/4); soft	Bedrock HP sampler screened 58.5-59.5 ft bgs GW sample LE532 collected at 1445

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD1	
Borehole Location: Site 1	*Northing:* 2192606.35	*Easting:* 6121426.4	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Paul Almanez	
Drilling Equipment: CME 85		Date Started: 1/25/2005	Total Depth (feet): 52.5
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/26/2005	Depth to Bedrock (feet): 43.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 55.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 547.91	
		Logged By: R. Lopez	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
					1510					CL	CLAY; dark grayish brown (10YR 4/2); 5-10% fine to coarse sand; trace gravel; soft; plastic; moist; no odor	Hand auger to 5 ft bgs
5				90	1535							
										CL	CLAY; brown (10YR 4/3); 10% fine sand; roots in upper 6"; highly plastic; slightly mois to to moist; yellow siltstone clasts at bottom; no odor	Sharp contact; color change
10				100	1545					SP	Poorly graded SAND; light yellowish brown (10YR 6/4); fine sand; trace silt; loose; massive; moist	Vegetation in sample similar to that found at surface. Could be slough
										SC	CLAYEY SAND grading into clay; yellowish brown (10YR 5/4); plastic	
15				100	1551					CL	CLAY with SAND; dark grayish brown (10Yr 4/2); 10% fine sand; moderate to high plasticity; slightly moist to moist	Disturbed sample; clay balls throughout - looks like auger cuttings
											CLAY with SAND as above	
20				100	1600						CLAY with SAND; brown (10YR 4/3); 10% sand; plastic; slightly moist	Disturbed sample
											CLAY with SAND; brown (10YR 4/3); 10% sand; plastic; slightly moist; slight reaction with HCl; no odor	
25				100	1630						CLAY with SAND as above	Disturbed sample
											CLAY with SAND; brown (10YR 4/3); 10% fine sand; massive; moderate plasticity; soft to firm	
30												Undisturbed sample

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD1
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				100	0755					CL	CLAY with SAND as above	
											CLAY; very dark gray (10YR 3/1); plastic; calcareous veins - rootlike; trace rounded fine gravel; some pinhole sized voids in clay (2%); soft	
35				100	0800						CLAY with SAND; 10% fine to medium sand; trace coarse sand and gravel; plastic; soft; slightly most	
											CLAY with SAND; yellowish brown (10YR 5/4); 10% fine sand; soft; plastic; massive; slightly moist; no odor	
											CLAY with SAND; dark yellowish brown (10YR 4/4); 10% fine sand; plastic; soft; vertical voids (root size)	
40				100	0805							Soil sample LE546 collected at 0850 at a depth of 40 ft bgs
										WBr	(BEDROCK) SANDSTONE; very pale brown to yelloish brown; oxidation stains; grain size varies, fine to medium, trace coarse angular to subrounded grains; trace fine angular gravel; slightly moist; no odor	
45				100	0812							Bedrock HP sampler screened 55.5-56.5 ft bgs
											At 47-49' - large $CaCO_3$ vein plus smaller fracture planes (very distinct with alteration zones)	GW sample LE547 collected at 0915
50				100	0830						SANDSTONE as above; coarse grained	

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD2	
Borehole Location: Site 1	*Northing:* 2192526.75	*Easting:* 6121532.45	Sheet *1* of *3*
Drilling Agency: Water Development Corp.		Driller: Paul Almanez	
Drilling Equipment: CME 85		Date Started: 2/2/2005	Total Depth (feet): 70.0
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 2/2/2005	Depth to Bedrock (feet): 67.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static: 40.91*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 545.07	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SC	SILTY CLAYEY SAND; very dark grayish brown (10YR 3/2); 20% silt; 30% clay; 30% very fine sand; moist	Hand auger to 5' bgs.
5				70	752						Grading to 60% very fine sand; 20% silt; 20% clay; moist; brown (10YR 5/3)	
										SM	Grading to 70% very fine sand; 30% clay; roots; moist; yellowish brown (10YR 5/4)	
										CL	SILTY SAND; pale olive (5Y 7/3); 80% very fine sand; 20% silt	
10				90	757					SC	CLAY with SAND; very dark grayish brown (10YR 3/2); 80% clay; 20% very fine sand; white calcareous veins	
											CLAYEY SAND; dark grayish brown (10YR 4/2); 70% very fine sand; 30% clay; moist	
										CL	CLAY with SAND; 60% clay; 20% silt; 20% sand	
15				50	801					SC	CLAYEY SAND; pale brown (10YR 7/3); 70% very fine to fine sand; 30% clay	
											Grading to 60% very fine sand; 20% clay; 20% silt; brown (10YR 4/3); moist	
										SM	SILTY SAND; yellowish brown (10YR 6/4); 70% very fine sand; 20% silt; 10% clay; gravel at base	
20				70	807						Grading to 40% very fine sand; 40% silt; 20% clay	
										SC	CLAYEY SAND; grayish brown (10YR 5/2); 70% very fine to fine sand; 30% clay; moist	
											Color change to yellowish brown (10YR 6/4)	
										SP-SM	SAND with silt; pale brown (10YR 7/3); 90% very fine sand; 10% silt; moist; coarsening downward; 5% fine, angular gravel	
25				100	812					CL	CLAY with SAND; yellowish brown (10YR 6/4); 60% clay; 20% silt; 20% very fine sand; moist	
										SC	CLAYEY SAND; yellowish brown (10YR 6/4); 70% very fine sand; 30% clay; moist	Rinsate sample LE588 collected at 0844
30										CLS		

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD2
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				60	818					SC	SANDY CLAY; 60% clay; 40% very fine sand; moist CLAYEY SAND; 70% very fine sand; 30% clay; moist	Soil sample LE589 collected at 0846 at a depth of 30 ft bgs
										SP-SM	SAND with silt; pale yellowish brown (10YR 7/4); 90% very fine to medium sand; 10% silt; trace gravel Grading to very fine sand	
35				50	827					SM	SILTY SAND; 70% very fine sand; 20% silt; 10% clay Grading to 30% clay; 70% very fine sand	
40				50	835					SC	CLAYEY SAND; yellowish brown (10YR 5/4); 70% very fine sand; 30% clay; wet	
45				30	931						Grading to 60% very fine sand; 40% clay; wet	Alluvium HP sample screened 45-49 ft bgs GW sample LE590 collected at 0905
50				100	939					CL	CLAY; brown (10Yr 4/3); 10-20% very fine to medium sand	
55				70	952					SC	CLAYEY SAND; yellowish brown (10YR 5/4); 80% very fine sand; 20% clay; coarse, surounded gravel Grading to 70% very fine sand; 30% clay	
60				25	1004					SP-SM	SAND with silt; yellowish brown (10YR 5/4); 90% very fine sand; 10% silt	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD2
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
					1025							Bedrcok HP sampler screened 70-71 ft bgs GW sample LE591 collected at 1059
										SC	CLAYEY SAND; 70% very sand; 30% clay	
										WBr	Coarse gravel overlying (BEDROCK)	
											SANDSTONE; oxidized fractures; some white.	
											$CaCO_3$? filled fractures	
70												

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	**Borehole Number:**	**01-HPD3**
Borehole Location: Site 1	*Northing:* 2192465.62	*Easting:* 6121670.8	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/26/2005	Total Depth (feet):	82.0
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 1/27/2005	Depth to Bedrock (feet): 81.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 38.00	*Static: 38.5*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 542.29	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
					1612					SM	SILTY SAND; very dark grayish brown (10YR 3/2); 75% very fine sand; 25% roots; trace gravel at surface; moderate density; faintly moist	Hand auger to 5 ft bgs
				75	1621						Increasing silt content with depth SILTY SAND as above; dark grayish brown (10YR 4/2); 30% silt; low plasticity; modearte density; trace clay	
5											Increasing clay content; 20% silt; 10% clay	
				5	1628					SP	Poorly graded SAND; light yellowish brown (10YR 6/4); fine sand; subrounded cobbles; trace surangular pebbles; loose; dry	
10												
				80	1634					SW	Well graded SAND; light yellowish brown (10YR 6/4); fine to coarse, subangular to subrounded sand; trace clay Cobble lens; increasing clay content	
15										SC	Grading to CLAYEY SAND; 85% fine sand; 15% clay; hard; dry to faintly moist	
				80	1640						Grading to 85-90% very fine to fine sand; trace medium and coarse sand; 10-15% clay; yellowish brown (10YR 5/6); moderate density; faintly moist	
20											Increasing clay content	
				75	1648					CLS	Grading to SANDY CLAY; dark yellowish brown (10YR 4/4); 55-60% clay; 40-45% very fine sand; platy structure; skeletal root structures filled with $CACO_3$; moderate density; faintly moist	
25										SC	Grading to CLAYEY SAND; 30% clay; moderate density	
				90	1655						Increasing clay with depth ~40-45% clay; slightly hard; dry to faintly moist	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD3
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SC	CLAYEY SAND; brown (10YR 5/3); 10-15% clay; 85-90% fine sand	Pulling rods out; shutting down for the day
										SP-SC	SAND with clay; 90% fine sand; 10% clay; trace cobbles and pebbles	Soil sample LE561 collected at 1140 at a depth of 30 ft bgs
				30	0751					SWG	GRAVELLY SAND; pale brown (10YR 6/3); 85-90% fine to coarse sand;10-15% gravel; trace cobbles	
35												
										SC	Grading to CLAYEY SAND; brown (10YR 5/3); 80% very fine to fine sand; 20% clay; modearte density; moist at 38'	
				40	0845							Alluvium HP sampler screened 38.5-42.5 ft bgs. GW sample LE559 collected at 0830
40											Saturated; sticky	
											Increasing clay content (25-30%)	Heaving sands after GW sample
				50	0854							
										SP-SC	Poorly graded SAND; light olive brown (2.5Y 5/3); 90-95% very fine to fine sand; 5-10% clay; loose; saturated	
45											Clay lens at 47-47.5'	
				80	0905					SP	Poorly graded, fine SAND; trace medium sand; trace clay; loose; saturated; no odor	
50												Rinsate sample LE560 collected at 0855
				45	0913					SW	Well graded, fine to coarse SAND; 10% well rounded pebbles; trace gravel; saturated	
55												
										CLS	SANDY CLAY; dark olive brown (2.5Y 3/3); 75% clay; 25% very fine sand; sticky; wet	
				95	0920							
										SW-SC	Fine to coarse SAND with CLAY	
60										CLS	SANDY CLAY; dark grayish brown (2.5Y 4/2); 70% clay; 30% very fine to fine sand; modearte density; sticky; saturated	
				25	0933					SC	CLAYEY SAND; 35-40% clay; fine to coarse sand; trace pebbles and gravel; wet	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD3
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SW	Fine to coarse SAND; light yellowish brown; trace clay; wet	
										SP-SC	Fine SAND with clay; 5-10% clay; wet	
					1013					SW	Well graded, medium SAND; grayish brown (2.5Y 5/2); fine to coarse, subangular to subrounded sand; loose; saturated; no odor	
70												
				25	1027						SAND with rounded pebles and cobbles; very dark grayish brown (2.5Y 3/2); fine to medium sand; 5-10% clay; saturated	
75											Well graded SAND; no cobbles or pebbles	
										SC	CLAYEY SAND; dark grayish brown (2.5Y 4/2); 85% very fine to fine sand; 15% clay; saturated; stiff	
				50	1051					SW	Well graded SAND; fine to coarse; loose; saturated	
80											Cobbles and pebbles	
										WBr	(BEDROCK) SANDSTONE; very fine grained; biotite rich	Refusal at 81'; Going to try to go a bit further to find bedrock contact. Was able to advance auger ~ 1' more. Refusal at 82'

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD4	
Borehole Location: Site 1	*Northing:* 2192268.22	*Easting:* 6121567.59	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/27/2005	Total Depth (feet): 76.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/28/2005	Depth to Bedrock (feet): 69.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 38.50	*Static: 37.9*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 538.37	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				10						SM	SILTY SAND; very dark grayish brown (10YR 3/2); 80% very fine sand; 20% silt; slightly moist; soft; roots throughout	Hand auger to 5 ft bgs
				70						SP-SM	SAND with SILT; brown (10YR 4/3); 90% fine to medium sand; 10% silt; trace clay; low to moderate density; loose; faintly moist	
5												
				95	1453					CLS	Increasing fines with depth SANDY CLAY; olive brown (2.5Y 4/3); 60% clay; 40% very fine sand; skeletal roots throughout; hard	
10										SC	CLAYEY SAND; yellowish brown (10YR 5/4); 70% very fine sand; 30% clay; hard; dry	
				90	1458					SW	Fine to coarse, well graded SAND; trace clay; loose; dry	
										SP	Grading to mostly fine sand; trace clay	
15										SC	CLAYEY SAND as above; very fine to fine sand 2" sand lens at 15.5'; trace gravel	
				60	1505						3" sand lens at 18' CLAYEY SAND; brown (10YR 5/3); fine to coarse sand; 40% clay; hard; low plasticity	
20										SP	SAND; yellowish brown (10YR 5/4); fine, trace medium grained; trace rounded pebbles; loose; dry	
										CLS	SANDY CLAY; olive brown (2.5Y 4/3); 70-80% clay; 20-30% fine to medium sand; slightly moist	
				50						SC	CLAYEY SAND; 80-90% fine to coarse sand; 10-20% clay	
25												Soil sample LE564 collected at 1610 at a depth of 28 ft bgs
										CLS	SANDY CLAY; brown (10YR 4/3); 60-70% clay; 30-40% fine to medium sand	
										SC	CLAYEY SAND as above; 30% clay	
				20						SP-SC	SAND with CLAY; light yellowish brown (2.5Y 6/4);	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD4
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SW	90-95% fine sand; 5-10% clay; trace gravel Well graded SAND; pale yellow (2.5Y 7/6); fine to coarse sand; angular gravel	
				25	1525					SW-SC	SAND with clay; 90-95% fine to coarse sand; 5-10% clay; trace angular gravel; trace rounded cobbles; loose	
35										SC	Grading to CLAYEY SAND; 80% fine sand; 20% clay; trace mica; very moist 6" lens of coarser sands; wet; trace cobbles	
					1702						CLAYEY SAND; trace gravel and pebbles; color change ot yellowish brown (10YR 5/4); 25% clay No recovery; sample fell out of shoe	Alluvium HP sampler screened 38.5-42.5 ft bgs GW sample LE563 collected at 1605 WL at 37.9 after sampling
40												
										SC	CLAYEY SAND; brown (10YR 4/3); 60% fine to coarse sand; 40% clay; trace subrounded to rounded gravel; low to moderate density; sticky; saturated	
45												
					0748						CLAYEY SAND as above; loose; saturated	
50											Grading to less clay; 15-20%; trace mica Grading to 20-30% clay; trace gravel	
					0752						Grading to finer sands CLAYEY SAND; fine to coarse sand; 30-40% clay; moderate density; sticky; saturated	
55											SANDY CLAY; dark grayish brown (10YR 4/2); 70% clay; 30% very fine sand; moderate plsticity; very moist Grading to 55% clay	
					0807					SC	CLAYEY SAND; 80-90% fine sand; trace medium sand; 10-20% clay; low density; low plasticity; sticky; saturated	
60										SW-SC	Well graded SAND with clay; fine to coarse sand; 10% clay	
				50						SC	CLAYEY SAND; light olive brown (2.5Y 5/3); 55-60% fine to coarse sand; 40-45% clay; trace	
65												

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD4
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											pebbles; saturated	
										CLS	Grading to finer sands; less clay (~30-40%); color change to dark grayish brown (2.5Y 4/2)	
											SANDY CLAY; 60% clay; 40% fine to medium sand; trace mica; low plasticity; wet	
				100						SW-SC	Well graded SAND with clay; 5-10% clay; fine to coarse sand; loose; saturated	
70										WBr	Weathered transitional zone between alluvium and bedrock; (BEDROCK) SANDSTONE; fine grained; moderate density; yellowish brown (2.5Y 6/3)	
				50								
75										CBr	More competent bedrock; fine grained SANDSTONE; some clays or silts; bedding structures (ripples) observed	Refusal

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD5	
Borehole Location: Site 1	*Northing:* 2192936.09	*Easting:* 6121925.53	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 2/2/2005	Total Depth (feet): 85.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 3	Date Finished: 2/3/2005	Depth to Bedrock (feet): 83.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static: 40.26*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 553.84	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND; pale brown (10YR 6/3); 80% very fine sand; 20% silt; moist	Hand auger to 5' bgs.
										CL-ML	SILTY CLAY; very dark grayish brown (10YR 3/2); 60% clay; 20% silt; 20% very fine sand; moist	
5				60	1409					SM	SILTY SAND;80% very fine sand; 20% silt Color change to brown (10YR 5/3)	
										CL-ML	SILTY CLAY; grading to very dark olive brown (10YR 3/2); 60% clay; 20% silt; 20% very fine sand; white traces of $CaCO_3$?	
10				100	1413					SC	CLAYEY SAND; 70% very fine sand; 30% clay; moist	
										CLS	SANDY CLAY; brown (10YR 5/3); 50% clay; 40% very fine sand; 10% silt	
										SC	CLAYEY SAND; 70% very fine sand; 30% clay; moist	
15				40	1423					CLS	SANDY CLAY; 50% clay; 40% very fine sand; 10% silt	
										SC	CLAYEY SAND; brown (10YR 5/3); 50% very fine sand; 30% clay; 20% silt	
										SM	SAND with SILT; grading to 70% very fine sand; 20% silt; 10% clay	
20				50	1430					SW-SM	Well graded SAND with SILT; 90% fine to very coarse sand; trace gravel; 10% silt; loose; moist; coarsening downward slightly Color change to pale yellowish brown (10YR 8/4)	
25				30	1437					SC	CLAYEY SAND; yellowish brown (10YR 6/4); 70% very fine sand; 30% clay	
30										SW-SM	SAND with silt; pale brown (10YR 6/3); 90% very	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD5
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				70	1445					SC	fine to medium sand; 10% silt; loose; moist CLAYEY SAND; pale brown (10YR 6/3); 70% very fine to fine sand; 30% clay Color change to pale yellowish brown (10YR 7/4)	Soil sample LE595 collected at 1540 at a depth of 30 ft bgs
35				50	1453							
40				50	1500					▽	Grading to 60% very fine sand; 30% clay; 10% silt; yellowish brown (10YR 6/4); moist Grading to 50% medium to coarse sand; 40% clay; 10% fine to coarse gravel; wet; possibly slough Grading to 60% medium to coarse sand; 40% clay	
45				60	1553					CL-ML SP-SM	SILTY CLAY; 50% clay; 30% silt; 20% very fine sand SAND with silt; 90% very fine to fine sand; 10% silt	Alluvium HP sampler screened 45-49 ft bgs GW sample LE594 collected at 1532
										SC	CLAYEY SAND; 80% fine to coarse sand; 20% clay	
50				60	1615					SP-SM	SAND with silt; 90% very fine to fine sand; 10% silt	
										SW-SM	SAND with silt; 90% medium to coarse sand; 10% silt	
55				50	1628					SC	CLAYEY SAND; 60% fine to medium sand; 40% clay with 1 100% clay layer Grading to 80% medium to coarse sand; 20% clay	
60				60	1648					SW-SM	SAND with silt; 90% medium to very coarse sand; fine gravel; 10% silt	
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD5
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				25	1702					SW-SM	15% coarse, rounded gravel below 64.5 SAND with silt as above Subrounded to rounded gravel at base	
70				25	806					GW-GM	GRAVEL with silt; grayish brown (10YR 5/2); 90% fine to medium gravel; 10% silt	
										SC	CLAYEY SAND; 70% very fine sand; 40% clay;	
										CL	CLAY with laminations; black (2.5Y 2.5/10;	
75				40	824					SW-SM	CLAYEY SAND at base ~2' thick SAND with silt; grayish brown (10YR 5/2); 90% medium to coarse sand; 10% silt	
										SC	1" clay underlain by CLAYEY SAND; 70% very fine to fine sand; 30% clay	Bedrock HP sampler screened 85-85.5 ft bgs GW sample LE598 collected at 0931
80					845					SW-SM	SAND with silt; grayish brown (10YR 5/2); 80% medium to coarse sand; 10% silt	
										WBr	(BEDROCK) SANDSTONE; dark olive brown (5Y 4/2); very fine sand; weathering to silt	
85												Water in auger prior to installing hydropunch. Only able to drive hydropunch 6 into bedrock.

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD6	
Borehole Location: Site 1	*Northing:* 2192992.36	*Easting:* 6121683.91	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/28/2005	Total Depth (feet): 50.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 1/28/2005	Depth to Bedrock (feet): 25.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 556.02	
		Logged By: E. Rasdal	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	Road base at surface SILTY SAND; dark yellowish brown (10YR 4/4); 50% fine to medium sand; 40% silt; 10% clay; trace gravel; moist.	Hand auger to 5' bgs.
										ML		
										CL-ML	SANDY SILT; very dark grayish brown (10YR 3/2); 40% silt, 30% clay, 30% fine sand, trace gravel; moist.	
5										CL	SAND with SILT; 7YR 3/1; 80% clay; 10% silt; 10% sand; trace gravel; moist.	
										CL-ML	CLAY; very dark grayish brown (10YR 3/2); SILTY CLAY; grayish brown (10YR 5/2); 75% clay; 20% silt; 5% fine sand; moist; white root traces react with HCl. Increasing silt with depth.	
10											Color change to grayish brown (10YR 5/2).	
											Color change to dark grayish brown (10YR 4/2).	
15											Vertical void spaces (1-3%); color change to grayish brown (10YR 5/2).	
20											Root traces, react with HCl; color change to brown (10YR 4/3). Grading to 60% clay; 40% silt; moist. Decreasing silt to 25%.	
25					1104					WBr	Degraded (BEDROCK) SANDSTONE; interbedded fine and coarser layers some with greasy surfaces. High angle fracture (1/4 thick), react with HCl. Two sets perpendicular to each other.	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPD6
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											Fine sand; no reaction with HCl; no obvious fracture planes; GLEY 6/1.	
35					1139						Alternating finer and coarser material.	Hard drilling from 35 to 40' bgs.
											Color change to 2.5Y 6/6	
40					1205						Hardened laminations; moist.	
											Very soft; incompetent.	
45					1340						20% lithics; incompetent; iron oxidation.	
											Vertical void spaces; moist.	
50												Stopped drilling as per Bill McClenney even though had not reached groundwater.

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE1	
Borehole Location: Site 1	*Northing:* 2191693.08	*Easting:* 6121253.32	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/26/2005	Total Depth (feet): 49.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 2	Date Finished: 1/26/2005	Depth to Bedrock (feet): 33.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 39.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 530.78	
		Logged By: R. Lopez	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
					0850							Hand auger to 5' bgs
5				60	0907					CL	CLAY; very dark brownish gray (10YR 3/2); slight organic odor	Soft drilling
10				80	0917					CLS	SANDY CLAY transition into SANDY SILT; brown (10YR 4/3); 10-30% fine to medium sand; slightly plastic	Gravel from 10-15'
										SW	Well graded SAND; light yellowish brown (10YR 6/4); fine to coarse (mostly coarse), angular sand; loose; dry	
15				55	0930					SP	Poorly graded SAND; light yellowish brown (10Yr 6/4); fine sand; clean, no silt; loose; dry	
										CL	CLAY; brown (10YR 4/3); plastic; 5% coarse sand; soft; slightly moist; moderate reaction to HCl	
										SP	Poorly graded SAND; yellowish brown (10YR 5/4); medium, subangular to subrounded sand; loose; dry; no odor	
										CL		
										GW		
20				75	0937					CL	CLAY; brown (10Yr 4/3); plastic; slightly organic; mottled (light brown); firm; slightly moist; moderate reaction to HCl	
											GRAVEL; pulverized gravel; diameter greater than 3", more like cobbles	
											CLAY; brown (10YR 4/3); plastic; soft; trace coarse sand; slightly moist; moderate reaction to HCl	
25				100	0947					ML	SILT with SAND; yellowish brown (10YR 5/6); 80% silt; 20% fine sand, trace coarse sand; massive	Soil sample LE540 collected at 1140 at a depth of 24 ft bgs Steady drilling, no change
											Calcareous veins in old root system; dry to slightly moist	
30										ML		

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE1
Borehole Location: Site 1		Sheet 2 of 2

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analysis: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				100	1000						CLAYEY SILT; yellowish brown (10YR 5/6); trace coarse sand; nonplastic; calcareous veins similar to above	
35				100	1015					WBr	(BEDROCK) FINE SANDSTONE; very pale brown (10YR 7/4) to white (10YR 8/2) to light yellowish brown (10YR 6/4); crumbles to loose material; oxidation staining; slightly moist to moist; no odor	
40				80	1030					WBr ▽	Weathered SANDSTONE; pale brown (10YR 6/3); 10% silt; 90% fine, angular to subangular sand grading to medium; crumbles with light pressure	
45				90	1050					WBr	Weathered SANDSTONE; yellowish brown (10YR 5/6); fine, poorly graded sand with calcareous veins at 45° angles; 3 sets; saturated; some oxidation staining. Abundant dissolution voids and calcareous veins Fracture planes	Bedrock HP sample screened 44.5-46 ft bgs GW sample LE539 collected at 1135
										WBr	SHALE; dark brownish gray; firm; dry	

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE2	
Borehole Location: Site 1	*Northing:* 2191714.68	*Easting:* 6121353.58	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almánez		
Drilling Equipment: CME 85	Date Started: 1/28/2005	Total Depth (feet): 70.0	
Drilling Method: Hollow Stem Auger	Number of Samples:	Date Finished: 1/28/2005	Depth to Bedrock (feet): 68.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 530.70	
		Logged By: R. Lopez	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
					1325					SW-SM	Well graded SAND with SILT; brown (10YR 4/3); 75% fine to coarse sand (mostly coarse); 10% subrounded gravel; 15% silt; loose; moist; no odor	Hand auger to 5' bgs
										CL	CLAY; dark brown (10YR 3/3); 5% coarse sand; plastic; soft; no odor	
										SW	Well graded SAND; brown (10YR 5/3); fine to coarse (mostly medium), angular to subrounded sand; loose	
5				50	1328					CL	CLAY; black (10YR 2/1) to dark brown (10YR 3/3); mottled; trace gravel; plastic; moist; no odor	
										SW-SM	SAND with SILT; dark yellowish brown (10YR 4/4); well graded, fine to coarse sand (mostly medium); 5% subangular gravel; patches of silt; plagioclase fragments; slightly moist	
10				100	1340					CL	CLAY; black (10YR 2/1); plastic; trace roots; rich in organics Color change to yellowish brown (10YR 5/4); moderate plasticity; moderate reaction to HCl; some roots; traces of fibers; slightly moist; no odor	
15				50	1408						Color change to brown (10YR 4/3); high plasticity; soft; 5% medium sand; very moist; slight reaction to HCl	
										SW	Well graded SAND; brown (10YR 5/3); fine to coarse (mostly coarse), subrounded to rounded sand; 10% gravel; slightly moist	
20				50	1414					CL-ML	CLAY/SILT; plastic; soft; silt laminations; slgihtly moist; no odor	
										SP-SM	Poorly graded SAND with interbedded SILT; pale brown (10YR 6/3) fine sand; loose Grain size coarsening with depth	
25				100	1422					CL	CLAY; dark brown (10YR 3/3); plastic; vertical, root size voids; no HCl reaction	Soil sample LE565 collected at 1625 at a depth of 25 ft bgs
										CL-ML	SILTY CLAY; dark yellowish brown (10YR 4/4); low to moderate plasticity; trace gravel; massive; soft; moist; no odor; moderate reaction with HCl	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE2
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
					1432					CL-ML	SILTY CLAY; dark yellowish brown (10YR 4/6); slightly plastic; massive; trace sand; soft; slgihtly moist	
35				50	1442					SP	Poorly graded SAND; brown (10YR 5/3); fine sand; faint lamination; moist; no odor	
										CL-ML	SILTY CLAY interbedded with well graded SAND; yellowish brown (10YR 4/4); silty clay - low to moderate plasticity; soft; trace fine sand - coarse; loose; saturated	
40				80	1457					CL	CLAY; yellowish brown; plastic; soft; wet	
										SW	Well graded SAND; yellowish brown; fine to coarse sand; loose; saturated	
										CL	CLAY; yellowish brown; plastic; soft; wet	
										SW	Well graded SAND; yellowish brown; fine to coarse (mostly coarse); 5% gravel	
45				100	1520					CLS	CLAY with sand; 15% fine sand; slightly plastic; massive; soft; moist	Alluvium HP sample screened 44-49 ft bgs GW sample LE562 collected 1505
50				50	1540					CL	CLAY; very dark grayish brown (10YR 3/2)	
55				100	1555					CL	CLAY; brown (10Yr 4/3); plastic; massive; firm; 5% rounded gravel	
60				40	1410					SW	Well graded SAND with gravel; brown (10YR 5/3); fine to coarse (mostly coarse) sand; 15% subrounded to rounded gravel; saturated	Heaving sands in auger
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE2
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
												Bedrock HP sampler screened 68-69 ft bgs
										WBr	(BEDROCK) SANDSTONE; yellow (10YR 7/6); 90% fine,10% medium angular sand; crumbles easily; slightly moist to moist; no HCl reaction	
										WBr		Hard drilling
70											SHALE; dark grayish brown; 70% clay; 30% fine sand; highly weathered feldspar; tight; dry	GW sample LE566 collected at 0803

Site 1\MCAS El Toro Phase II\36097

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE3	
Borehole Location: Site 1	*Northing:* 2191652.56	*Easting:* 6121507.05	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Paul Almanez		
Drilling Equipment: CME 85	Date Started: 1/26/2005	Total Depth (feet): 95.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 4	Date Finished: 1/26/2005	Depth to Bedrock (feet): 91.0
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 40.00	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 533.05	
		Logged By: R. Lopez	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
					1100					CL	CLAY; brown (10YR 5/3); plastic; soft; moist; no odor	Hand auger to 5 ft bgs
										CLS	SANDY CLAY; very dark grayish brown (10YR 3/2); 65% clay; 35% fine to medium, angular to subangular sand; slightly moist to moist; no odor	
5				90	1110					CL	CLAY; color grading from very dark brown (10YR 2/2) to dark grayish brown (10YR 4/2) to black (10YR 2/1); plastic; vertical voids (root size)	
											Trace laminated silt with clay	
10				100	1114						Highly organic	
											CLAY; brown (01YR 4/3); 5% fine sand; plastic; soft; moist; trace roots and vertical voids as above	
15				70	1120					CLS	CLAY grading into SANDY CLAY; brown (10YR 4/3); upper: plastic; abundant vertical voids as above; trace sand; bottom: 30% fine sand; nonplastic	
										SW	Well graded SAND; very pale brown (10YR 7/3); fine to medium sand; grading to coarse sand with trace angular to subangular gravel toward bottom; loose; slightly moist	
										CLS	SANDY CLAY; brown (10YR 4/3); 30% fine to medium sand; trace rounded gravel; moist; slightly plastic	
20				100	127					ML	CLAYEY SILT with sand; brown (10YR 5/3); some vertical, root sized voids; increasing fine to medium sand with depth	
										ML	SILT; brown (10YR 5/3); soft; massive; slightly moist	
25				80	1141							
										SP	Poorly graded SAND; light brownish gray; very clean sand; loose; slightly moist	
										ML	SILT; pale brown (10YR 6/30; soft; slightly moist;	
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE3
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				50	1151					CL	no odor CLAY; brown (10YR 4/3); trace coarse sand; soft to firm; plastic	Soil sample LE553 collected at 1310 at a depth of 30 ft bgs
										SP-SM	Fine SAND with silt; pale brown (10YR 6/3); fine to medium, angular to subangular sand; 5-10% silt; loose; slightly moist; no odor	
										CL	CLAY; brown (10YR 5/3 to 4/3); increase in fine to medium sand, coarse sand increasing with depth; soft; plastic; slightly moist	
35				50	1200							
												Alluvium HP sampler screened 38-42 ft bgs GW sample LE551 collected at 1300 Duplicate sample LE552 collected at 1305
40				60	1212					CL-SC	CLAY with interbedded SANDY CLAY/SAND; brown (10YR 4/3); 90% clay; plastic; soft; 10% interbedded sand, well graded, medium to coarse sand; trace rounded gravel; saturated	
45				70	1315					CL	CLAY; brown (10YR 5/3); soft; plastic; faint laminations with stringers of sand (<5%); saturated	Rinsate sample LE554 collected at 1320
50				100	1327					CL-SW	CLAY with interbedded well graded SAND; brown (10YR 5/3); clay - soft; plastic; well graded - coarse, angular to subangular sand; trace gravel; schist rock fragment; saturated	
55				55	1337							
										SW-SC	Well graded SAND with interbedded CLAY; pale brown (10YR 6/3); fine to coarse (mostly coarse), angular to subrounded sand; 2% gravel; 30% clay; saturated	
60				60	1430					SW	Well graded SAND; pale brown (10YR 6/3); angular to subrounded sand; 3% subrounded to rounded gravel; saturated	Add water - 10 gallons Heaving sand
65												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE3
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
				60	1450					SC	CLAYEY SAND; yellowish brown to brown; 70% fine sand; 30% clay; saturated	Add water - 6 gallons
70				60	1500					SW	Well graded SAND; fine to coarse (mostly medium), angular to subangular sand; loose; saturated	
75				50	1517					SW	Well graded SAND; coarse subangular to subrounded sand; moslty quartz; saturated	Stop drilling for the day 1-27-05
80				50	1700					SW	Well graded SAND as above	Resume drilling with wooden plug until refusal 1-28-05 Will try to collect sample if in bedrock
85											No sample collected	
90					0900						No sample collected BEDROCK contact inferred by drilling rate/penetration at 91 ft bgs	No sample, knock out plug
95												

EARTH TECH

Borehole Log

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE4	
Borehole Location: Site 1	*Northing:* 2191592.93	*Easting:* 6121679.47	Sheet *1* of *3*
Drilling Agency: Water Development Corp.	Driller: Gary Whitley		
Drilling Equipment: CME 85	Date Started: 1/26/2005	Total Depth (feet): 66.0	
Drilling Method: Hollow Stem Auger	Number of Samples:	Date Finished: 1/26/2005	Depth to Bedrock (feet): 63.5
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water (feet): *Drilling:* 43.50	*Static:*
Completion Information: Cement bentonite grout to surface		Elevation (feet MSL): 534.11	
		Logged By: V. Diep	Checked By: R. Lopez (RG)

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
				50	1014					SM	SILTY SAND; brown (7.5YR 5/3); 90% very fien sand; 10% silt; trace coarse sand; roots at surface; loose; faintly moist	Hand auger to 5 ft bgs
				60	1021					SM-SC	SILTY CLAYEY SAND; strong brown (7.5YR 4/6); 60% very fine sand; trace coarse sand; 20% silt; 20% clay; slight moist	
5										CLS	SANDY CLAY; strong brown (7.5YR 4/6); 60% clay; 40% fine sand; nonplastic; moderate density; slightly moist	
										SC	CLAYEY SAND; 60% very fine sand; 40% clay; nonplastic; faintly moist; white veins	
				60	1032					SP	Poorly graded SAND; strong brown (10YR 5/6); 95% very fine sand; trace medium and coarse sand (<1%); trace clay; loose; dry	
10										SC	Grading to CLAYEY SAND; 70% fine to medium sand; 30% clay; moderate density; slightly hard; slightly moist	
				50	1041						CLAYEY SAND as above; yellowish brown (01YR 5/4) 85% fine to medium sand; 15% clay; loose; faintly moist; no odor	
15										SWG	GRAVELLY SAND; fine to coarse sand; subangular to subrounded gravel; trace cobbles; loose	
				30	1047					SW	Well graded SAND; little to no fines	
20										SWG	GRAVELLY SAND; medium to coarse sand; 30% gravel; trace subangular to subrounded pebbles and cobbles	
										SP	100% fine SAND; light yellowish brown (10YR 6/4)	
				45	1053					SW	Well graded SAND; fine to coarse, clean sand; loose; very moist	
25										SP	Poorly graded SAND; 98% fine sand; 2% clay; loose; moist	
										SW	Well graded SAND; fine to coarse sand; trace usbrounded pebbles; trace gravel; loose	
				35	1102							Soil sample LE555 collected at 1500 at a depth of 28 ft bgs
30												

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE4
Borehole Location: Site 1		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SP	Poorly graded SAND; light yellowish brown (10YR 6/4); fine sand; trace clay; loose; faintly moist Grading to 0% clay; dry	
				35	1108					SW	Well graded SAND; very pale brown (10YR 7/3); fine to coarse sand; loose; faintly moist	
35				30	1113					SW	Well graded SAND; brown (7.5YR 5/4); fine to coarse; trace angular to subangular gravel; loose; very moist to wet; no odor	
40				25	1221					SW	Well graded SAND; pale brown (10YR 6/3); fine to coarse sand; trace gravel; trace subangular pebbles; wet	Alluvium HP sampler screened 43.5-47.5 ft bgs GW sample LE549 collected collected at 1150 Duplicate sample LE550 collected at 1159 DTW 39.25 after sampling
45										SW	Well graded SAND; light yellowish brown (10YR 6/4); fine to coarse subangular to subrounded sand	Heaving sands; poor recovery
50										SW	Well graded SAND as above	
55										SC	Grading to CLAYEY SAND; light olive brown (2.5Y 5/3); 70% very fine sand; 30% clay; nonplastic; moderate density; very moist	
					1311					SP	Poorly graded SAND; 100% fine sand	
60										SW	Well graded SAND; trace subrounded pebbles	Tough drilling
65										WBr	(BEDROCK) CONGLOMERATIC SANDSTONE; olive yellow (2.5Y 6/6); fine grained sandstone;	

EARTH TECH

Borehole Log
(Continuation Sheet)

Project Name: MCAS El Toro Phase II	Project Number: 36097	Borehole Number: 01-HPE4
Borehole Location: Site 1		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
											subangular to subrounded cobbles and pebbles	
												Auger refusal at 66'; no HP sample collected

Appendix C
Munitions and Explosives of Concern Range Evaluation

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ACRONYMS AND ABBREVIATIONS

BCT	BRAC Cleanup Team
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CRWQCB	California Regional Water Quality Control Board, Santa Ana Region
CSP	California State Plane
CSS	coastal sage scrub
CTO	contract task order
DOD	Department of Defense
DON	Department of the Navy
DTSC	Department of Toxic Substances Control
EM	electromagnetic
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FFA	Federal Facilities Agreement
GIS	Geographic Information System
GPS	global positioning system
IRP	Installation Restoration Program
JEG	Jacobs Engineering Group
MCAS	Marine Corps Air Station
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
mm	millimeter
mV	milliVolt
NEESA	Naval Energy and Environmental Support Activity
PACNAVFACENGCOM	Pacific Division, Naval Facilities Engineering Command
PDOP	position degradation of precision
RI	remedial investigation
R3M	Range Rule Risk Methodology
RTK	real-time kinematic
SWDIV	Southwest Division, Naval Facilities Engineering Command
U.S.	United States
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

1. INTRODUCTION

This technical memorandum documents field investigation activities and presents the results of the munitions and explosives of concern (MEC) risk assessment conducted in support of the MEC range evaluation at Installation Restoration Program (IRP) Site 1, Explosive Ordnance Disposal (EOD) Training Range, Former Marine Corps Air Station (MCAS), El Toro, California (Figure 1-1). The scope of this investigation was to evaluate the explosives safety risk at Site 1 (due to remnant MEC items originating from past EOD training) by characterizing the types of MEC and the location and depth of MEC at the site. Using data collected during the MEC field investigation, the explosives safety risk was assessed using procedures consistent with the Department of Defense's *Range Rule Risk Methodology (R3M) Interim Procedures Manual* (DOD 2000).

This technical memorandum was prepared for the United States (U.S.) Department of the Navy (DON), Southwest Division, Naval Facilities Engineering Command (SWDIV), as authorized by the Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) under contract task order (CTO) no. 0072 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract no. N62742-94-D-0048.

The work conducted in support of the MEC range evaluation complies with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan in Title 40 of the Code of Federal Regulations, Part 300, and Section 6.8 of the California Health and Safety Code.

As described in the project Work Plan (Earth Tech 2001a), this technical memorandum has been developed consistent with the methodology described in the R3M (DOD 2000). The R3M is a process to effectively manage risks posed by MEC and other constituents often found on former military ranges. The R3M process consists of seven steps: (1) range identification, (2) range assessment, (3) range evaluation, (4) response selection, (5) site-specific action, (6) recurring review, and (7) closeout.

A range identification and preliminary range assessment was conducted by the U.S. Army Corps of Engineers (USACE) for Former MCAS El Toro, including Site 1 (USACE 1998). This technical memorandum has been prepared to document a more detailed evaluation of the explosives hazards (R3M Step 3, range evaluation) identified in the range identification and preliminary range assessment (USACE 1998) and available records for Site 1.

Prior to publication of the *Final Work Plan* (Earth Tech 2001a), the *Draft Final Work Plan* (Earth Tech 2001b) was made available for public review and comment between November 3 and December 3, 2001. No comments were received.

1.1 SITE DESCRIPTION AND BACKGROUND OF FORMER MCAS EL TORO

Former MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). Former MCAS El Toro covers approximately 4,740 acres. Land use around Former MCAS El Toro includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the Base Realignment and Closure (BRAC) Act.

Initial work conducted by the DON at Former MCAS El Toro included an Initial Assessment Study during 1985 (NEESA 1986).

MCAS El Toro was added to the National Priorities List of the Superfund Program on 15 February 1990 due to contamination by volatile organic compounds at the MCAS boundary and in the agricultural wells west of the MCAS. A Federal Facilities Agreement (FFA) was signed by the Marine Corps/DON in October 1990 with the Region 9 of the Environmental Protection Agency (EPA), California Department of Health Services (part of which is currently the Department of Toxic Substances Control [DTSC]), and the California Regional Water Quality Control Board, Santa Ana Region (CRWQCB).

In March 1993, MCAS El Toro was placed on the list of military facilities scheduled for closure under the BRAC Act. A BRAC Cleanup Team (BCT) comprised of representatives from SWDIV, EPA, DTSC, and CRWQCB was formed to oversee implementation of the FFA.

Implementation of the FFA at MCAS El Toro included the following investigations and studies: Air Quality Solid Waste Assessment Test, Phase I remedial investigation (RI), Phase II RI, and a feasibility study. Groundwater sampling is conducted station-wide on a routine basis by the Navy.

1.2 Site 1 Location

Site 1 is located in the northeast region of Former MCAS El Toro in the foothills of the Santa Ana Mountains. Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above mean sea level (Figure 1-2). Site 1 includes the Northern EOD Training Range (16.9 acres), the Southern EOD Training Range (16.6 acres), and an approximately 40.1-acre Buffer Zone, for a total of 73.7 acres (BNI 1995).

A bermed retention pond is present in the northern portion of the site. Seasonal accumulations of rainwater have been observed in the retention pond during high precipitation events. The site has been characterized by fairly rapid groundwater recharge in response to storm events (JEG 1993).

1.3 EOD Activities at Site 1

Training for EOD and demolition of munitions has been conducted at Site 1 since 1952 (BNI 1995). Use of the EOD Training Range has been discontinued with the closure of MCAS El Toro on 2 July 1999.

The majority of recent military EOD training took place at the Northern EOD Training Range, and EOD training by the Orange County Sheriff Department and federal law enforcement agencies took place at the Southern EOD Training Range (BNI 1995). Several demolition pits, a range building, and a former observation bunker constructed from metal ammunition cans were reported to be present. Many of these metal cans were reported to be filled with the burned residue of used munitions, such as cartridge-actuated devices and 20 millimeter (mm) ammunition (USACE 1998).

Military ordnance formerly used at the site includes hand grenades, land mines, projectiles, cluster bombs, smoke bombs, and rocket warheads. Civilian and commercial explosives, such as dynamite and plastic and gelatinous explosives, have been used at the EOD Training Range. Munitions were often detonated in trenches and pits, which were continually filled with soil and then re-excavated. In 1982, approximately 2,000 gallons of sulfur trioxide chlorosulfonic acid (FS smoke) were reportedly burned in trenches located in the northern portion of the site. An estimated 300,000 gallons of petroleum fuels were burned during disposal from 1952 through 1993 (JEG 1993). Perchlorate was identified as a potential contaminant of concern at Site 1, due to its use in explosives and propellants.

In addition, there are unconfirmed reports that low-level radioactive material was disposed of at the site (NEESA 1986).

M60050_003916
MCAS EL TORO
SSIC NO. 5090.3.A

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURE 1-1 – PROJECT LOCATION MAP

FOR ADDITIONAL INFORMATION, CONTACT:

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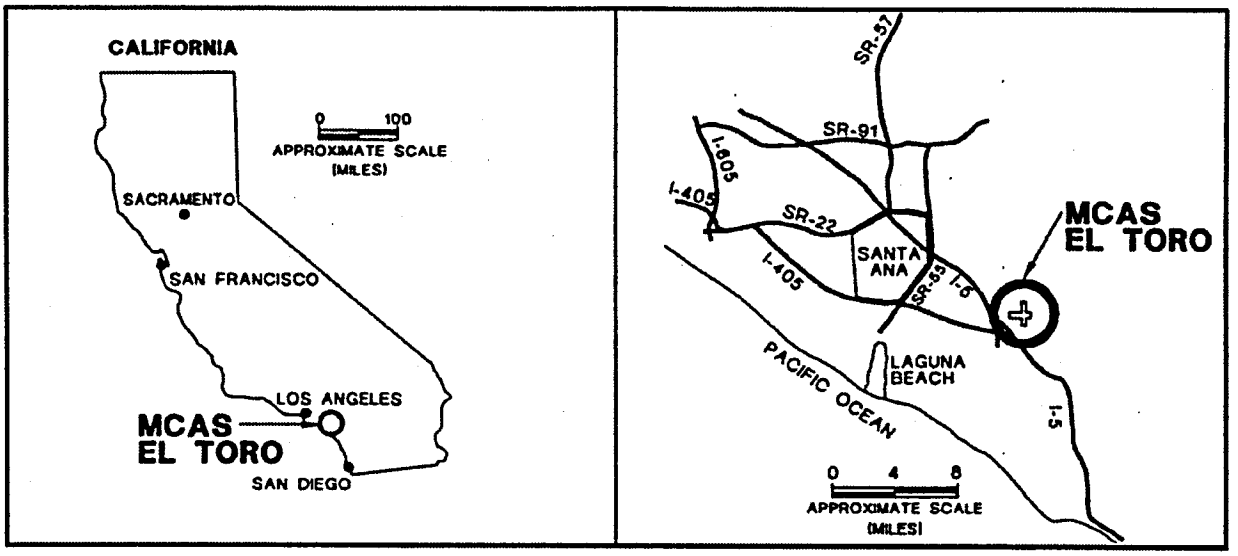

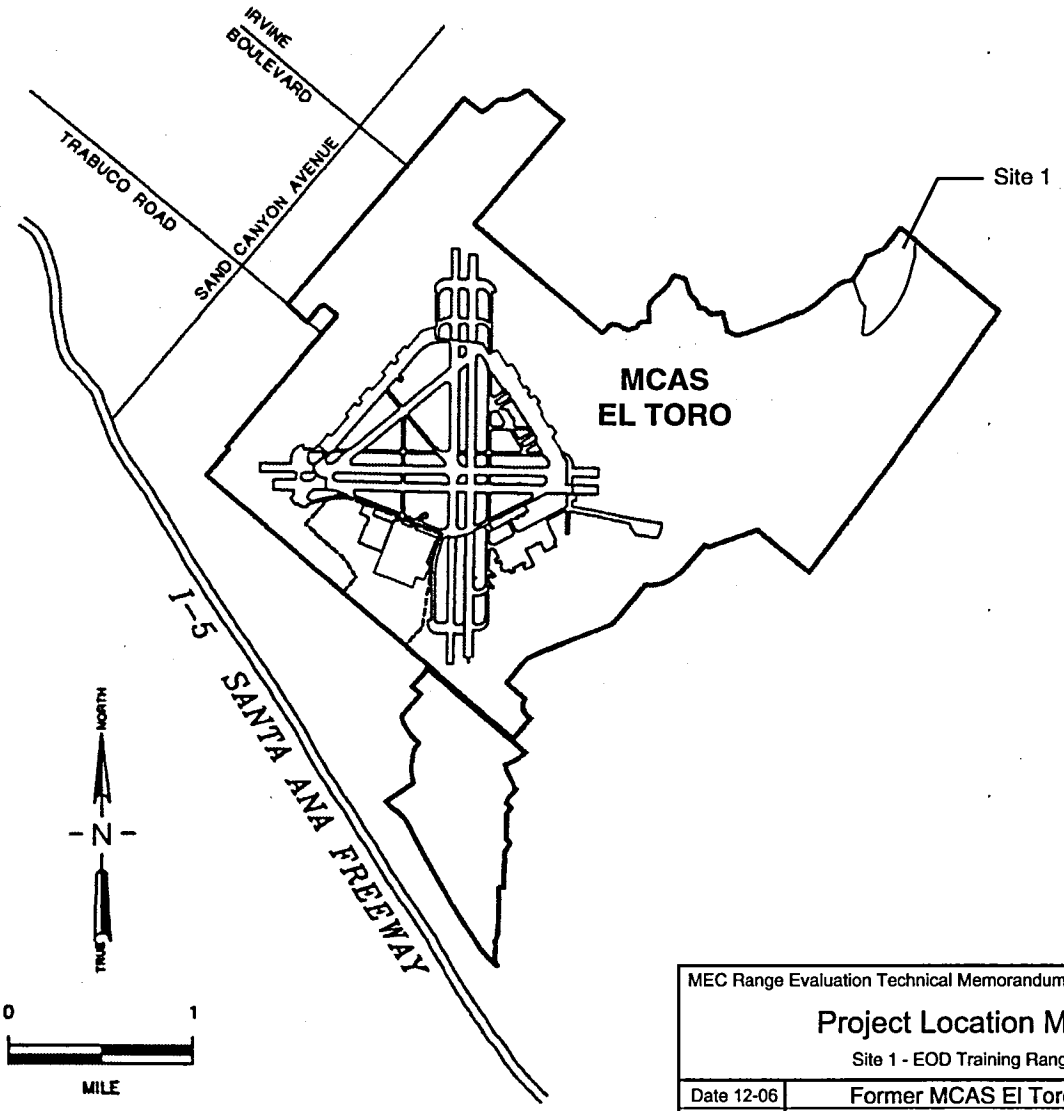

MEC Range Evaluation Technical Memorandum		Final
Project Location Map Site 1 - EOD Training Range		
Date 12-06	Former MCAS El Toro	Figure 1-1
Project No. 36097		

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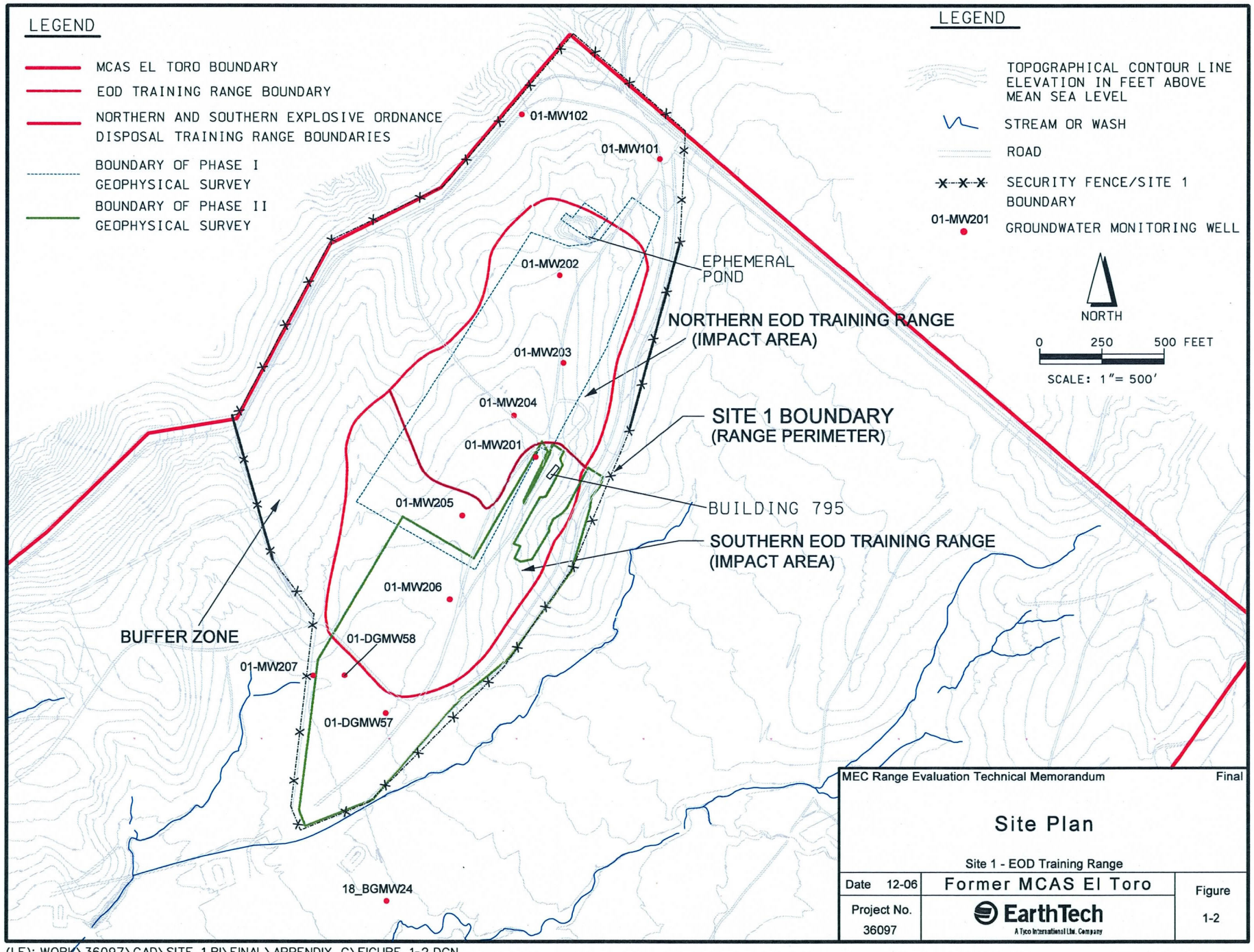

MEC Range Evaluation Technical Memorandum — Final

Site Plan

Site 1 - EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	1-2

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\APPENDIX C\FIGURE 1-2.DGN

PAGE NO. 1-6

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1.4 OTHER TRAINING ACTIVITIES AT SITE 1

For many years, the Federal Bureau of Investigation (FBI), in conjunction with the Orange County Sheriff's Department, has used Site 1 for training purposes (FBI 2000). The following paragraphs summarize the FBI's training and emergency response operations.

Bomb Technician Training. Bomb technician training consisted of "hands on" explosive training. Bomb technicians demonstrated proficiency in firing both an electrical and nonelectrical charge. This training also included testing of new explosive products to determine their applicability to EOD operations. Generally, this involved only a few ounces of the material, and demolition was initiated off the ground on a hard target surface.

Post-Blast Investigation Training. Post-blast investigation training emphasized the identification, location, access, and recovery of explosive devices and any products surviving demolition. Various devices were detonated, and students secured and located, collected, and identified the fragmentation and components from the devices for the purpose of reconstructing the devices.

Emergency Response Operations. The EOD Training Range at Site 1 served as a technical training area for the use and study of emergency explosive device responses. However, during emergency response operations, the FBI periodically transported improvised explosive devices to Site 1 and rendered them safe either by disassembly or by counter-charges. These types of operations occurred intermittently, when devices were located by the FBI or by local law enforcement.

1.5 PROPERTY TRANSFER AND PROPOSED REUSE

Currently, Site 1 is in the process of being transferred to the Federal Aviation Administration (FAA). Upon transfer, the FAA plans to allow the FBI to use the property for purposes similar in nature to the past use for EOD training. To accommodate immediate use of a portion of the property, the DON is planning to allow access and use of an approximately 3.3-acre area in the southern portion of the site by the FAA prior to the completion of the CERCLA process for the entire site. This area will be made available to the FAA immediately following transfer. However, access to the remaining portion of the property will be restricted until the completion of the CERCLA process (Earth Tech 2001d).

In order to complete the CERCLA process, the DON is currently conducting an RI at Site 1, which includes site characterization and establishment baseline risk to human health and the environment. After completion of the CERCLA process, the FAA will be allowed to use the entire site, subject to any restrictions that DON finds necessary to protect human health and the environment.

1.6 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of this investigation was to characterize explosives safety risk at Site 1 due to remnant MEC items originating from past EOD training so that response actions consistent with the anticipated reuse can be evaluated (Earth Tech 2001a). The scope of this investigation was to conduct a site characterization for MEC items to complete the evaluation of the training range (step 3 of the R3M process).

2. FIELD INVESTIGATION ACTIVITIES

Field investigation activities in support of the MEC range evaluation at Site 1 were initiated in January 2002 and concluded in April 2002. Four areas were investigated: Northern EOD TrainingRange, Southern EOD Training Range, Buffer Zone, and Range Perimeter. For each of the four areas, a surface survey was conducted, the area was geophysically surveyed, and then subsurface MEC sampling was conducted. Photographs from the field investigation are included in Attachment A. The following paragraphs detail the investigation design and the field activities conducted in the four areas.

2.1 INVESTIGATION DESIGN

The percentage of each area to be investigated was calculated using the UXO [unexploded ordnance] Calculator, a statistical sampling tool developed by the U.S. Army Engineering and Support Center, Huntsville. The UXO Calculator uses test densities to determine total acreage to be investigated. A test density of 0.1 MEC per acre would be used where 20 or more people could reasonably use or pass through the area each day. Where public usage of the land is less than 20 per day, a 0.5 MEC per acre test density would be used. The resulting calculations provided the minimum number of acres to be investigated in each area. For all areas at Site 1, a test density of 0.5 MEC per acre was used. Using the UXO Calculator, the following areas were selected for investigation (total area designated for sampling is shown in parenthesis): (1) Northern EOD Training Range – 16.9 acres (4.1 acres); (2) Southern EOD Training Range – 16.6 acres (4.1 acres); and (3) Buffer Zone – 40.1 acres (4.4 acres). For the geophysical survey along the Range Perimeter 100 percent of the perimeter length was selected for investigation to evaluate kick-outs. Figure 2-1 presents the investigation approach.

2.1.1 Northern and Southern EOD Training Ranges

The Northern and Southern EOD Training Ranges were characterized by previous geophysical surveys (Earth Tech 2001e) that covered a majority (greater than 85 percent) of the area and identified numerous subsurface anomalies (see Figure 2-1). Each training range was divided into 1-acre grids (fixed-pattern grid sampling). Typically, the grids would be randomly selected; however, for purposes of this investigation, the grids with the highest densities of anomalies were selected to obtain a worst-case estimate of the extent of buried MEC items. Within the Northern and Southern EOD Training Ranges, nine grids (which are indicative of trenches or pits where detonation of munitions was likely conducted) were selected to represent these areas to meet the required 4.1 acres of sampling in each of the two EOD Training Ranges, as determined by the UXO Calculator. Subsurface MEC sampling included the investigation (using transient or time-domain electromagnetic instrumentation) of anomalous areas (i.e., pothole locations) over 50 milliVolts (mV) within the nine grids to define the actual boundaries of the former disposal pits and trenches.

2.1.2 Buffer Zone

The area immediately surrounding the impact area (Northern and Southern EOD Training Ranges) served as the buffer zone (area around the range) for past EOD training activities. Previous geophysical surveys, as presented in the Work Plan (Earth Tech 2001a), encompassed the south region of the Buffer Zone and the strip of land between the Southern EOD Training Range and the site boundary to the east. The Buffer Zone was characterized by establishing transects, which are essentially very narrow, fixed-pattern grids (see Figure 2-1), for purposes of evaluating the lateral extent of kick-outs. The transects were approximately 25 feet wide and originated from a central area of the Northern EOD Training Range, radiating outward toward the site boundary in all directions, at 15-degree intervals (where feasible). However, only geophysical anomalies within the transect segments from the boundary of the Northern and Southern EOD Training Ranges to the Range Perimeter boundary were investigated, in accordance with the sampling design outlined in the Work Plan (Earth Tech 2001a). The transects were geophysically

mapped and investigated to meet the required 4.4 acres of sampling, as determined by the UXO Calculator. Representative surface clearance surveys were conducted prior to geophysical mapping to evaluate kick-outs.

2.1.3 Range Perimeter

The security fence enclosing Site 1 served as the boundary and is the Range Perimeter. Representative surface clearance surveys, followed by geophysical surveys (and subsequent subsurface soil sampling of anomalies), where required, were conducted to evaluate kick-outs, in accordance with the sampling design outlined in the Work Plan (Earth Tech 2001a).

2.2 LOCATION SURVEY

Anomaly reacquisition and surveying were conducted during the field investigation using a real-time kinematic (RTK) global positioning system (GPS). The benchmarks used were classified as Class I, Third Order. Horizontal control was based on the English system and referenced to the NAD83 and Zone 6 of the California State Plane (CSP) Grid Coordinate System. Horizontal accuracy of the roving units was plus or minus 1 foot.

The purpose of surveying was to locate and install semi-permanent markers to record the locations of the following:

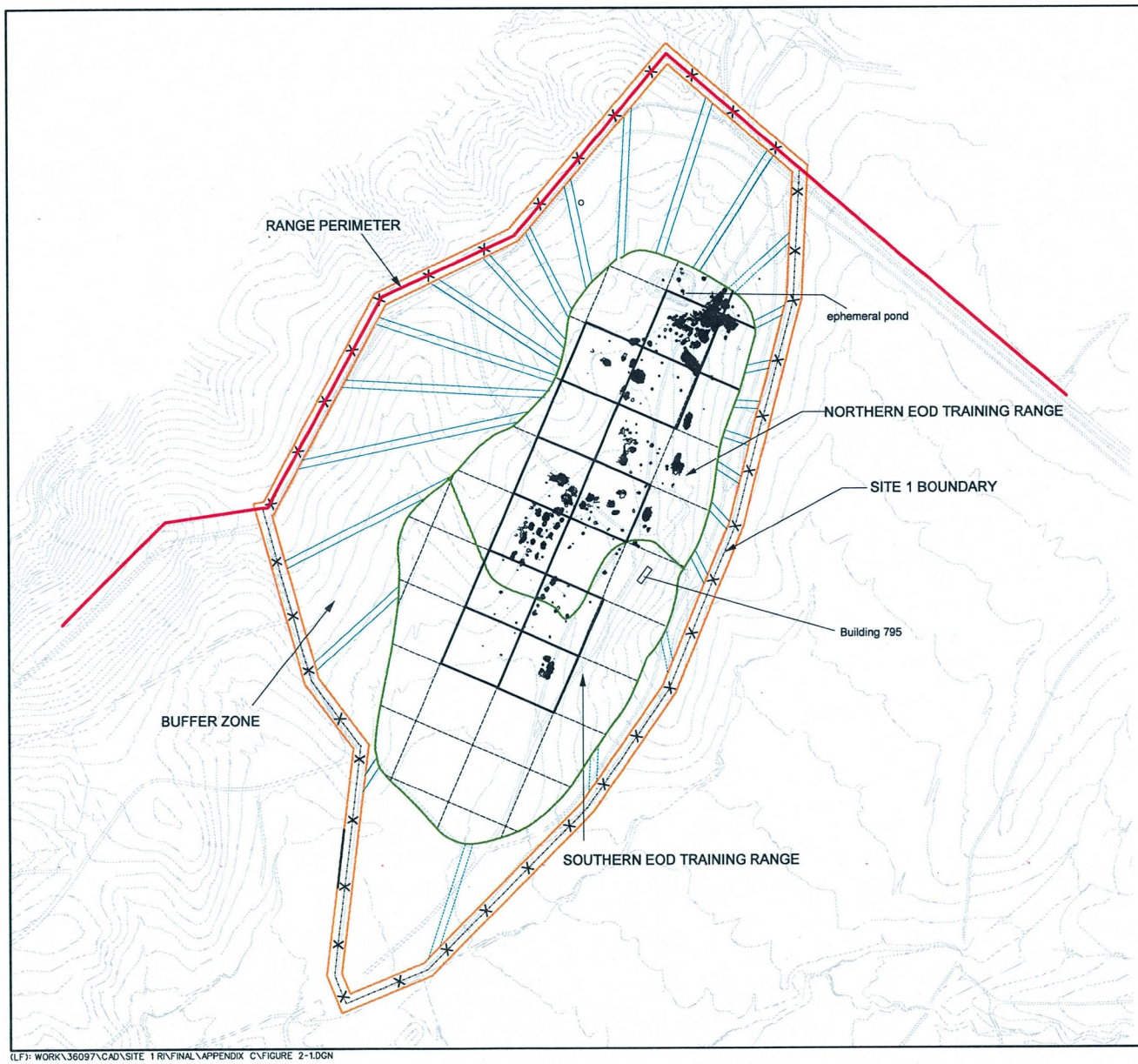
- Northern and Southern EOD Training Range boundaries
- Pothole locations selected for intrusive investigation in the Northern and Southern EOD Training Ranges
- 25-foot–wide radial lanes within the Buffer Zone
- A 50-foot–wide path on the inside of the Range Perimeter
- Geophysical anomalies selected for intrusive investigation
- All MEC and munitions debris (MD) recovered during the field investigation
- Locations of soil samples collected to evaluate the potential for chemical contamination caused by MEC at the site.

All surveyed areas except MD were marked with 2-inch by 36-inch wood laths painted with biologically safe, fluorescent orange paint to provide easy visual location. Locations of MD were marked with pin flags. All locations were downloaded and plotted into the project Geographic Information System (GIS).

2.3 GEOPHYSICAL DATA COLLECTION METHODOLOGY

Geophysical data were collected using two Geonics, Ltd., EM61 Mk2 High Sensitivity Metal Detectors (EM61s). Both electronically captured and real-time data were acquired with these systems. The EM61 is a transient electromagnetic (EM) conductivity system; the Mk2 variant allows collection of up to four "windows" of data. A fact sheet for the EM61 is attached as Attachment B. Transient EM systems record the amplitude of secondary, induced signals as a voltage at discrete times after the signal is generated. Signal amplitude is proportional to the conductivity of the material(s) in which the secondary current is induced. Highly conductive objects (metal) retain the induced signal longer than poorly conductive material(s) (soil). The time intervals recorded by the EM61 capture the persisting signal in conductive media, while missing the early, fast-decaying signals from soil.

Discrimination of responses caused by conductive objects buried in soil is accomplished by identification of discrete peaks (anomalies) above the background response. Background response levels derive



LEGEND

- PREVIOUSLY IDENTIFIED GEOPHYSICAL ANOMALY
- MCAS EL TORO BOUNDARY
- SECURITY FENCE/SITE 1 BOUNDARY
- EOD TRAINING RANGE BOUNDARY
- 25' WIDE GEOPHYSICAL SURVEY RADIAL LANES (SHOWN DASHED IN AREAS COVERED BY PREVIOUS GEOPHYSICAL SURVEYS)
- SURFACE AND GEOPHYSICAL SURVEY PATHS INSIDE AND OUTSIDE RANGE PERIMETER
- 1-ACRE GRID SELECTED FOR INTRUSIVE INVESTIGATION OF ALL ANOMALIES WITHIN GRID (ONLY GRIDS SHOWN WITH SOLID LINES REQUIRED TO BE INTRUSIVELY SAMPLED FOR MEC)
- MEC — MUNITIONS AND EXPLOSIVES OF CONCERN

NOTE: THE MEC INVESTIGATION APPROACH WAS PRESENTED IN THE FINAL OE RANGE EVALUATION WORK PLAN (EARTH TECH 2001A) AND APPROVED BY THE BASE REALIGNMENT AND CLOSURE (BRAC) CLEANUP TEAM (BCT) AFTER PUBLIC NOTIFICATION.

NORTH

0 — 350 FEET

SCALE: 1"= 350'

MEC Range Evaluation Technical Memorandum — Final

MEC Investigation Areas

Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	2-1

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\APPENDIX C\FIGURE 2-1.DGN

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primarily from the electrical properties of the near-surface soils. The conductivity of dirt is much lower than that of metal objects, and the wavelength of the background response is much longer than that of a finitely bounded object with dimensions close to, or smaller than, the dimensions of the EM61 receiver antennas. The short, spike-like character of metal-induced (e.g., MEC-caused) anomalies is readily distinguishable from the responses caused by most geologic sources.

2.3.1 Equipment Field Tests

Target detection is a function of object size and depth below ground surface (bgs). The minimum performance criteria for detection of representative debris and MD at the project site was 72 inches for mixed debris and MD in pits and 12 to 48 inches for individual MEC items. To demonstrate the detection capabilities of the EM61s, 15 MD items were buried along transects located in the southern portion of the training range. Items were buried to between 3 and 48 inches, depending on the size of the object. Additionally, approximately 50 pounds of MD and metal debris were buried in each of three pits. The pits ranged from 24 to 72 inches in depth.

The EM61s were then traversed over these buried targets. Figure 2-2 presents the results of test runs conducted over MD items and over simulated disposal pits. As can be seen on Figure 2-2, larger MEC items were readily identifiable, as were multiple items buried to 48 inches below ground surface (simulated disposal pits). The 72-inch deep multiple items were detected, but the response was approaching background levels. All of the 2.25-inch and larger MD items were detected. Of the smaller (20mm) MD items, only those buried at 6 inches or less were reliably detected. Anomalous responses to the 20mm items at 12 inches bgs were not likely to be detected without prior knowledge of their position. However, in a "kickout" scenario, 20mm or 37mm projectiles would not be found buried deeper than 3 to 6 inches unless buried by some subsequent activity. Accordingly, the equipment tests demonstrated that the EM61 Mk2 was capable of detecting buried pits or trenches, as well as scattered kickout items from a disposal operation.

2.3.2 Data Analysis and Anomaly Selection

Digital geophysical data were collected along three transects radiating from the Northern and Southern EOD Training Ranges and along a 30-foot–wide swath around the inside perimeter of Site 1 (Figure 2-3). Data were spatially referenced by synchronization between clocks in the GPS and geophysical data loggers. Some of these data were not recoverable due to a timing problem in the data logger's internal clock. Although some data were lost, sufficient coverage was obtained to detect and map anomaly locations both along the radial and perimeter survey transects.

The data were plotted on a grid and analyzed using commercially available software (Golden Software *SURFER* and GeoSoft *OASIS montaj*) to produce color images and isopleth plots of the geophysical response. The coverage of the data was defined by the GPS track. Geophysical data density was constrained by a 4-hertz (cycles per second) sampling rate and a 2.5-foot spacing between survey lanes. Survey speed was approximately 2 to 3 feet per second, resulting in a 0.5- to 0.8-foot data collection interval along the survey transects.

Figure 2-4 presents an example of the EM61 Mk2 geophysical investigation. The data are from a section of the perimeter survey along the northeast portion of the project area. Hot colors (red) in the image represent high conductivities (metal objects). These data, and all other surveyed area data, were collected at 2.5-foot line spacings and 0.5 to 0.8-foot intervals along each line. The figure shows a concentration of metallic objects in the southern portion of the section, with other objects scattered along the length of the presented data.

Anomalies of interest were selected from the data images by identifying "closed" contours or bright spots that had the discrete, bounded characteristics of responses caused by metal objects. Suspect anomalies were typically 5 to 10 feet wide (consequently, occurring on at least two different survey lanes) and had amplitudes ranging from 30 to 40 millivolts to several hundred millivolts. The coordinates of these anomalies were captured digitally and provided to the MEC investigation team for reacquisition (using GPS) and intrusive investigation.

Eighty-two discrete anomalies were identified for intrusive investigation through processing of geophysical data collected during the field investigation using the EM61. All anomalies greater than or equal to 50 mV were investigated unless there was clear evidence in the field notes that these were caused by cultural features (e.g., water lines, fences, or roadways). An ASCII-formatted tabulation of the anomalies was generated. The table included anomaly number, northing and easting (CSP grid coordinates measured in feet), anomaly amplitude, and other anomaly attributes (i.e., estimated depth). An additional 128 discrete anomalies were selected for investigation through real-time geophysical mapping using the EM61. Geophysical anomaly locations selected for intrusive investigation are shown on Figure 2-5.

2.3.3 Quality Control

To ensure collection and interpretation of usable, representative geophysical data, quality controls implemented with the survey design were checked each survey day. The following paragraphs detail the measures taken to ensure usable, representative geophysical data.

The position degradation of precision (PDOP) of the GPS was monitored to ensure both sufficient satellite availability and adequate distribution geometry. No data were collected with a PDOP greater than 6.

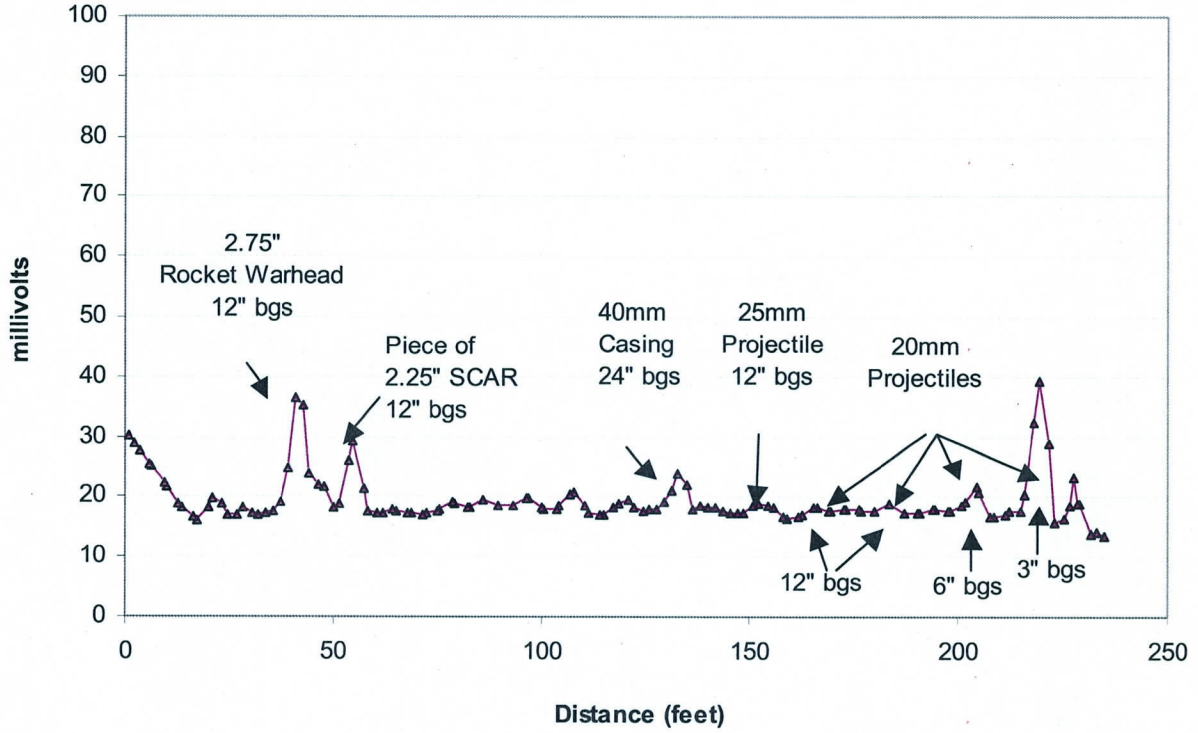
Before beginning each survey sortie and prior to switching the EM61s off after a sortie, a response to a standard target was recorded. The standardization responses were required to be within 10 percent of the calculated mean standard response developed for each instrument prior to beginning the field investigation. The positional accuracy of the spatially referenced data was ensured by checking the GPS position for a known location for each sortie. This was accomplished by verifying the coordinate position measured at the same location each day.

Lastly, as a verification step, the geophysical data was assessed by comparing the given anomaly amplitude and width with the amplitude and width of an example of the apparent discovered source. Whenever the reported source was not considered representative of the geophysical response, that anomaly was re-evaluated. This entailed returning to the anomaly location with the EM61 and determining if a metallic source could be confirmed as present. If an anomaly source was confirmed, the exploration was advanced further until a representative source was found. Where no metal source was confirmed with the EM61 re-survey, terrain and/or cultural sources in the vicinity of the anomaly were inspected to determine if an environmental source was present, such as a berm or depression. If no other sources for the anomaly were obvious, a record of "No Contact" was made.

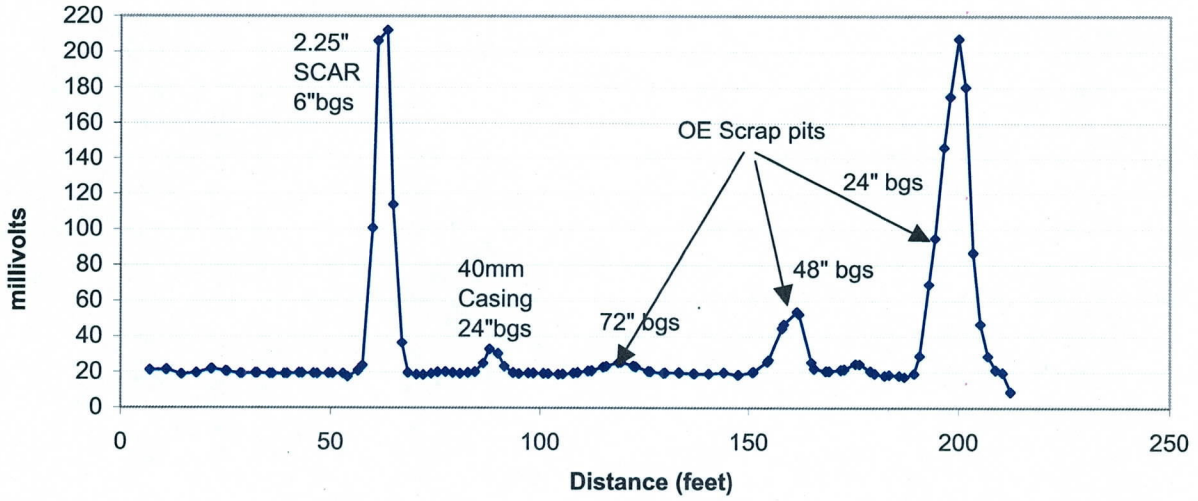
2.4 Surface Survey, Geophysical Survey, and Subsurface MEC Sampling

Surface clearance, geophysical mapping, and subsurface MEC sampling activities were conducted in accordance with the protocols outlined in the Work Plan (Earth Tech 2001a). Prior to geophysical mapping, a visual survey of the ground surface (i.e., surface clearance, or "survey") was conducted to locate and remove all MEC and MD, and metallic debris larger than 1 inch by 2 inches that would interfere with geophysical mapping and/or be a physical hazard to the field crew. Surface surveys were conducted on 100 percent of the surface area that could be accessed by survey line personnel (excluding

EM61 Mk2 Profile over Test Line OE Scrap



EM61 Mk2 Profile over Test Line Pits



MEC Range Evaluation Technical Memorandum		Final
Geophysical Test Line Profiles		
Site 1 – EOD Training Range		
Date 11-06	Former MCAS El Toro	Figure 2-2
Project No. 36097	EarthTech A Tyco International Ltd. Company	

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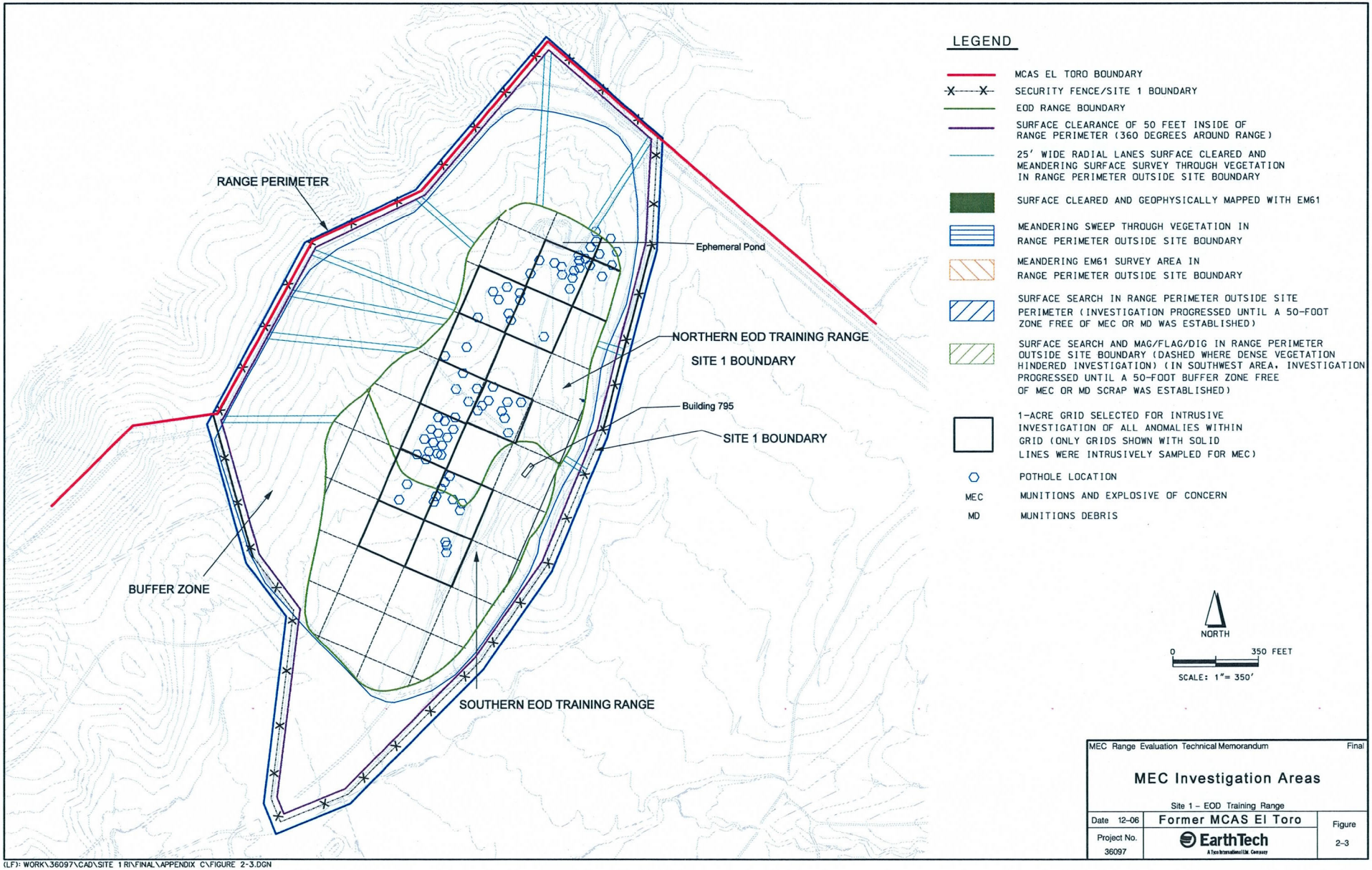

MEC Range Evaluation Technical Memorandum — Final

MEC Investigation Areas

Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	2-3

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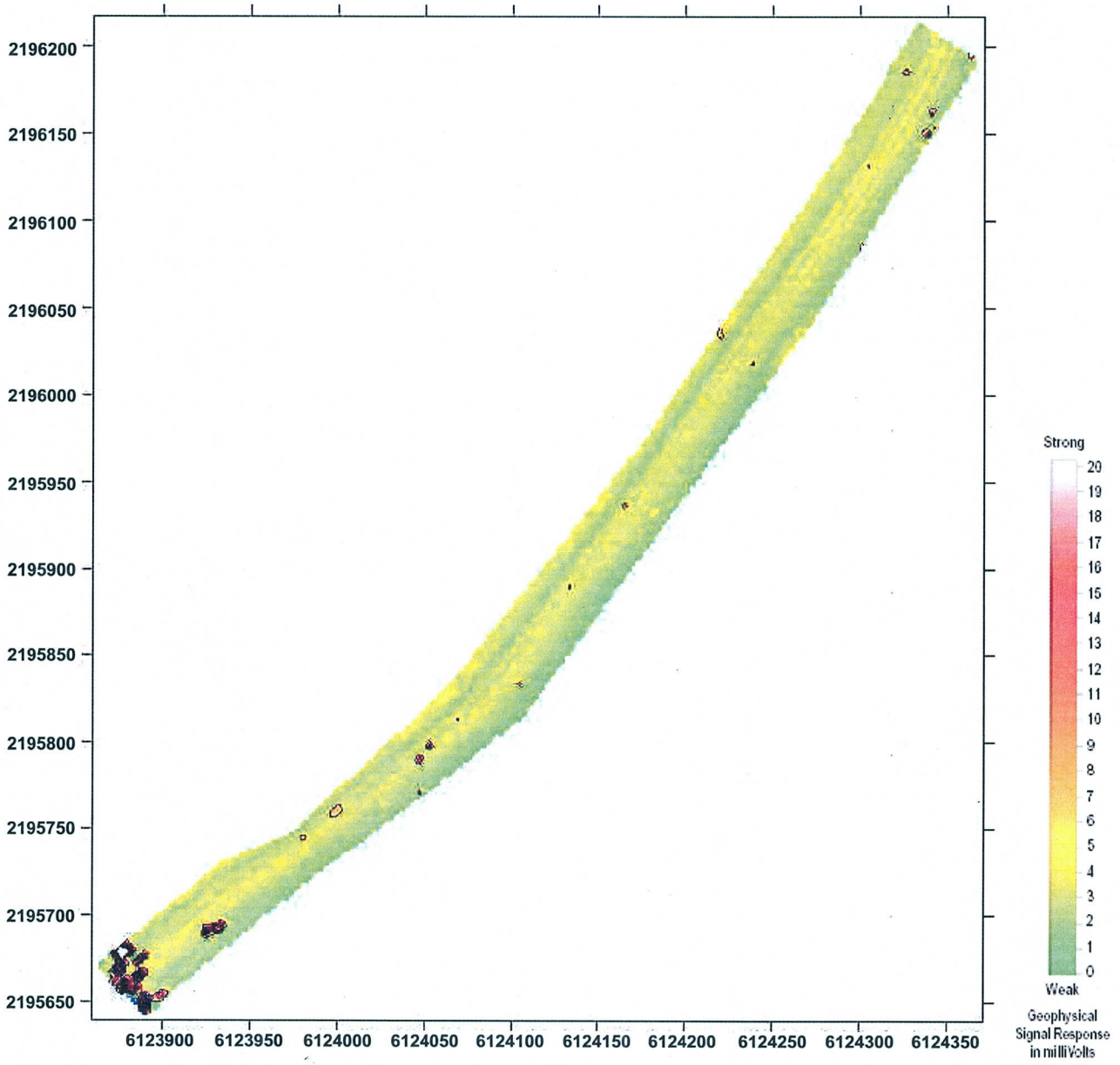

MEC Range Evaluation Technical Memorandum — Final

Sample Geophysical Data

Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure 2-4
Project No. 36097	EarthTech (A Tyco International Ltd. Company)	

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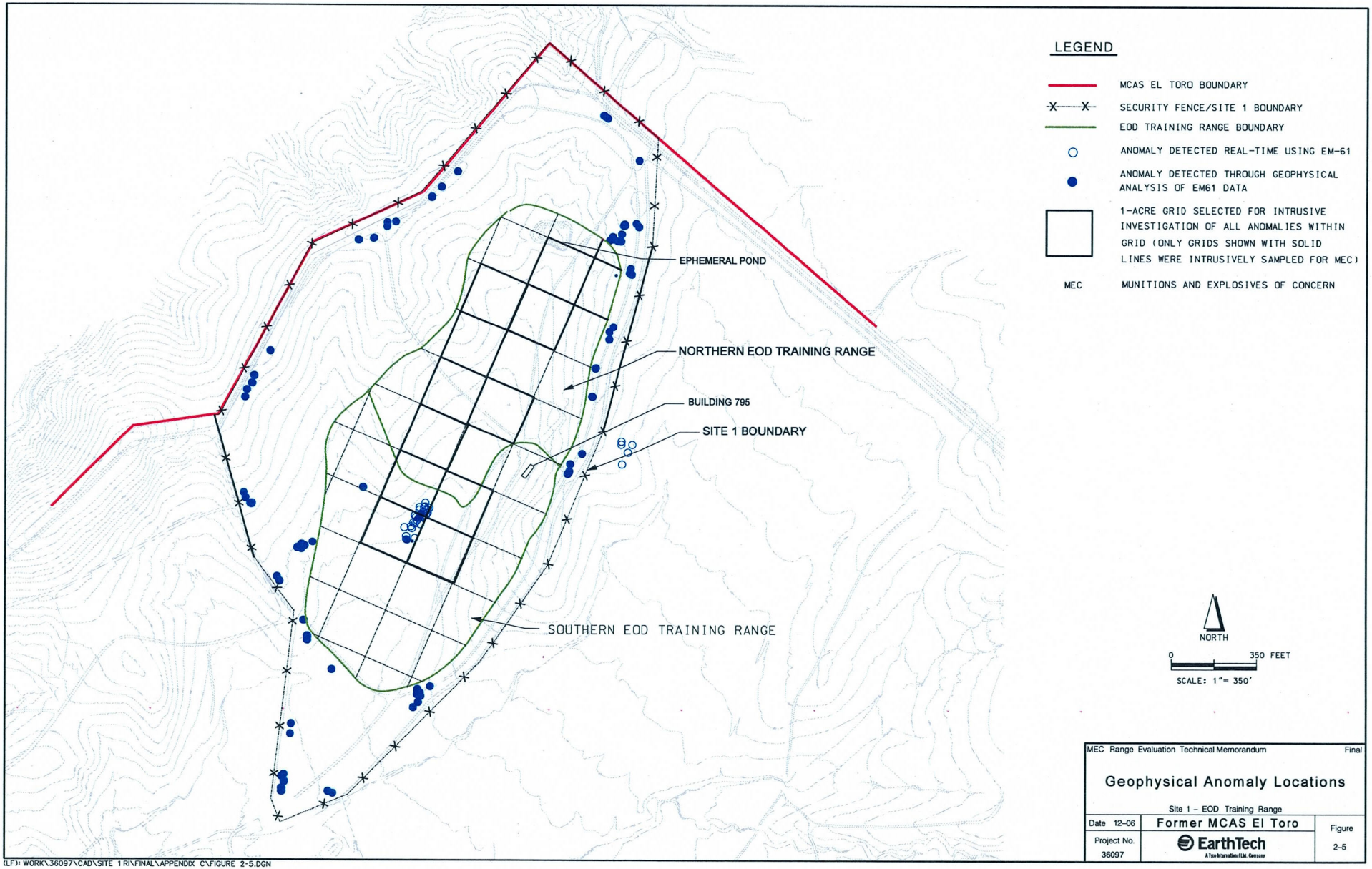

MEC Range Evaluation Technical Memorandum — Final

Geophysical Anomaly Locations

Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech	2-5

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\APPENDIX C\FIGURE 2-5.DGN

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areas with dense vegetation and steep terrain), within the designated investigation areas (Figure 2-3). Surface surveys included 25-foot–wide radial lanes within the Buffer Zone, a 50-foot–wide lane on the inside of the Range Perimeter, areas investigated on the outside of the Range Perimeter, geophysical anomaly locations detected during the field investigation, and pothole locations selected from geophysical data gathered during previous characterization activities within the Northern and Southern EOD Training Ranges. Additional geophysical surveys were performed in all four areas investigated, followed by intrusive investigation of anomalies. For each location intrusively investigated, type of item located, description of item, quantity, and depth bgs were recorded. Upon completion of subsurface sampling, all pothole locations (which investigated geophysical anomalies) were backfilled and graded to match existing contours.

2.4.1 Northern and Southern EOD Training Ranges

Geophysical Survey. As part of a perchlorate verification study that was conducted at Site 1 (Earth Tech 2001e), a geophysical survey was performed throughout the Northern and Southern EOD Training Ranges to locate buried debris (see Figure 2-1). Data from this investigation was used to identify 73 pothole locations (with readings greater than 50 mV) to be intrusively investigated (see Figure 2-3). It was also determined that several areas within the Northern and Southern EOD Training Ranges needed additional geophysical mapping during the investigation (see Figure 2-3). An additional 26 discrete anomalies were selected from geophysical data collected in real-time mode during the field investigation using the EM61. A total of 0.4 acres were geophysically mapped in the Northern and Southern EOD Training Ranges during this investigation, with 25.7 acres geophysically mapped during the previous investigation.

Surface Survey. A surface survey was conducted in accordance with the Work Plan (Earth Tech 2001a) at each pothole location to be intrusively sampled in order to identify and remove any near-surface contacts. In addition, a surface survey was conducted in the areas identified for additional geophysical mapping with the EM61 (see Figure 2-3).

Intrusive MEC Investigation. During the field investigation, subsurface MEC sampling was performed to investigate the 73 pothole locations identified during the previous characterization activities at Site 1. All pothole locations were investigated using the trenching/potholing method outlined in the Work Plan (Earth Tech 2001a), as they were all large pit areas and not singular anomaly sources. All pothole locations were excavated with a backhoe until the bottom of the anomaly source was located. During the excavation process, all located MEC and MD was logged and recorded using a GPS and marked with a pin flag.

2.4.2 Buffer Zone

Sampling within the Buffer Zone was intended to evaluate the potential for kick-outs originating from the Northern and Southern EOD Training Ranges.

Surface Survey. Surface surveys were initiated in the Buffer Zone within all of the 25-foot–wide radial lines radiating outward from a central location within the Northern EOD Training Range, in accordance with the Work Plan (Earth Tech 2001a) (see Figure 2-3) in order to identify and remove any near-surface contacts. As the surface survey progressed, it was determined that due to steep terrain and extremely dense vegetation (some of which was coastal sage scrub (CSS), a critical habitat for the California gnatcatcher), it would not be possible to geophysically map several of the radial lines with the EM61. In order to ensure that enough acreage was geophysically mapped (based on the UXO Calculator's estimation), additional areas were chosen that would be conducive to geophysical mapping using the EM61. In particular, a large portion of the site near the northern end of Site 1 and an additional strip on the eastern hillside between the site perimeter and the Northern and Southern EOD Training Ranges were

to be investigated (see Figure 2-3). A surface survey was conducted at those additional areas prior to geophysical mapping.

Geophysical Survey. A geophysical survey was performed within the Buffer Zone in several of the 25-foot–wide radial lines and additional areas. Two radials that extended from the Buffer Zone into the Northern and Southern EOD Training Ranges were used to characterize the Buffer Zone because they were considered to be representative of the Buffer Zone, rather than active EOD Training Range activities (see Figure 2-3). Eighty-two discrete anomalies were identified for intrusive investigation through processing of EM61 geophysical data. An additional 13 discrete anomalies were selected from EM61 geophysical data collected in real-time mode. A total of 3.2 acres were geophysically mapped in the Buffer Zone during this investigation.

Intrusive MEC Investigation. A total of 95 locations were intrusively investigated in the Buffer Zone. Three of the locations (near the northeast boundary of the Northern EOD Range) were investigated as potholes specifically to assess and characterize the lateral extent of MEC and MD recovered in pothole locations in the Northern EOD Training Range (see Figure 2-3). All pothole locations were investigated using the trenching/potholing method outlined in the Work Plan (Earth Tech 2001a). All pothole locations were excavated with a backhoe until the bottom of the anomaly source was located. The remaining 92 locations were investigated using hand tools (e.g., shovel) until the anomaly source was located. During the excavation process, all encountered MEC and MD was logged, and locations recorded using a GPS and marked with pin flag.

2.4.3 Range Perimeter

Sampling within the Range Perimeter was intended to evaluate the potential for kick-outs originating from the Northern and Southern EOD Training Ranges.

Surface Survey. A surface survey was conducted along the entire Range Perimeter, inside the boundary fence line, using a White Surfmaster Pro Pulse Induction hand-held all metals detector (Surfmaster) in order to identify and remove any near-surface contacts. The surface survey located MD along the northwestern and southwestern portions of Site 1. In accordance with the Work Plan (Earth Tech 2001a), it was determined that a surface survey would be conducted outside the boundary fence line, adjacent to the portions where the MD was located (see Figure 2-3). All locations with subsurface contacts were flagged and subsequently investigated intrusively. In a portion of this area, the vegetation prevented a full surface clearance, and only areas free of dense brush were surface-cleared (see Figure 2-3).

The surface survey also located MD along the eastern portion of the perimeter of Site 1. In accordance with the Work Plan (Earth Tech 2001a), it was determined that a surface survey would be conducted outside the boundary fence line, adjacent to the portion where the MD was located. MD was also located in this area. The surface survey proceeded adjacent to the fence line until no additional MD was located. The survey proceeded outward from the fence line until either no additional MD was found, or until it was unsafe to proceed due to topography (see Figure 2-3).

Geophysical Survey. Within the area of the Range Perimeter (inside the fence line), a 30-foot–wide path located 20 feet away from the perimeter fence was geophysically mapped (see Figure 2-3) using the EM61. A total of 6.5 acres were geophysically mapped along the inside perimeter of Site 1 during this investigation (see Figure 2-3).

In the east range perimeter, due to heavy vegetation and steep terrain, a Surfmaster was used to complete 97 percent of the geopysical investigation. The remaining 3 percent of this area was investigated in real-time mode using the EM61 in a meandering fashion. During this meandering survey, the EM61 was used only in the portion of the area not covered by brush. A total of 0.04 acre was geophysically mapped with the EM61 along the east range perimeter during this investigation (see Figure 2-3).

Intrusive MEC Investigation. Eighty-nine discrete geophysical anomalies, identified during the field investigation using a Surfmaster or an EM61 in real-time mode, were intrusively investigated in the Range Perimeter. The following subsections describe MEC investigation activities conducted in the Range Perimeter area of Site 1. Locations of Range Perimeter areas are shown on Figure 2-3.

Area 1: Inside Range Perimeter Fence Line. All anomaly locations identified within this area were investigated using hand tools. Each anomaly was excavated until the anomaly source was located. During the excavation process, all located MEC and MD was logged and recorded using a GPS and marked with a pin flag.

Area 2: Northwest Range Perimeter. Due to heavy vegetation in this area, a Surfmaster was used to detect and locate anomaly sources. All subsurface anomalies were flagged and investigated using hand tools. The lateral extent of MEC and MD could not be determined due to steep terrain that would not support sampling activities.

Area 3: Southwest Range Perimeter. Due to heavy vegetation in this area, a Surfmaster was used to detect and locate anomaly sources. All subsurface anomalies were flagged and investigated using hand tools. This area was investigated until a 50-foot buffer zone free of MEC and MD could be established around the outside perimeter.

Area 4: East Range Perimeter. The East Range Perimeter was the largest area investigated outside of the Range Perimeter. All significant anomaly sources detected in this area were investigated using hand tools until a 50-foot buffer zone free of MEC and MD could be established around the outside perimeter of this area.

3. NATURE AND EXTENT OF ORDNANCE AND EXPLOSIVES

3.1 DISTRIBUTION OF MEC AND MD

The following ordnance-related items were recovered during the MEC field investigation: 4 Safe-to-Move MEC items and 776 MD items (totaling approximately 5,000 pounds). No Unsafe-to-Move MEC was found during the field investigation. MEC was recovered in the Northern EOD Training Range, while MD was recovered in all four areas investigated. Photographs in Attachment A show various types of MEC and MD recovered during the MEC field investigation at Site 1. Tables in Attachment C provide a detailed summary (including description and depth) of all ordnance-related items recovered during the MEC field investigation. The total number of MEC and MD items recovered in each investigation area are provided in Table 3-1.

Table 3-1: Number of MEC and MD Recovered During MEC Field Investigation

Investigation Area	Total Acres	Acres Investigated	MEC	MD
Northern EOD Range	16.9	13	4[c]	409
Southern EOD Range	16.6	13.1	—	26
Buffer Zone	25.7	3.2[b]	—	165
Range Perimeter	14.5[a]	6.5	—	176
Total	73.7	35.8	4	776

Notes:
[a] Total acreage of Range Perimeter includes the portion within the 20-foot buffer along the fenceline that could not be investigated due to interference with geophysical equipment.
[b] Acres listed for the Buffer Zone investigation includes the two portions extending from the Buffer Zone into the Northern and Southern EOD Ranges (see Figure 2-3); these two portions were considered to be representative of the Buffer Zone, rather than active EOD Range activities.
[c] 23 items were initially characterized as Safe-to-Move MEC; upon post-detonation inspection (Section 3.2), 19 were concluded to not contain explosive compounds.

The depth distribution (minimum and maximum depth) of MD recovered during the MEC field investigation at Site 1 is shown in Table 3-2.

Table 3-2: Depth Distribution of MEC and MD

Investigation Area	Minimum Depth	Maximum Depth (inches bgs)
Northern EOD Range	Surface	96
Southern EOD Range	Surface	24
Buffer Zone	Surface	12
Range Perimeter	Surface	10

The type and depth of Safe to Move MEC recovered and subsequently destroyed (by explosive demolition) during the MEC field investigation are summarized in Table 3-3.

Table 3-3: Type and Depth of MEC Recovered During MEC Field Investigation

Type of MEC	Quantity	Depth encountered (inches bgs)	Area Recovered
Flex-linear shaped charge	1	0	Northern EOD Range
40mm cartridge primer	2	12	Northern EOD Range
Smokeless powder	¼- pound	12	Northern EOD Range

Figure 3-1 shows the location of all MEC and MD items recovered during the MEC field investigation at Site 1. In some cases, multiple MEC and MD items were recovered in a single location. Multiple MEC items are noted on Figure 3-1, while multiple MD items are only shown as a single point. A detailed list of MEC and MD recovered during the MEC field investigation is provided as Attachment C.

3.2 DETONATION OF MEC

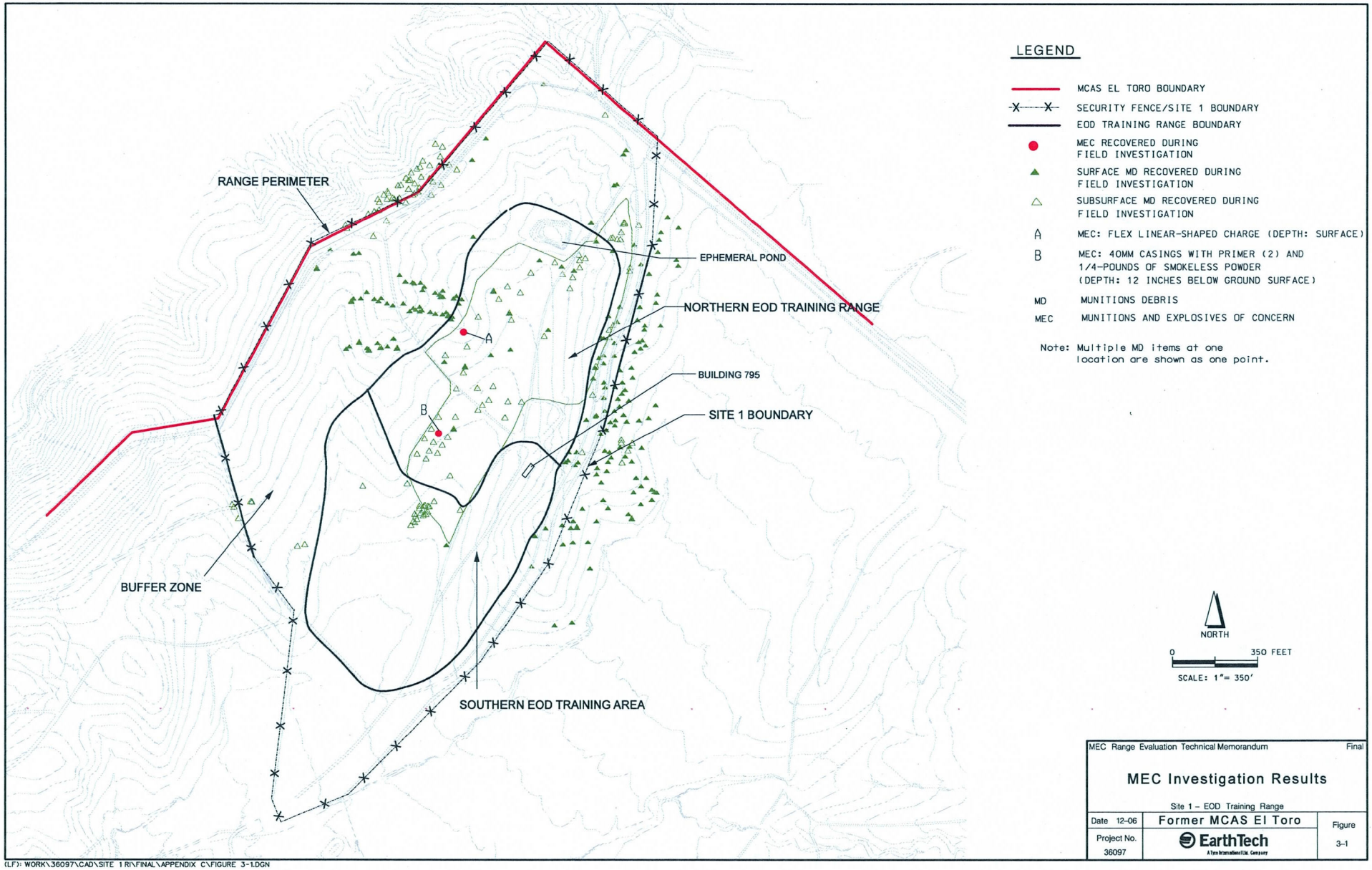
Twenty-three MEC or potential MEC items were recovered during the field investigation. All of these items were slated to be destroyed and/or vented by means of explosive detonation, and subsequently inspected. Prior to detonation, notifications were made to SWDIV, Orange County Sheriff's Department, Orange County Fire Authority, the Federal Aviation Authority, and the Federal Bureau of Investigation. A detonation location was set up in the northeast portion of Site 1. Prior to detonation, preparations were made to mitigate blast and fragmentation effects. This entailed building four sandbag enclosures around the potential MEC item(s) to be destroyed. Once all safety precautions were implemented, explosives purchased from and delivered by Alpha Explosives (located in Mojave, California) were used to explosively destroy and/or vent/demilitarize all MEC or potential MEC items recovered during the field investigation. Two detonation shots were performed: one that included detonation of materials within four enclosures and one that included detonation of materials within two enclosures. Upon completion of detonation procedures, and after thorough inspection of metal components of the items that had undergone explosive detonation, it was confirmed that only 4 of the 23 potential MEC items had contained explosive compounds (see Table 3-3). Photographs of the MEC or potential MEC items destroyed or vented are presented in Attachment A. Documentation of the detonation shots and the explosives accountability (i.e., receipt) is included as Attachment D. Also included in Attachment D is the MEC notification provided to the BCT prior to the detonation activities.

3.3 MD DISPOSAL PROCEDURES

Approximately 5,000 pounds of MD and 2,500 pounds of non-MEC metal scrap were collected and consolidated during the field investigation at Site 1. All MD recovered during the MEC field investigation was separated, initially inspected, and will subsequently be certified as free of explosive hazards and disposed of in accordance with local, state, and federal regulations. During this process, all items will be cleared of any soil or other obstructions. Items will then be cut into pieces so that they no longer resemble intact military ordnance and do not contain any sealed cavities that would prevent the complete inspection of the item. A Senior UXO Supervisor will sign a certification letter that attests to all items being free and clear of explosives. The waste will then be transported to the approved waste facility. Once all MD is certified as demilitarized, and disposed of, pertinent documentation will be included in Attachment D.

3.4 DESCRIPTION OF MEC HAZARDS

The following paragraphs summarize the types of MEC recovered during the MEC field investigation and the purpose or function of each item. Table 3-4 lists the types of MEC recovered, a brief description of the MEC hazard, the condition or state in which it was found in, and the sensitivity and hazard associated with the item. For each of the MEC items recovered, an individual would have to perform some deliberate



MEC Range Evaluation Technical Memorandum — Final

MEC Investigation Results

Site 1 – EOD Training Range

Date 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech A Tyco International Company	3-1

(LF): WORK\36097\CAD\SITE 1 RI\FINAL\APPENDIX C\FIGURE 3-1.DGN

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act to be exposed to MEC risk.

In terms of sensitivity, MEC items that are classified as "very sensitive" are likely to detonate with very little effort (e.g., simple touch or movement) and are also designated as Unsafe-to-Move. MEC items that are classified as "sensitive" are likely to detonate with moderate effort (e.g., dropping the item, striking it, driving over it, or exposing it to extreme heat). MEC items classified as a "residual risk" are those that would require extreme effort (i.e., cutting the item, drilling into it, mutilating it, or crushing it) to detonate. Sensitive and residual risk MEC items are also designated as Safe-to-Move.

In terms of hazard, MEC items classified as "likely to cause minor injury" are items that would likely inflict injuries that do not cause permanent disability and/or dismemberment if caused to detonate by an individual. MEC items that are classified as "likely to cause major injury" are those that would likely inflict injuries that may cause permanent disability and/or dismemberment (e.g., loss of fingers, hands, eyes) if caused to detonate by an individual.

Table 3-4: Characteristics of MEC Recovered During MEC Field Investigation

Ordnance and Explosives Type	Hazard	Condition	Sensitivity
40mm cartridge primer	Likely to cause minor injury	Functionable [a]	Sensitive
Flex-linear shaped charge	Likely to cause major injury	Functionable [a]	Sensitive
Smokeless powder	Likely to cause major injury	Functionable [a]	Sensitive

Note:
[a] Functionable items become hazardous when improperly handled.

40mm Cartridge Primers. These primers contain approximately ¼-ounce of primary explosives (tetryl), are designed to ignite the smokeless powder in the 40mm cartridge, and can project small, high-velocity fragments out of an empty cartridge case.

Flex-Linear Shaped Charge. This is a type of specialized demolition charge used for explosively cutting into dense metal casings, such as projectiles and bombs. It is constructed with a metal housing that contains pentaerythrite tetranitrate (PETN) or cyclotrimethylenetrinitramine (RDX) explosives. The flex-linear shaped charge recovered during the field investigation was approximately 3 ounces in net explosive weight. Fragments from this charge may project in a 360-degree pattern.

Smokeless Powder. Smokeless powder is used as a propellant in cartridges to expel projectiles through a gun barrel at a target. A typical 40mm cartridge can contain up to 500 grams of propellant. The smokeless powder propellant recovered during the field investigation was loosely contained in a partially burned cartridge and equaled approximately 8 to 12 ounces. Smokeless powder, if ignited, burns very violently at high temperatures and is consumed almost instantly.

4. MUNITIONS AND EXPLOSIVES OF CONCERN RISK EVALUATION

The explosives safety risk at Site 1 has been evaluated in accordance with the interim R3M guidance (DOD 2000). Explosives safety risks are presented in qualitative terms using a scale that ranges from A (lower risk) to E (higher risk). The estimation methods have been developed primarily to characterize risks to individual human receptors. The MEC risk has been evaluated for each of the four areas investigated: Northern EOD Training Range, Southern EOD Training Range, Buffer Zone, and Range Perimeter. Each area was evaluated using the following three risk factors: Accessibility Assessment, Overall Hazard Assessment, and Exposure Assessment. For purposes of this risk evaluation, it is assumed (based on the assumption of a federal agency-to-federal agency transfer of Site 1 to the FBI) that the overall land use within the four areas of Site 1 will remain consistent with past EOD training activities. For a summary of risks presented below, see Table 4-1.

4.1 NORTHERN EOD TRAINING RANGE

The Northern EOD Training Range was the site for the majority of former EOD training activities, as evidenced by the magnitude of MEC-related materials, establishment of permanent/semi-permanent demolition infrastructure (e.g., subsurface firing wire, viewing stands with sighting scopes, and obvious demolition pits), and the confirmation of MEC in this area. Other evidence found included burial pits possibly used in training activities.

Accessibility Assessment. Based on best professional judgment, migration of MEC is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of MEC that may be buried at shallow depths. The level of activity, based on anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool (Attachment E), is 5 on a scale of 1 to 5 (lowest to highest).

Overall Hazard Assessment. Four MEC items (one of which contained a mass explosion compound) were recovered in the Northern EOD Training Range during the field investigation: one four-inch-long flex-linear shaped charge, two 40mm cartridges with primer, and 0.25-pound of smokeless powder (see Figure 3-1). The MEC items were recovered on the surface and at a depth of 12 inches bgs. A total of 409 MD items were recovered between the surface and 96 inches (8 feet) bgs. MD is inert (nonhazardous) and does not pose a safety risk. The presence of MEC suggests the potential for additional MEC in this area. The sensitivity of the types of MEC recovered is low (unfuzed) and the explosive fillers were in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool (Attachment E), is 5 on a scale of 1 to 5 (lowest to highest).

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (2 to 8 entries per month). MEC density, which was computed by dividing the acreage of the Northern EOD Training Range by the total number of MEC found, is anticipated to be less than 2 MEC items per acre. The intensity of activity is expected to be moderate (less than or equal to 6 hours per entry) and portability of MEC was defined as easily portable since most items found in this area were small (i.e., less than 5 pounds each). The exposure score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Northern EOD Training Range, based on the explosives safety risk tool (Attachment E), is characterized as Explosive Safety Risk "E" (higher risk).

4.2 SOUTHERN EOD TRAINING RANGE

The Southern EOD TrainingRange contained some of the former EOD training activities, but at a much smaller scale than the Northern EOD Range, as evidenced by the absence of MEC, small quantities of MD , and the lack of visual evidence of burial pits.

Accessibility Assessment. No MEC items recovered during the field investigation of the Southern EOD Training Range. However, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on best professional judgment, migration of MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallowdepths. The level of activity, based on anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Hazard Assessment. No MEC items were recovered during the field investigation of the Southern EOD Training Range (see Figure 3-1); however, 26 MD items were recovered between the surface and 24 inches bgs. MD is inert (nonhazardous) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in the Southern EOD Training Range (i.e., 20mm and 40mm cartridges), potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These types of MEC are considered low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool (Attachment E), is 3 on a scale of 1 to 5 (lowest to highest).

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (2 to 8 entries per month). MEC density (because no MEC items were recovered) is anticipated to be less than 2 MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to 6 hours per entry) and portability of MEC was defined as easily portable since most items found at the site were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Southern EOD Training Range, based on the explosives safety risk tool (Attachment E), is characterized as Explosive Safety Risk "A" (lower risk).

4.3 BUFFER ZONE AND RANGE PERIMETER (INSIDE THE FENCE)

The Buffer Zone and Range Perimeter (area within the perimeter fence) contained kick-outs from the former EOD training activities, as evidenced by the small quantities of MEC-related materials/scrap recovered during the field investigation. No MEC items were recovered during the field investigation, and there was no evidence of burial pits.

Accessibility Assessment. No MEC items were recovered during the field investigation of the Buffer Zone and Range Perimeter (area inside the fence line); however, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on best professional judgment, migration of potential MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallow depths. The level of activity, based on best professional judgment and anticipated land use, will be moderate intrusion with ground disturbances up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Hazard Assessment. No MEC items were recovered during the field investigation of the Buffer Zone and Range Perimeter (area inside the fence line) (see Figure 3-1); however, 165 MD items were recovered between the surface and 12 inches bgs. MD is inert (nonhazardous) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in this area during the field investigation, potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These MEC types have low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool (Attachment E), is 3 on a scale of 1 to 5 (lowest to highest).

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (2 to 8 entries per month). MEC density (because no MEC was recovered) is anticipated to be less than 2 MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to 6 hours per entry). Portability of MEC was defined as easily portable since most items found in this area were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Buffer Zone (including the area inside the Range Perimeter fence), based on the explosives safety risk tool (Attachment E), is characterized as Explosive Safety Risk "A" (lower risk).

4.4 RANGE PERIMETER (OUTSIDE THE FENCE)

The Range Perimeter outside of the perimeter fence contained kick-outs from the former EOD training activities, as evidenced by the small quantities of MEC-related materials/MD recovered in the three areas investigated (see Figure 3-1). No MEC items were recovered during the field investigation, and there was no evidence of burial pits. Based on the patterns of MD located outside of the perimeter fence, isolated open burn/open detonation activities may have occurred in the past on the outer edges of the Northern EOD Range or in open areas of the Buffer Zone.

Accessibility Assessment. No MEC items were recovered during the field investigation of the Range Perimeter (area outside perimeter fence); however, the potential does exist for MEC to be present, but to a much lesser degree than the Northern EOD Training Range. Based on best professional judgment, migration of potential MEC (if present) is possible over a long period of time and through recurring natural events. Surficial soil movement could cause migration of potential MEC that may be buried at shallow depths. The level of activity, based on best professional judgment and anticipated land use, will be moderate intrusion with ground disturbances expected up to 2 feet bgs. The accessibility score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Hazard Assessment. There were no MEC items recovered during the field investigation of the Range Perimeter (area outside perimeter fence); however, 176 MD items were recovered between the surface and 10 inches bgs (see Figure 3-1). MD is inert (nonhazardous) and does not pose a safety risk; however, it does indicate the potential for MEC. Based on the types of MD recovered in this area, potential MEC (if present) would most likely consist of the type that would produce mass fire or minor blast. These MEC types have low sensitivity (unfuzed) and would most likely occur in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool (Attachment E), is 3 on a scale of 1 to 5 (lowest to highest).

Exposure Assessment. Based on best professional judgment and anticipated land use, the frequency of entry into this area is expected to be occasional (2 to 8 entries per month). MEC density (because no MEC was recovered) is anticipated to be less than 2 MEC items per acre. The intensity of activity is anticipated to be moderate (less than or equal to 6 hours per entry). Portability of MEC was defined as easily portable

since most items found in this area were small (less than 5 pounds each). The exposure score, based on the explosives safety risk tool (Attachment E), is 2 on a scale of 1 to 5 (lowest to highest).

Overall Explosives Safety Risk Assessment. The overall explosives safety risk for the Range Perimeter (outside the perimeter fence), based on the explosives safety risk tool (Attachment E), is characterized as Explosive Safety Risk "A" (lower risk).

4.4 SUMMARY OF MEC RISKS

Based on the recovery of four safe-to-move MEC items in the Northern EOD Training Range, as well as the recovery of 776 MD items from all four investigation areas (the Northern EOD Training Range, Southern EOD Training Range, buffer zone, and range perimeter), it is estimated that there are less than 2 safe-to-move energized MEC items present per acre at Site 1. MEC risk was evaluated, based on the sampling results, for all four areas, assuming that the overall land use within the four areas of Site 1 will remain consistent with past EOD training activities. Each area was evaluated using three risk factors - accessibility assessment, overall hazard assessment, and exposure assessment. Table 4-1 presents the summary of risks. The explosivity risk would be higher for any activity that results in more land disturbance than the like use scenario due to higher potential for encountering MEC items.

Table 4-1: Summary of MEC Risks

Investigation Area	Accessibility Assessment[a]	Overall Hazard Assessment[b]	Exposure Assessment[a]	Overall Explosives Safety Risk[b]
Northern EOD Range	5	5	2	E
Southern EOD Range	2	3	2	A
Buffer Zone and Range Perimeter (inside fenceline)	2	3	2	A
Range Perimeter (outside fenceline)	2	3	2	A

Note:
[a] Scale is 1 to 5, lowest to highest risk.
[b] Scale is A to E, lowest to highest risk.

5. CONCLUSIONS

Using data collected during the MEC field investigation (conducted in support of the MEC range evaluation at Former MCAS El Toro Site 1) and the results of the MEC risk evaluation, the following conclusions are stated:

- The presence of MEC was confirmed, with explosive- or propellant- filled ordnance or demolition materials (primers and smokeless powder from 40mm cartridges and flex linear shaped charge), within the Northern EOD Training Range.
- MEC items are most likely present only in the subsurface region of the Northern EOD Training Range where long-term EOD training/burials have occurred.
- Due to proximity to the Northern EOD Training Range, the potential for migration of MEC from kick-outs into the Southern EOD Training Range and Buffer Zone cannot be ruled out; therefore, a residual risk of MEC remains in these areas, as well as the east and southeast areas outside the perimeter fence.
- The risk of encountering MEC items on the surface is low; however, erosion or surficial soil movement could uncover MEC items (if present) that may be buried in the shallow subsurface.
- Areas outside the perimeter fence in the northwest region of Site 1 could not be 100-percent investigated due to steep terrain and dense vegetation constraints; therefore, MD may still be present beyond the areas investigated. It is possible that additional MD ould be found up to 150 feet from the perimeter fence; however, based on investigation results, it is anticipated that no MEC is present outside the perimeter fence.
- The boundaries for areas outside the perimeter fence in the east and southwest regions of Site 1 demarcate what was identified as the end line for evidence of MEC-related materials. No other MD could be visually located beyond these boundaries. Subsurface investigations in these areas were restricted by dense vegetative cover.

Due to the potential for buried MEC, elevated risk is present in the Northern EOD Training Range, with slightly elevated risk within the Southern EOD Training Range caused by potential for kick-outs. The Site 1 property is to be transferred to the FAA and upon transfer, the FAA plans to allow the FBI to use the property for purposes similar in nature to the past use for EOD training. Because of this, the risk at the site is acceptable and no response action is required. Additionally, the site is adequately characterized and no additional MEC evaluation is required.

6. REFERENCES

Bechtel National, Inc. (BNI). 1995. *Final Work Plan Phase II Remedial Investigation/Feasibility Study.* San Diego, CA.

Department of Defense (DOD). 2000. *Range Rule Risk Methodology (R3M) Interim Procedures Manual.* Washington, D.C. March.

Earth Tech. 2001a. *Work Plan, Ordnance and Explosives Range Evaluation, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu, HI. December.

———. 2001b. *Draft Final Work Plan, Ordnance and Explosives Range Evaluation, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu, HI. November.

———. 2001c. *Final Site-Specific Baseline Survey Report, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu, HI. August.

———. 2001d. *Final Federal Agency-to-Agency Property Transfer, Environmental Summary Document for Certain Property (Parcel 5a2), Marine Corps Air Station, El Toro, California.* Honolulu, HI. August.

———. 2001e. *Draft Technical Memorandum, Verification of Perchlorate at IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu, HI. July.

Federal Bureau of Investigation (FBI). 2000. Letter Report Stating the FBI's Use of the MCAS El Toro EOD Range. Los Angeles, CA. March.

Jacobs Engineering Group, Inc. (JEG) 1993. *Draft Phase I Remedial Investigation Technical Memorandum.* Irvine, CA.

Naval Energy and Environmental Support Activity (NEESA). 1986. *Initial Assessment Study of Marine Corps Air Station, El Toro, California*, Port Hueneme, CA. May.

United States Army Corps of Engineers (USACE). 1998. *Range Identification and Preliminary Range Assessment.* Draft. MCAS El Toro. St. Louis. March.

Attachment A
Photographs of Munitions and Explosives of Concern Range Evaluation Field Activities at El Toro Site 1

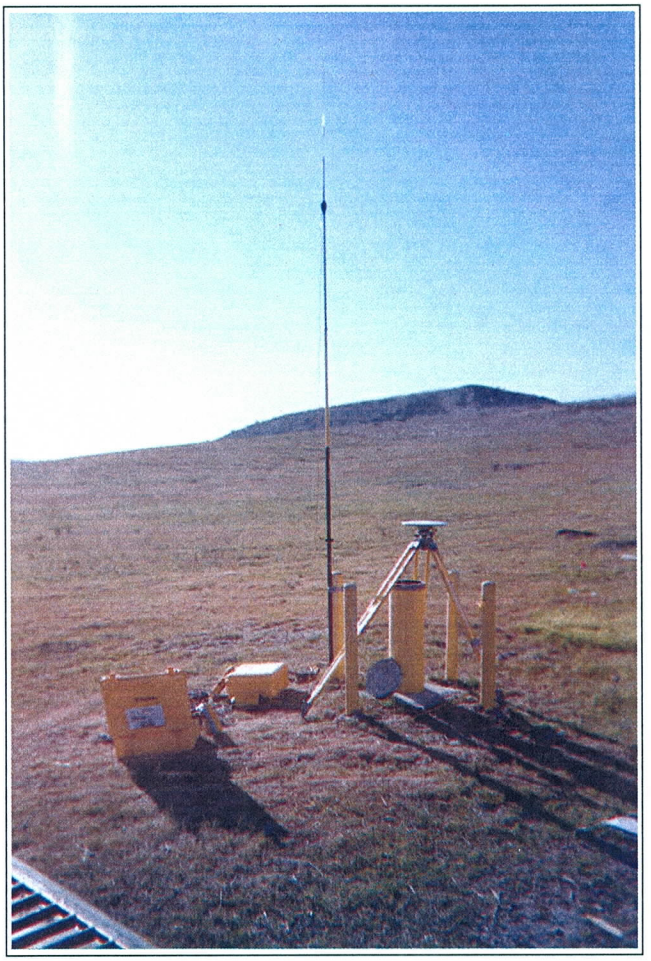

Photo 1 - Geophysical base station.

Photo 2 - Geophysical test plot seeds: 20mm and 40mm projectiles, M103 fuze, and various projectiles.

Photo 3 - Geophysical mapping using EM61.

Photo 4 - Initiating pothole investigation.

Photo 5 - Pothole investigation.

Photo 6 - Pothole investigation.

Photo 7 - Uncovering non-OE scrap during pothole investigation.

Photo 8 - Pothole investigation.

Photo 9 - Measuring dimensions of pothole excavation.

Photo 10 - Completion of pothole investigation at anomaly location.

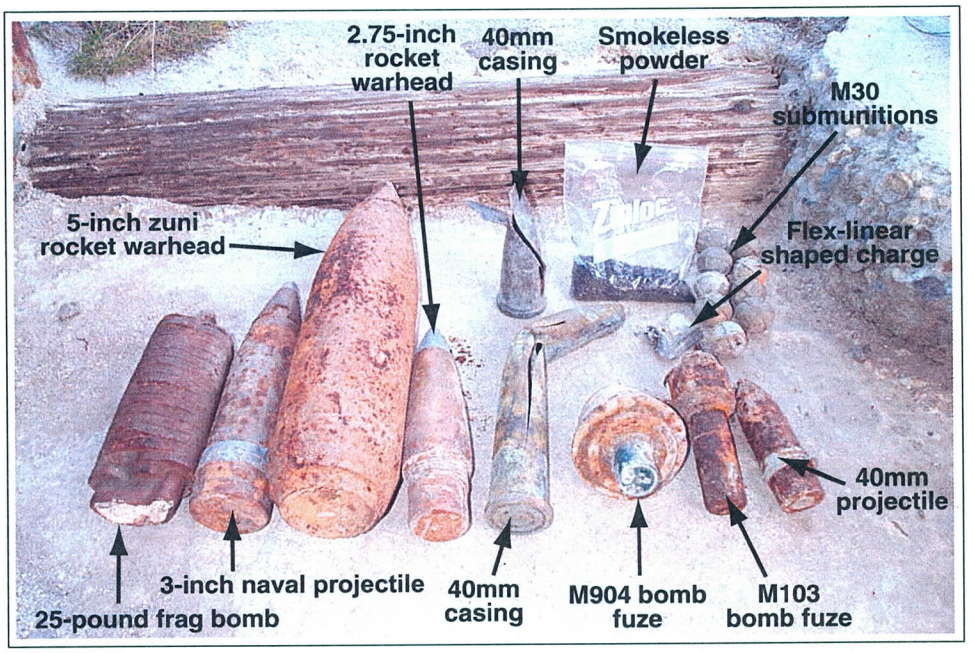

Photo 11 - OE and OE scrap.

Photo 12 - OE scrap (40mm casings and projectiles) recovered during pothole investigation.

Photo 13 - OE scrap (40mm casings).

Photo 14 - OE scrap (Mk82 bomb).

Photo 15 - OE scrap (20mm projectiles).

Photo 16 - OE scrap (40mm casings).

Photo 17 - OE scrap (40mm casings).

Photo 18 - OE scrap (2.75-inch rocket warhead).

Photo 19 - OE scrap (40mm casings).

Photo 20 - OE scrap (40mm casings and projectiles).

Photo 21 - OE scrap (5-inch naval projectile).

Photo 22 - OE scrap (sparrow missile).

Photo 23 - OE scrap (40mm casing) and non-OE scrap.

Photo 24 - OE scrap (5-inch zuni rocket warhead) and miscellaneous non-OE scrap (heavy equipment parts).

Photo 25 - OE scrap (40mm casings).

Photo 26 - OE scrap (40mm casing frag) and non-OE scrap.

Photo 27 - OE scrap (20mm projectiles) and non-OE scrap.

Photo 28 - OE scrap (20mm projectiles) and non-OE scrap (marsh matting).

Photo 29 - OE scrap (20mm projectile frag) and non-OE scrap.

Photo 30 - OE scrap (5-inch rocket warheads) and non-OE scrap.

Photo 31 - OE scrap (40mm casing frag) and non-OE scrap.

Photo 32 - Miscellaneous OE scrap (sparrow missile on left) and non-OE scrap.

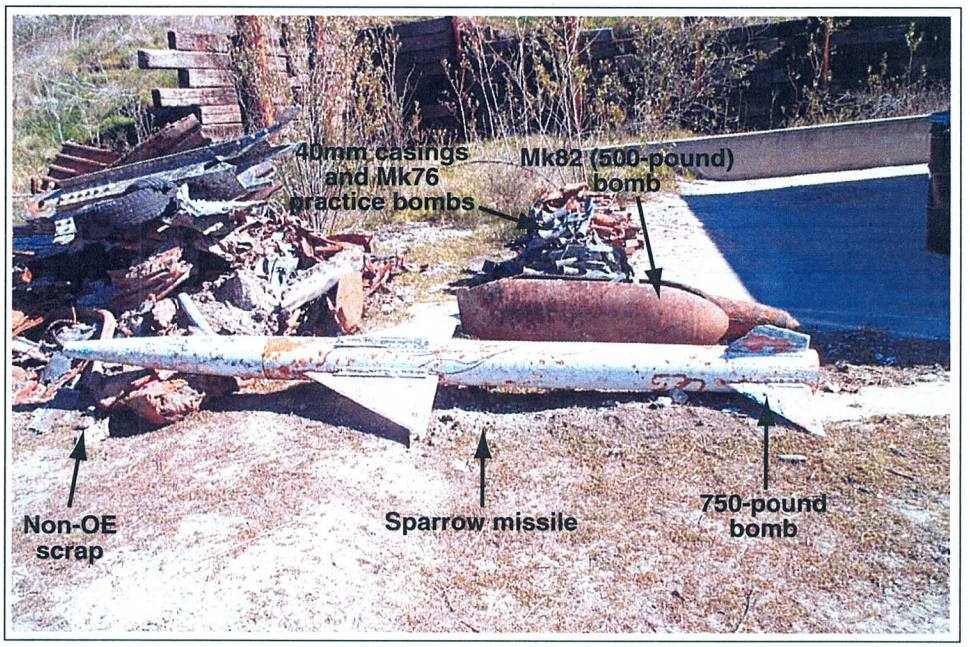

Photo 33 - Consolidation of OE scrap (pile on right) and non-OE scrap (pile on left) recovered during OE field investigation.

Photo 34 - Non-OE scrap recovered during pothole investigation.

Photo 35 - Non-OE scrap recovered during pothole investigation.

Photo 36 - Non-OE scrap (automobile parts).

Photo 37 - Non-OE scrap.

Photo 38 - Non-OE scrap.

Photo 39 - Non-OE scrap.

Photo 40 - Non-OE scrap.

Photo 41 - Non-OE scrap.

Photo 42 - Non-OE scrap.

Photo 43 - Non-OE scrap (automobile parts).

Photo 44 - Non-OE scrap.

Photo 45 - Non-OE scrap.

Photo 46 - Non-OE scrap.

Photo 47 - Non-OE scrap.

Photo 48 - Non-OE scrap.

Photo 49 - Non-OE scrap recovered during pothole investigation.

Photo 50 - 20mm projectile and other potential OE items.

Photo 51 - Demolition pit with first layer of sandbags.

Photo 52 - Preparing 40mm projectile and 40mm practice grenades for demolition.

Photo 53 - Partial construction of sandbag enclosure (blast mitigation) for demolition.

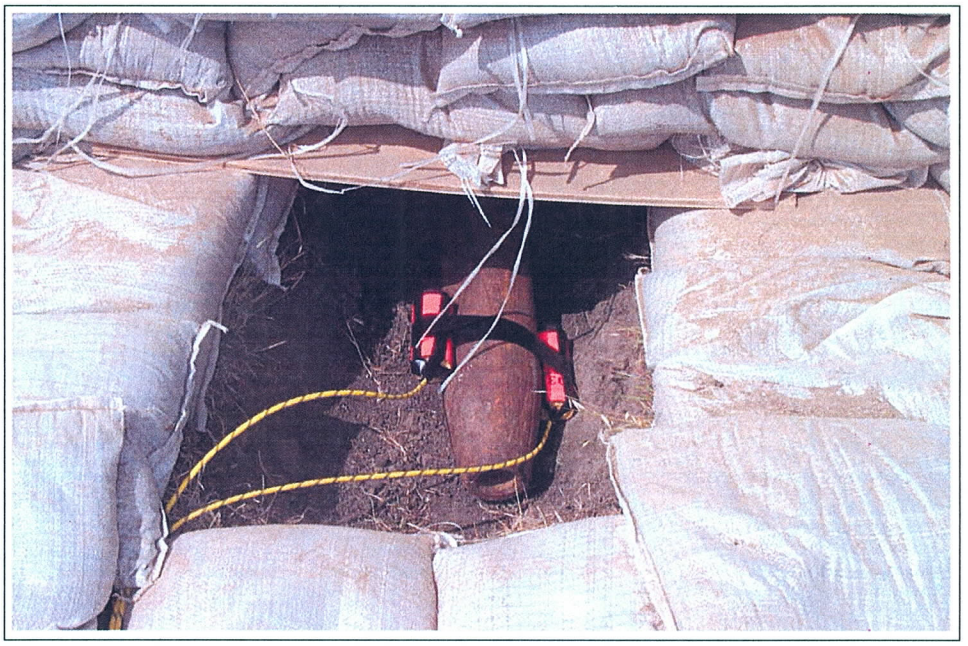

Photo 54 - Primed (explosives attached to) 5-inch zuni rocket warhead.

Photo 55 - Preparing M-30 series submunitions and M904 fuze for demolition.

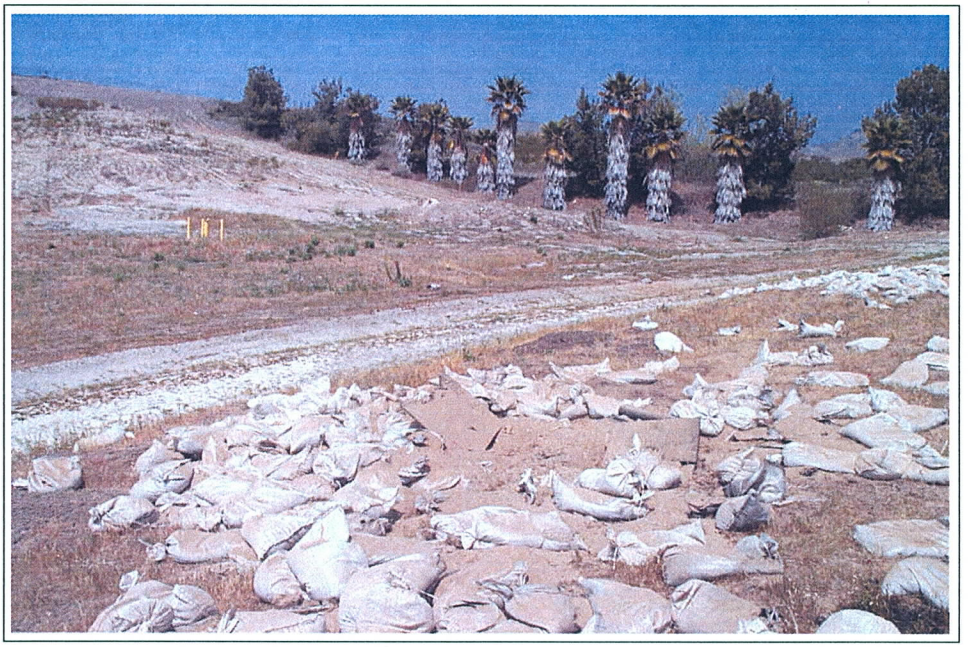

Photo 56 - Post-demolition view of sandbags.

Photo 57 - Post demolition: 5-inch zuni rocket warhead and 40mm casing.

Attachment B
EM61-Mk2 Fact Sheet for Geophysical Survey

New!

METAL DETECTOR

EM61-MK2

Advancing the state-of-the-practice for applications in the detection of buried metal, the EM61-MK2 Metal Detector offers several new features to enhance system performance:

- ***multiple time gates for improved target characterization***
- ***earlier time gates for increased sensitivity to smaller targets***
- ***a mid-range time gate for 'standard' EM61 data acquisition***
- ***computer-based system controller with real-time graphic display***
- ***fully integrated GPS (optional)***
- ***ergonomically re-designed backpack***

GEONICS LIMITED

1745 Meyerside Dr., Unit 8, Mississauga, Ontario, CANADA L5T 1C6 Tel (905) 670-9580 Fax (905) 670-9204 E-mail: geonics@geonics.com URL: http://www.geonics.com

FEATURES

EM61-MK2

- multiple time gates — three or four; user-selectable — provide a more complete measurement of the response decay rate for improved target characterization
- earlier time gates improve the detection of smaller targets:
  — detection of short decay response not detectable with the 'standard' gate position
  — response amplitude is more than four times that of the 'standard' gate position, for most targets
- a mid-range time gate at the same position as the 'standard' EM61 for comparison with, and continuation of 'standard' EM61 data sets
- computer-based digital recorder with real-time graphic display of data for review and quality control; high capacity data storage (min. 8MB) for extended survey time; increased rate of data collection; and additional input connections for simultaneous collection of EM and GPS data
- immediate GPS compatibility; fully integrated Trimble Ag 114 — with no requirement for a separate GPS receiver console — available as an option
- high-power output modification available for increased depth of exploration
- hand-held attachment available with optional top coil for 'differential' measurements
- improved ergonomics with smaller, lighter backpack and electronic components
- toggle switch for master/slave operation included to accommodate multiple-unit configurations
- compatibility with some components from 'standard' EM61

TECHNICAL SPECIFICATIONS

MEASURED QUANTITY	Four channels of secondary response in mV	
EM SOURCE	Air-cored coil, 1 x 0.5m size	
CURRENT WAVEFORM	Unipolar rectangular current with 25% duty cycle	
EM SENSORS	Bottom coil:	Air-cored coil, 1 x 0.5 m in size, coincident with EM source
	Top coil:	Air-cored coil, 1 x 0.5 m in size 28 cm above main coil
MAXIMUM OUTPUT	10 000 mV	
DYNAMIC RANGE	18 bits	
TIME GATES	Four gates of bottom coil response only, centered at 216, 366, 660 and 1266μsec; or, three gates of bottom coil response at 216, 366 and 660μsec, with one gate of top coil response at 660μsec.	
SYSTEM CONTROLLER	***PRO4000*** field computer with 486 AMD processor; 16-line LCD display with 24 characters per line.	
ACQUISITION SPEED	Up to 12 records (4 time gates per record) per second	
DATA STORAGE	8MB solid state memory for up to 330,000 records; extended memory, optional	
POWER SUPPLY	12 V rechargeable battery for 4 h continuous operation	
OPERATING WEIGHT & DIMENSIONS	Backpack:	8 kg; 60 x 30 x 20 cm
	Coil Assembly:	14 kg (23 kg in trailer mode)
	Bottom:	100 x 50 x 5 cm
	Top:	100 x 50 x 2 cm
SHIPPING WEIGHT & DIMENSIONS	38 kg (70 kg with trailer option) 108 x 60 x 25 cm (Box 1; harness mode only) 54 x 54 x 52 cm (Box 2; with trailer option)	

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Attachment C
Munitions and Explosives of Concern Investigation Results

Table C-1: Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Northern EOD Range

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
PH009	2196436.83	6124059.39	A	Non-MEC	Automobile part	>1	12
PH010	2196453.69	6124021.74	A	Non-MEC	Automobile part	>1	18
PH011	2196497.84	6123973.99	A	Non-MEC	Wire pallet	1	0
PH011	2196497.84	6123973.99	B	Non-MEC	Metal pipe	>1	0
PH012	2196524.71	6123988.20	A	Non-MEC	Razor wire	1	36
PH012	2196524.71	6123988.20	B	Non-MEC	Wire pallet	1	36
PH013	2196548.98	6124008.89	A	Non-MEC	Log, rope, and Non-MEC scrap	1	60
PH013	2196548.98	6124008.89	B	MD	MD	>1	60
PH014	2196618.08	6123911.28	A	MD	40mm casing	>1	24
PH014	2196618.08	6123911.28	B	MD	40mm projectile	>1	24
PH015	2196638.19	6123873.47	A	MD	40mm casing (Bofors)	12	24
PH016	2196636.00	6123974.00	A	Non-MEC	Pipe (metal)	1	6
PH017	2196641.75	6123957.82	A	MD	40mm casing	14	18
PH018	2196650.38	6123923.86	A	MD	40mm projectile	4	19.2
PH018	2196650.38	6123923.86	B	MD	40mm casing	>1	19.2
PH019	2196675.33	6123977.56	A	MD	40mm casing	10	12
PH020	2196687.26	6123941.39	A	MD	40mm casing	25	18
PH021	2196701.22	6123904.83	A	MD	40mm casing	7	18
PH022	2196707.69	6123999.12	A	MD	40mm casing	10	10
PH022	2196707.69	6123999.12	B	MD	40mm projectile	2	10
PH023	2196726.00	6123961.00	A	MEC	40mm cartridge primer (2) and 0.25-pound smokeless powder	3	12
PH023	2196725.93	6123961.26	B	Non-MEC	Metal/aluminum car part	>20	6
PH023	2196725.93	6123961.26	C	MD	40mm casing (burial area)	>20	48
PH024	2196742.14	6123932.91	A	MD	40mm casing and 40mm casing debris	6	36
PH025	2196741.83	6124023.65	A	MD	40mm casing	20	0
PH026	2196776.52	6123988.43	A	Non-MEC	Aluminum I-beam	1	36
PH026	2196776.52	6123988.43	B	Non-MEC	Marsh matting	2	36
PH027	2196791.15	6123961.76	A	MD	40mm casing/casing fragment	12	24
PH028	2196791.27	6124030.83	A	MD	Burn pit (large) with ash residue and molten aluminum	1	42
PH028	2196791.27	6124030.83	B	MD	Small arms	>1	42
PH029	2196856.05	6124085.84	A	Non-MEC	55-gallon barrels (fuel)	>1	72
PH029	2196856.05	6124085.84	B	Non-MEC	Marsh matting	>1	48
PH030	2196907.35	6124034.67	A	MD	Ammunition can	2	48
PH030	2196907.35	6124034.67	B	MD	MD	>1	48
PH030	2196907.35	6124034.67	C	MD	500-pound practice bomb	1	10
PH030	2196907.35	6124034.67	D	Non-MEC	Marsh matting	1	60
PH031	2196972.56	6124063.27	A	MD	Burn pit (5-inch rocket motors)	>1	96
PH031	2196972.56	6124063.27	B	MD	Small arms (linked)	>1	96
PH031	2196972.56	6124063.27	C	MD	Ammunition cans	>1	96
PH031	2196972.56	6124063.27	D	Non-MEC	Fuel cans	>1	96
PH031	2196972.56	6124063.27	E	MD	Cartridge actuated device	>1	96
PH032	2196909.47	6124120.69	A	MD	MD	>1	24
PH032	2196909.47	6124120.69	B	Non-MEC	Non-MEC scrap	>1	24
PH032	2196909.47	6124120.69	C	MD	Training missile (possible sparrow) without nozzle	1	60
PH032	2196909.47	6124120.69	D	Non-MEC	Matting	>1	60
PH032	2196909.47	6124120.69	E	Non-MEC	Boxes	>1	60
PH033	2196819.24	6124123.77	A	MD	Burn pit with residue	1	30
PH033	2196819.24	6124123.77	B	Non-MEC	Marsh matting	1	30
PH033	2196819.24	6124123.77	C	Non-MEC	Pipe	>1	30
PH033	2196819.24	6124123.77	D	MD	Small arms	>1	30
PH034	2196839.33	6124141.70	A	Non-MEC	Barrels (fuel)	>1	72
PH034	2196839.33	6124141.70	B	MD	Aluminum	1	24
PH034	2196839.33	6124141.70	C	MD	8-inch projectile	>1	24
PH035	2196859.85	6124168.69	A	MD	Burn debris (large area)	1	12
PH035	2196859.85	6124168.69	B	MD	MD	>1	12
PH035	2196859.85	6124168.69	C	Non-MEC	Non-MEC scrap	>1	12
PH035	2196859.85	6124168.69	D	Non-MEC	Marsh matting	4	18
PH036	2196816.98	6124222.86	A	Non-MEC	Marsh matting	1	6
PH037	2196788.22	6124234.36	A	Non-MEC	Automobile tire	1	2
PH037	2196788.22	6124234.36	B	MD	20mm ammunition can	2	8
PH037	2196788.22	6124234.36	C	MD	20mm projectile	4	8

Table C-1: Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Northern EOD Range

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
PH038	2196727.88	6124249.21	A	Non-MEC	Non-MEC scrap	1	18
PH039	2196854.18	6124246.00	A	MD	MD	1	6
PH039	2196854.18	6124246.00	B	MD	Demolition wire	1	6
PH040	2196852.89	6124301.76	A	MD	Wire scrap	1	8
PH040	2196852.89	6124301.76	B	MD	Steel	1	8
PH040	2196852.89	6124301.76	C	MD	Steel plate	>1	8
PH041	2196916.38	6124186.98	A	MD	MD	>1	6
PH042	2197189.83	6124260.00	A	MD	40mm casing	>20	12
PH042	2197189.83	6124260.00	B	MD	MD	1	10
PH043	2197217.97	6124250.93	A	MD	40mm casing	>20	0
PH043	2197217.97	6124250.93	B	MD	MD	>1	10
PH044	2197272.51	6124297.66	A	Non-MEC	Non-MEC scrap	>20	10
PH045	2197301.38	6124296.18	A	MD	40mm casing	12	8
PH045	2197301.38	6124296.18	B	MD	MD	>20	8
PH046	2197274.88	6124209.88	A	MD	MD	>20	8
PH047	2197307.78	6124187.29	A	MD	Small arms (burned)	>20	0
PH047	2197307.78	6124187.29	B	MD	MD	>20	78
PH047	2197307.78	6124187.29	C	Non-MEC	Automobile parts and other Non-MEC scrap	>20	78
PH048	2197326.45	6124243.74	A	Non-MEC	Scrap	>20	10
PH048	2197326.45	6124243.74	B	MD	40mm casing (large burn pit)	>20	10
PH049	2197382.08	6124339.45	A	MD	Commo wire	>1	42
PH049	2197382.08	6124339.45	B	Non-MEC	Automobile part	>1	42
PH049	2197382.08	6124339.45	C	Non-MEC	Non-MEC scrap	>1	42
PH050	2197435.73	6124375.88	A	MD	MD	>20	0
PH050	2197435.73	6124375.88	B	Non-MEC	Barrel, car frame, and other Non-MEC	>20	78
PH051	2197318.88	6124501.40	A	MD	Metal sheet (napalm dispenser?)	1	18
PH051	2197318.88	6124501.40	B	MD	Mk76	1	30
PH051	2197318.88	6124501.40	C	MD	2.36-inch rocket	1	30
PH051	2197318.88	6124501.40	D	MD	Ammunition box	>1	30
PH051	2197318.88	6124501.40	E	MD	Mk25 flare	>1	30
PH051	2197318.88	6124501.40	F	Non-MEC	Construction debris	1	36
PH052	2197363.54	6124512.60	A	MD	MD	>1	48
PH052	2197363.54	6124512.60	B	Non-MEC	Heavy reinforced steel drums (2), barrel lids, pallet	>1	48
PH053	2197376.75	6124470.14	A	MD	Frag: 105mm projectile and 2.75-inch rocket warhead	>1	8
PH053	2197376.75	6124470.14	B	Non-MEC	Non-MEC scrap	>1	8
PH054	2197404.57	6124541.17	A	MD	Firing wire (potential burn pit)	>1	12
PH054	2197404.57	6124541.17	B	Non-MEC	Tire	1	12
PH054	2197404.57	6124541.17	C	Non-MEC	Wire pallet	1	12
PH054	2197404.57	6124541.17	D	MD	M48 bomblet	2	24
PH054	2197404.57	6124541.17	E	MD	40mm casing	2	24
PH054	2197404.57	6124541.17	F	MD	MD	>1	36
PH054	2197393.00	6124519.00	G	MD	M30 series submunition	1	0
PH055	2197409.62	6124467.43	A	MD	MD	>1	0
PH056	2197424.83	6124438.76	A	MD	MD	>1	30
PH056	2197424.83	6124438.76	B	Non-MEC	Non-MEC scrap	>1	30
PH056	2197424.83	6124438.76	C	Non-MEC	Car transmission	1	1
PH056	2197424.83	6124438.76	D	MD	MD	>1	1
PH056	2197424.83	6124438.76	E	Non-MEC	Fence post	>1	12
PH056	2197424.83	6124438.76	F	MD	Frag: 2.75-inch rocket motor parts/skin	>1	12
PH056	2197424.83	6124438.76	G	MD	MD	>1	12
PH057	2197456.22	6124537.66	A	MD	2.75-inch rocket dispenser	>1	60
PH057	2197456.22	6124537.66	B	MD	5-inch rocket motor	>1	60
PH057	2197456.22	6124537.66	C	Non-MEC	Burial area: barrels (55 gallon), pallets, styrofoam packing, and building scrap	1	60
PH058	2197433.77	6124540.39	A	MD	Deposit of ash/MEC burn residue (5-inch zuni, small arms, jato bottles) trash pit	1	60
PH058	2197433.77	6124540.39	B	MD	Mk103 nose fuze	1	60
PH059	2197442.32	6124565.22	A	MD	Metal plate	1	30
PH059	2197442.32	6124565.22	B	MD	20mm can	>1	30
PH060	2197414.81	6124583.51	A	Non-MEC	Non-MEC scrap	>1	0
PH061	2197369.81	6124633.58	A	Non-MEC	No metallic contact	1	0
PH062	2197416.42	6124674.90	A	Non-MEC	No metallic contact	1	0
PH066	2197461.66	6124622.48	A	Non-MEC	Matting strip	1	0

Table C-1: Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Northern EOD Range

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
PH067	2197512.19	6124609.58	A	MD	Small arms	>1	0
PH067	2197512.19	6124609.58	B	Non-MEC	Non-MEC scrap (may be start of contaminated soils)	1	0
PH068	2197489.44	6124586.94	A	Non-MEC	No metallic contact	1	0
SS001	2197140.00	6124063.00	A	MEC	Flex-linear shaped charge	1	0
SS003	2197069.00	6124255.00	A	MD	5-inch zuni rocket warhead	1	0
SS004	2197019.05	6123985.38	A	MD	Projectile (dummy round with M48 fuze)	1	0
SS005	2196996.34	6124070.16	A	MD	Nose adaptor for bomb (includes part of M904 fuze)	1	0
SS006	2197046.11	6124177.27	A	MD	2.75-inch practice rocket warhead (no fuze)	1	0
SS007	2197149.54	6124410.79	A	MD	105mm projectile - unfired (no rifling - possible base fuze)	1	0
SS059	2197193.33	6124012.16	A	MD	M904 bomb fuze (front end only)	1	0
SS060	2197204.55	6124016.21	A	MD	20mm brass casing	1	0
SS084	2197275.78	6124056.62	A	MD	40mm brass casing	1	0
SS084	2197275.78	6124056.62	B	MD	Frag	8	0
SS084	2197275.78	6124056.62	C	MD	20mm casing	2	0
SS084	2197275.78	6124056.62	D	MD	White phosphorus grenade body (MT)	1	0
SS085	2197258.46	6124042.84	A	MD	Steel bomb body	1	0
SS085	2197258.46	6124042.84	B	MD	Mk118 (dart) practice (partial)	1	0
SS085	2197258.46	6124042.84	C	MD	Rocket motor tube (steel)	1	0
SS085	2197258.46	6124042.84	D	MD	Frag	4	0
SS133	2196645.13	6124497.84	A	MD	Frag: 155mm projectile	1	0
SS222	2197043.00	6123989.00	A	MD	3-inch naval projectile	1	6
SS223	2197079.00	6124078.00	A	MD	M904 nose fuze	1	6
SS224	2197202.00	6124124.00	A	MD	2.75-inch rocket warhead	1	6
SS225	2197122.00	6124395.00	A	MD	40 mm Projectile	1	6
SS226	2197434.00	6124540.00	A	MD	M103 bomb fuze	1	6

Total MEC recovered during field investigation: **4**
Total MD recovered during field investigation: **409**
Total Non-MEC scrap recovered during field investigation: **146**

Table C-2: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Southern EOD Range

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
GM065	2196292.32	6123829.41	A	Non-MEC	Automobile part	2	6
GM066	2196380.40	6123881.35	A	Non-MEC	Aluminum strongback	1	12
GM067	2196396.35	6123889.55	A	MD	Frag: 40mm projectile	1	4
MF098	2196422.02	6123924.85	A	MD	40mm casing	1	3
MF099	2196442.99	6123908.31	A	Non-MEC	Angle iron	1	1
MF100	2196423.58	6123919.02	A	MD	Mk25 marine marker	1	12
MF101	2196427.40	6123907.65	A	MD	Frag: projectile	1	10
MF101	2196427.40	6123907.65	B	MD	Frag: projectile	1	10
MF102	2196412.81	6123914.58	A	Non-MEC	Car part (exhaust)	1	8
MF103	2196424.55	6123902.22	A	MD	Aluminum (fin assembly)	1	10
MF104	2196402.00	6123917.87	A	MD	40mm casing	1	2
MF105	2196424.70	6123883.93	A	MD	40mm casing	1	4
MF106	2196400.22	6123914.68	A	Non-MEC	Automobile exhaust pipe	1	12
MF107	2196406.23	6123899.08	A	MD	Frag: projectile	2	4
MF108	2196390.51	6123911.08	A	MD	40mm casing	1	3
MF109	2196414.13	6123883.69	A	MD	Aluminum	1	1
MF110	2196390.01	6123902.80	A	MD	Frag	1	2
MF110	2196390.01	6123902.80	B	MD	Aluminum	1	6
MF111	2196385.40	6123899.66	A	MD	40mm casing	1	1
MF112	2196392.64	6123864.57	A	MD	Frag: projectile	1	4
MF113	2196390.71	6123863.15	A	MD	40mm casing	1	3
MF114	2196382.96	6123868.25	A	MD	40mm projectile without nose (practice)	1	4
MF115	2196370.43	6123873.59	A	MD	Rocket fin assembly (aluminum)	1	2
MF116	2196354.63	6123887.34	A	Non-MEC	Jack handle	1	2
MF117	2196357.89	6123864.89	A	MD	40mm casing	1	6
MF118	2196361.16	6123857.34	A	MD	40mm casing	1	3
MF119	2196338.13	6123852.22	A	Non-MEC	Metal bar	1	8
MF120	2196345.98	6123847.96	A	MD	40mm casing	1	10
MF121	2196342.38	6123821.76	A	Non-MEC	Aluminum automobile part	1	1
MF122	2196297.85	6123863.57	A	Non-MEC	Rod (steel)	1	6
MF123	2196305.55	6123828.88	A	Non-MEC	Automobile part (steel)	1	2
PH001	2196235.05	6123995.27	A	Non-MEC	Non-OE scrap	>1	0
PH002	2196263.59	6123997.04	A	MD	Missile fin (aluminum)	1	0
PH003	2196279.10	6123992.16	A	Non-MEC	Fence post with wire attached	1	18
PH004	2196452.36	6123800.85	A	Non-MEC	Automobile part	>1	24
PH005	2196515.93	6123833.21	B	Non-MEC	Automobile part	>1	3
PH005	2196515.93	6123833.21	A	MD	Aluminum (molten)	1	3
PH006	2196443.53	6123944.30	B	Non-MEC	Aluminum	1	24
PH006	2196443.53	6123944.30	C	Non-MEC	Barrel remains	1	24
PH006	2196443.53	6123944.30	A	MD	A/C dispenser	1	24
PH007	2196466.76	6123953.79	A	Non-MEC	Metal pipe with chain (possible strongback)	1	12
PH008	2196408.50	6124051.44	B	Non-MEC	Automobile part	>1	12
PH008	2196408.50	6124051.44	A	MD	Smoke grenade	1	12

Total MEC recovered during field investigation: **0**
Total MD recovered during field investigation: **26**
Total Non-MEC scrap recovered during field investigation: **19**

Table C-3: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Buffer Zone

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
GM001	2196558.57	6124490.36	A	Non-MEC	No metallic contact	1	0
GM002	2196563.07	6124493.36	A	Non-MEC	No metallic contact	1	0
GM003	2196569.43	6124498.01	A	Non-MEC	No metallic contact	1	0
GM004	2196573.44	6124500.22	A	Non-MEC	No metallic contact	1	0
GM005	2195678.62	6123877.06	A	Non-MEC	Steel pipe	1	10
GM006	2195669.18	6123876.77	A	Non-MEC	Steel pipe	1	10
GM007	2195664.17	6123887.57	A	Non-MEC	Gauge pipe	2	12
GM008	2195650.19	6123890.27	A	Non-MEC	Telephone pole anchor	1	0
GM009	2195691.35	6123929.21	A	Non-MEC	Fence pipe	1	1
GM010	2196603.23	6124503.31	A	Non-MEC	No metallic contact	1	0
GM011	2196645.22	6124552.55	A	MD	20mm casing	3	6
GM012	2196881.19	6124595.36	A	MD	40mm projectile	1	6
GM013	2196998.94	6124608.30	A	MD	Frag: projectile	1	6
GM014	2197116.70	6124664.60	A	MD	20mm projectile	1	1
GM015	2197578.12	6124786.57	A	MD	Rocket motor venturi	1	3
GM016	2197591.82	6124774.16	A	Non-MEC	Non-MEC scrap	1	6
GM017	2197404.55	6124750.54	A	MD	Frag	1	4
GM017	2197404.55	6124750.54	B	MD	20mm projectile	1	6
GM018	2197389.77	6124749.35	A	MD	Frag: projectile	1	1
GM019	2197384.70	6124756.04	A	Non-MEC	Non-MEC scrap	1	4
GM020	2197117.06	6124663.91	A	MD	Projectile	1	6
GM021	2197147.49	6124662.94	A	MD	Rocket fuze	1	4
GM022	2197167.55	6124680.96	A	MD	Frag: projectile	1	1
GM023	2198033.19	6124637.95	A	Non-MEC	Nail (large)	2	1
GM024	2198022.67	6124654.35	A	Non-MEC	Wire	2	4
GM025	2198027.93	6124646.07	A	MD	Frag: 155mm projectile	1	4
GM026	2197850.06	6124786.57	A	Non-MEC	3-inch pipe	1	1
GM027	2197522.57	6123629.73	A	Non-MEC	Non-MEC scrap	1	6
GM028	2197578.46	6123745.41	A	Non-MEC	Base to fence gate	3	2
GM029	2197598.18	6123781.37	A	Non-MEC	Tension wire	2	6
GM030	2197595.47	6123746.87	A	MD	Frag (aluminum)	1	3
GM031	2197530.96	6123692.30	A	MD	Frag	1	6
GM031	2197530.96	6123692.30	B	Non-MEC	Pipe	3	10
GM032	2197066.69	6123266.61	A	Non-MEC	Plow blade	1	6
GM032	2197066.69	6123266.61	B	Non-MEC	Fence wire	2	4
GM033	2196963.56	6123200.53	A	Non-MEC	Pipe	2	12
GM034	2196933.77	6123192.13	A	Non-MEC	Pipe	1	8
GM035	2196907.03	6123170.93	A	Non-MEC	Non-MEC scrap	2	10
GM036	2196876.47	6123164.70	A	Non-MEC	Pipe	2	4
GM037	2197804.69	6124035.27	A	MD	Frag: projectile	1	10
GM038	2197742.35	6123970.40	A	MD	Frag: projectile	1	4
GM038	2197742.35	6123970.40	B	MD	MD	1	4
GM039	2197702.34	6123930.40	A	MD	Frag: bomb	1	1
GM040	2195960.59	6123406.86	A	Non-MEC	Bolt (large)	1	4
GM041	2195896.98	6123421.65	A	Non-MEC	Barbed wire	1	0
GM042	2195890.71	6123422.93	A	Non-MEC	Barbed wire	1	0
GM043	2195880.13	6123421.65	A	Non-MEC	Barbed wire	1	0
GM044	2195537.21	6123357.27	A	Non-MEC	8-inch crescent wrench	1	6
GM045	2196483.17	6123159.67	A	Non-MEC	Metal rod	1	3
GM046	2196463.70	6123167.26	A	Non-MEC	Aluminum can	1	4
GM047	2196441.99	6123187.63	A	MD	40mm practice projectile with dummy fuze	1	12
GM048	2196440.83	6123191.83	A	MD	Frag (aluminum)	1	6
GM049	2196139.13	6123297.34	A	Non-MEC	Aluminum	1	4
GM050	2196121.44	6123307.61	A	Non-MEC	Barbed wire	1	6
GM051	2195625.08	6123879.58	A	Non-MEC	Fence pipe	1	4
GM052	2195604.31	6123859.22	A	Non-MEC	Fence wire	1	10
GM053	2195651.26	6123889.17	A	Non-MEC	Telephone pole anchor	1	0
GM054	2195659.33	6123882.49	A	Non-MEC	Heavy gauge pipe	2	12
GM055	2195656.42	6123875.35	A	Non-MEC	Heavy gauge pipe	2	12
GM056	2195260.96	6123509.88	A	Non-MEC	Metal plate	1	6

Table C-3: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Buffer Zone

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
GM057	2195253.11	6123529.23	A	Non-MEC	Aluminum can	1	10
GM058	2195260.69	6123317.70	A	Non-MEC	Aluminum can	1	6
GM059	2195495.60	6123357.43	A	Non-MEC	Railroad spike	1	12
GM060	2195328.82	6123327.24	A	Non-MEC	Aluminum can	1	6
GM061	2195321.73	6123320.04	A	Non-MEC	Metal plate	1	6
GM062	2195301.78	6123329.42	A	Non-MEC	Wire/chain link	1	10
GM063	2195273.22	6123317.43	A	Non-MEC	Aluminum	1	6
GM064	2195757.78	6123523.62	A	Non-MEC	No metallic contact	1	0
GM068	2196280.96	6123442.81	A	Non-MEC	Horseshoe	1	2
GM069	2197518.82	6124711.78	A	MD	20mm ammunition link	2	3
GM069	2197518.82	6124711.78	B	MD	Frag: 20mm projectile	2	3
GM070	2197520.01	6124698.19	A	MD	Grenade canister	1	6
GM070	2197520.01	6124698.19	B	MD	20mm ammunition link	3	4
GM071	2197548.38	6124714.83	A	MD	Frag (metal)	1	6
GM072	2197526.80	6124679.19	A	MD	Ammunition can	1	4
GM073	2197538.05	6124676.85	A	Non-MEC	Fence wire	1	6
GM074	2197522.35	6124663.71	A	Non-MEC	No metallic contact	1	0
GM075	2197583.32	6124723.06	A	MD	Frag (metal)	1	3
GM076	2197589.20	6124726.80	A	MD	Frag (metal)	1	3
GM077	2197584.26	6124728.21	A	MD	Frag (metal)	1	3
GM078	2196506.41	6123651.01	A	Non-MEC	Fence wire	1	6
GM078	2196506.41	6123651.01	B	MD	Projectile base	1	2
GM079	2196271.97	6123398.96	A	Non-MEC	Metal link chain	1	6
GM080	2196258.31	6123381.05	A	MD	20mm projectile	2	4
GM081	2196255.20	6123396.15	A	Non-MEC	Metal scrap (automobile part)	1	1
GM082	2196265.44	6123411.25	A	MD	Aluminum	2	4
MF013	2196429.48	6123135.84	A	Non-MEC	Aluminum soda can	1	4
MF019	2196461.07	6123131.75	A	Non-MEC	Barbed wire (buried)	1	2
MF020	2196485.24	6123122.08	A	Non-MEC	Fence post	1	6
MF021	2196484.81	6123118.65	A	Non-MEC	Barbed wire (buried)	1	4
MF025	2196492.34	6123117.35	A	Non-MEC	Barbed wire	1	6
MF026	2196493.42	6123119.81	A	Non-MEC	Barbed wire (buried)	1	10
MF027	2196498.97	6123120.77	A	Non-MEC	Bolt	1	3
MF028	2196522.23	6123113.07	A	Non-MEC	Barbed wire	1	2
MF029	2196525.11	6123112.76	A	Non-MEC	Aluminum automobile aprt	1	3
MF060	2197824.69	6124003.20	A	MD	MD (steel)	1	1
MF061	2197755.42	6123937.43	A	MD	MD (steel)	1	1
MF062	2197724.47	6123904.61	A	Non-MEC	Non-MEC scrap	1	1
MF063	2197670.43	6123825.99	A	MD	Frag: projectile	1	1
PH063	2197470.76	6124696.36	A	Non-MEC	No metallic contact	1	0
PH064	2197524.69	6124669.95	A	MD	MD	>1	12
PH065	2197553.13	6124607.63	A	Non-MEC	Remnants of burn area	1	42
SS002	2197530.00	6124101.00	A	MD	25-pound frag bomb	1	0
SS034	2196794.21	6124603.95	A	MD	20mm casing	1	0
SS035	2197035.70	6124620.75	A	MD	Frag (steel)	1	0
SS036	2197114.76	6124640.11	A	MD	Frag (steel)	1	0
SS037	2197207.18	6124659.18	A	MD	Frag (steel)	1	0
SS038	2197246.08	6124709.68	A	MD	Frag (steel)	1	0
SS039	2197472.75	6124677.18	A	MD	20mm brass casing	1	0
SS040	2197589.68	6124589.58	A	MD	Aluminum from rocket motor tube	1	0
SS041	2197743.19	6124682.79	A	MD	Aluminum from M48 submunition trainer	1	0
SS042	2197746.88	6124697.33	A	MD	20mm projectile	1	0
SS043	2197870.50	6124724.15	A	MD	Frag: aluminum strip	1	0
SS044	2197886.32	6124733.09	A	MD	Frag (steel)	1	0
SS045	2197084.22	6123822.50	A	Non-MEC	Air cooled engine part	2	0
SS046	2197075.81	6123812.10	A	Non-MEC	Engine part	1	0
SS047	2197072.59	6123791.22	A	MD	Bomb skin (half)	1	0
SS047	2197072.59	6123791.22	B	MD	20mm casing	1	0
SS048	2197112.84	6123776.70	A	MD	20mm brass casing	1	0
SS049	2197079.30	6123766.51	A	Non-MEC	Plastic piece	1	0

Table C-3: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Buffer Zone

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
SS049	2197079.30	6123766.51	B	Non-MEC	Automobile part	1	0
SS050	2197081.68	6123751.39	A	MD	20mm projectile	1	0
SS051	2197064.17	6123674.84	A	MD	Frag (steel)	1	0
SS051	2197064.17	6123674.84	B	MD	Aluminum part	1	0
SS052	2197075.18	6123723.39	A	MD	Windshield for 20mm projectile	1	0
SS052	2197075.18	6123723.39	B	MD	5.56 brass	1	0
SS052	2197075.18	6123723.39	C	MD	20mm projectile	1	0
SS052	2197075.18	6123723.39	D	MD	Fuze part	1	0
SS052	2197075.18	6123723.39	E	MD	Aluminum part	1	0
SS053	2197094.20	6123711.59	A	MD	20mm projectile	1	0
SS054	2197073.22	6123669.41	A	MD	Frag: aluminum piece	1	0
SS055	2197095.90	6123634.74	A	MD	20mm projectile	1	0
SS055	2197095.90	6123634.74	B	MD	Cartridge part	1	0
SS056	2197078.70	6123593.09	A	MD	Cartridge base	1	0
SS057	2197069.52	6123581.48	A	MD	Frag: steel skin from projectile	1	0
SS058	2197058.66	6123530.52	A	Non-MEC	Steel car part	1	0
SS061	2197207.10	6124011.46	A	MD	Aluminum metal	1	0
SS062	2197206.66	6124000.84	A	MD	20mm projectile	1	0
SS062	2197206.66	6124000.84	B	MD	Brass casing	1	0
SS063	2197214.66	6124005.54	A	MD	Frag	5	0
SS063	2197214.66	6124005.54	B	Non-MEC	Car part	1	0
SS064	2197222.04	6123992.04	A	MD	Projectile base piece	1	0
SS064	2197222.04	6123992.04	B	MD	Mk13 day/night smoke/flare	1	0
SS064	2197222.04	6123992.04	C	MD	20mm casing	1	0
SS065	2197213.15	6123977.59	A	MD	M103 bomb fuze	1	0
SS065	2197213.15	6123977.59	B	MD	20mm projectile	1	0
SS066	2197215.81	6123947.98	A	MD	Frag (aluminum)	1	0
SS067	2197223.31	6123927.05	A	MD	Frag (steel)	2	0
SS068	2197230.01	6123893.26	A	MD	20mm projectile	1	0
SS069	2197225.38	6123883.01	A	MD	Frag (steel)	1	0
SS070	2197244.90	6123882.31	A	MD	20mm casing and link	1	0
SS071	2197231.75	6123867.90	A	MD	20mm brass casing	1	0
SS072	2197240.78	6123855.96	A	MD	20mm casing	1	0
SS073	2197227.74	6123841.88	A	MD	Aluminum spacer	1	0
SS074	2197258.41	6123819.46	A	MD	Frag: 20mm projectile	1	0
SS075	2197248.58	6123772.47	A	MD	Frag: 20mm projectile	1	0
SS076	2197258.43	6123749.44	A	MD	Mk344 fuze piece (bomb tail fuze)	1	0
SS077	2197280.11	6123726.13	A	MD	Frag	1	0
SS078	2197268.25	6123715.32	A	MD	M203 fuze piece	1	0
SS078	2197268.25	6123715.32	B	MD	20mm casing	1	0
SS079	2197276.04	6123695.16	A	MD	Frag	1	0
SS079	2197276.04	6123695.16	B	MD	20mm casing	1	0
SS080	2197279.40	6123640.86	A	MD	Fuze piece	1	0
SS081	2197304.32	6123666.36	A	MD	Smoke grenade (expended)	1	0
SS082	2197277.54	6123612.56	A	MD	Frag: bomb	1	0
SS083	2197264.88	6123602.43	A	MD	20mm projectile	1	0
SS086	2197289.16	6124034.10	A	MD	20mm brass casing with link	3	0
SS087	2197279.56	6124022.58	A	MD	20mm brass casing	3	0
SS087	2197279.56	6124022.58	B	MD	Missile skin (possible terrier)	1	0
SS087	2197279.56	6124022.58	C	MD	20mm projectile	1	0
SS088	2197285.47	6123978.31	A	MD	Frag: 40mm projectile	1	0
SS089	2197284.94	6123970.26	A	MD	20mm casing and link	1	0
SS090	2197294.54	6123964.76	A	MD	Aluminum fin piece	1	0
SS091	2197310.19	6123978.08	A	MD	Steel metal skin	1	0
SS092	2197300.83	6123947.19	A	MD	20mm casing	1	0
SS093	2197312.73	6123894.30	A	MD	Frag: aluminum strip	1	0
SS094	2197326.47	6123902.60	A	MD	20mm casing	1	0
SS095	2197343.54	6123887.58	A	MD	20mm casing	1	0
SS096	2197339.75	6123860.29	A	MD	Bomb fuze adapter	1	0
SS096	2197339.75	6123860.29	B	MD	20mm casing	1	0

Table C-3: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Buffer Zone

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
SS096	2197339.75	6123860.29	C	MD	Frag	3	0
SS097	2197344.50	6123852.59	A	MD	20mm casing	2	0
SS098	2197347.64	6123824.03	A	MD	Frag (aluminum)	1	0
SS099	2197374.02	6123801.13	A	MD	20mm projectile	1	0
SS100	2197464.45	6123633.80	A	MD	Frag: 155mm projectile	1	0
SS101	2197463.08	6123611.22	A	MD	Cartridge actuated device	1	0
SS113	2196611.92	6124493.15	A	MD	Frag	1	0
SS114	2196949.60	6124596.64	A	MD	Frag: 20mm case	1	0
SS115	2196992.05	6124605.08	A	MD	Aluminum fuze case	1	0
SS116	2197012.24	6124640.04	A	MD	MD	1	0
SS117	2197045.94	6124638.94	A	MD	Frag: 40mm projectile	1	0
SS118	2197117.07	6124629.91	A	MD	Frag: 40mm projectile	1	0
SS119	2197095.95	6124685.41	A	MD	40mm case	1	0
SS120	2197183.69	6124698.93	A	MD	Frag	1	0
SS121	2197418.65	6124795.74	A	MD	Base	1	0
SS122	2197499.93	6124769.35	A	MD	Frag: 20mm case	1	0
SS123	2198155.22	6124390.25	A	MD	Frag: 20mm case	1	0
SS124	2196593.40	6124522.60	A	MD	Frag	1	0
SS125	2197932.99	6124154.67	A	MD	Aluminum flare case	1	0
SS126	2197846.39	6124098.05	A	MD	Aluminum flare case	1	0
SS127	2197480.09	6123515.99	A	MD	Frag: 20mm case	1	0
SS128	2197400.24	6123458.35	A	MD	Part of 2.75-inch warhead (electrical section)	1	0
SS129	2196178.26	6124340.19	A	MD	Banding material	1	0
SS130	2196302.05	6124359.25	A	MD	Part of 2.75-inch warhead (electrical section)	1	0
SS131	2196332.85	6124400.59	A	MD	20mm projectile (target practice)	1	0
SS132	2196604.45	6124482.15	A	MD	4-inch munition adaptor	1	0
SS134	2196603.39	6124534.58	A	MD	Frag	1	0
SS135	2196646.20	6124530.96	A	MD	7.62mm brass case	1	0
SS136	2196781.16	6124568.80	A	MD	Frag (aluminum)	1	0
SS137	2196798.86	6124608.79	A	MD	Nose section (part of)	1	0
SS138	2196871.76	6124642.04	A	MD	Ammunition can	1	0
SS139	2196914.03	6124647.28	A	MD	20mm base	1	0
SS140	2196933.53	6124641.71	A	MD	20mm case (part of)	1	0
SS164	2196346.35	6124469.74	A	MD	MD	1	0
SS166	2196722.59	6124627.40	A	MD	MD	1	0
SS169	2196817.78	6124647.18	A	MD	MD	1	0
SS178	2197043.93	6124685.81	A	MD	MD	1	0

Total MEC recovered during field investigation: **0**
Total MD recovered during field investigation: **165**
Total Non-MEC scrap recovered during field investigation: **87**

Table C-4: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Range Perimeter

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
MF001	2196364.15	6123135.81	A	Non-MEC	Steel car part	1	1
MF002	2196372.53	6123131.47	A	Non-MEC	Car spring	1	1
MF003	2196372.79	6123136.69	A	MD	7.62mm cartridge	1	4
MF004	2196378.08	6123144.15	A	Non-MEC	Barbed wire	1	1
MF005	2196382.81	6123139.64	A	Non-MEC	Barbed wire	1	4
MF006	2196389.58	6123133.28	A	Non-MEC	Barbed wire	1	3
MF007	2196396.93	6123132.54	A	Non-MEC	Barbed wire	1	6
MF008	2196413.56	6123110.86	A	Non-MEC	Barbed wire	1	8
MF009	2196419.73	6123118.91	A	MD	20mm projectile	1	6
MF010	2196429.90	6123111.43	A	MD	5.56mm cartridge (blank)	1	5
MF011	2196431.74	6123114.41	A	Non-MEC	Metal ring	1	2
MF012	2196433.00	6123127.88	A	Non-MEC	Aluminum soda can	1	6
MF014	2196453.19	6123119.42	A	Non-MEC	Barbed wire	1	1
MF015	2196462.74	6123107.03	A	Non-MEC	Barbed wire	1	3
MF016	2196477.69	6123104.32	A	Non-MEC	Barbed wire	1	1
MF017	2196474.40	6123106.83	A	Non-MEC	Barbed wire	1	1
MF018	2196472.46	6123111.77	A	Non-MEC	Barbed wire	1	1
MF022	2196486.05	6123115.10	A	Non-MEC	Barbed wire	1	6
MF023	2196483.19	6123109.76	A	Non-MEC	Barbed wire	1	4
MF024	2196483.94	6123103.28	A	Non-MEC	Stainless steel pipe	1	2
MF030	2196526.23	6123096.53	A	Non-MEC	Chain link	1	1
MF031	2196431.25	6123078.28	A	Non-MEC	Barbed wire	1	1
MF032	2197702.21	6123854.99	A	MD	20mm projectile target practice	1	10
MF033	2197707.51	6123861.44	A	MD	.50 caliber projectile	1	3
MF034	2197724.90	6123836.13	A	MD	Grenade fuze	1	1
MF035	2197714.56	6123876.86	A	MD	Frag: projectile	1	1
MF035	2197714.56	6123876.86	B	MD	30mm HEI with tracer	1	1
MF036	2197731.15	6123881.20	A	MD	Bomb tail piece (possible)	1	3
MF037	2197748.45	6123861.33	A	MD	20mm nose section (without fuze)	1	6
MF038	2197774.86	6123889.04	A	MD	20mm projectile body	1	2
MF039	2197762.63	6123891.88	A	Non-MEC	Barbed wire	1	4
MF040	2197756.80	6123922.44	A	Non-MEC	Barbed wire	1	6
MF041	2197768.38	6123923.63	A	MD	MD	1	3
MF042	2197816.39	6123907.15	A	Non-MEC	Non-MEC scrap	1	5
MF043	2197821.63	6123924.21	A	MD	20mm nose piece	1	1
MF044	2197821.38	6123962.99	A	MD	20mm nose piece	1	2
MF045	2197858.12	6123967.37	A	MD	20mm TP	1	1
MF046	2197897.87	6123976.87	A	MD	Grenade fuze	1	3
MF047	2197909.41	6123947.61	A	MD	MD	3	2
MF048	2197896.43	6123930.68	A	Non-MEC	Nail	8	1
MF049	2197840.33	6123895.67	A	MD	20mm projectile body	1	4
MF050	2197815.86	6123884.35	A	MD	MD	1	4
MF051	2197806.97	6123892.14	A	Non-MEC	Electrical wiring	1	2
MF052	2197807.85	6123871.20	A	MD	20mm projectile body	1	3
MF053	2197763.71	6123842.81	A	MD	Frag (small)	2	2
MF054	2197761.01	6123836.81	A	MD	Frag (small)	1	3
MF055	2197792.23	6123846.86	A	MD	20mm projectile practice fuze	1	2
MF056	2197770.11	6123826.81	A	MD	Grenade fuze	1	4
MF057	2197757.56	6123832.77	A	Non-MEC	Barbed wire spool	1	2
MF058	2197742.35	6123805.55	A	MD	Grenade fuze	1	1
MF059	2197739.40	6123793.67	A	MD	Grenade fuze	1	2
MF064	2197558.42	6123568.77	A	Non-MEC	Bailing wire	1	2
MF065	2197564.42	6123583.43	A	MD	Partial aluminum rocket fuze	1	1
MF066	2197576.82	6123577.24	A	MD	Frag: projectile	1	1
MF067	2197591.63	6123580.88	A	Non-MEC	Part of metal container	1	0
MF068	2197608.66	6123668.20	A	Non-MEC	Aluminum can	1	6
MF069	2197620.68	6123673.02	A	Non-MEC	Chain link	1	0
MF070	2197622.39	6123671.91	A	MD	Frag: projectile	1	4
MF071	2197627.10	6123673.42	A	Non-MEC	Bailing wire	1	1
MF072	2197633.52	6123695.99	A	MD	Frag	2	3

Table C-4: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Range Perimeter

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
MF073	2197636.16	6123707.99	A	MD	Bomb fin (partial)	1	0
MF074	2197640.00	6123715.94	A	MD	Projectile body	1	8
MF075	2197663.72	6123780.60	A	Non-MEC	Automobile part (stick shift)	1	0
MF076	2197673.33	6123792.23	A	MD	Frag: projectile	1	1
MF077	2197677.53	6123793.12	A	MD	Frag: bomb	1	6
MF078	2197684.72	6123777.85	A	MD	Grenade fuze	1	3
MF079	2197688.82	6123772.10	A	MD	Cartridge base	1	2
MF080	2197689.04	6123799.55	A	MD	Frag: projectile	1	2
MF081	2197709.63	6123754.05	A	MD	Grenade fuze	1	3
MF082	2197715.65	6123750.52	A	MD	20mm brass casing	1	3
MF083	2197702.12	6123735.31	A	MD	20mm projectile (no fuze)	1	3
MF084	2197684.52	6123748.50	A	MD	20mm projectile (target practice)	1	3
MF085	2197662.14	6123730.82	A	Non-MEC	Chain link	1	0
MF086	2197662.60	6123727.68	A	Non-MEC	Chain link	1	0
MF087	2197664.20	6123725.59	A	Non-MEC	Bailing wire	1	3
MF088	2197670.07	6123728.48	A	Non-MEC	Chain link	1	3
MF089	2197670.87	6123722.42	A	Non-MEC	Chain link	1	3
MF090	2197671.97	6123716.79	A	MD	20mm projectile (target practice)	1	2
MF091	2197684.06	6123710.90	A	MD	20mm base part	1	2
MF092	2197690.60	6123711.12	A	Non-MEC	Chain link	1	2
MF093	2197692.90	6123713.96	A	Non-MEC	Chain link	1	2
MF094	2197694.86	6123712.50	A	Non-MEC	Chain link	1	2
MF095	2197702.54	6123703.67	A	Non-MEC	Chain link	1	2
MF096	2197715.55	6123696.26	A	Non-MEC	Chain link	1	2
MF097	2197727.47	6123687.91	A	Non-MEC	Chain link	1	2
MF124	2196602.57	6124719.31	A	MD	MD	1	6
MF125	2196651.51	6124742.85	A	MD	MD	1	6
MF126	2196684.19	6124716.54	A	MD	MD	1	6
MF127	2196696.30	6124716.85	A	MD	MD	1	6
MF128	2196683.15	6124761.17	A	MD	MD	1	6
SS008	unknown	unknown	A	MD	Slag (aluminum)	1	0
SS009	unknown	unknown	A	MD	2.36-inch rifle grenade - white phosphorus (expended)	1	0
SS009	unknown	unknown	B	MD	20mm brass casing	1	0
SS010	unknown	unknown	A	MD	Frag (aluminum)	2	0
SS011	unknown	unknown	A	MD	Pop flare (expended)	1	0
SS012	unknown	unknown	A	MD	Fuze component	1	0
SS013	unknown	unknown	A	MD	Nose fuze	1	0
SS014	unknown	unknown	A	MD	Frag (steel)	1	0
SS015	unknown	unknown	A	MD	Frag (steel)	1	0
SS016	unknown	unknown	A	MD	20mm casing	1	0
SS017	unknown	unknown	A	MD	Fuze part	1	0
SS017	unknown	unknown	B	MD	20mm brass casing	1	0
SS018	unknown	unknown	A	MD	Projectile piece	1	0
SS019	unknown	unknown	A	MD	Brass casing	1	0
SS020	unknown	unknown	A	MD	40mm projectile (drill)	1	0
SS020	unknown	unknown	B	MD	20mm brass casing	1	0
SS021	unknown	unknown	A	MD	Shell from M48 drill submunition (half of)	1	0
SS022	unknown	unknown	A	MD	FS smoke cannister (half of)	1	0
SS023	unknown	unknown	A	MD	Shell FS smoke canister (half of)	1	0
SS024	unknown	unknown	A	MD	Shell FS smoke canister (half of)	1	0
SS025	unknown	unknown	A	MD	Shell FS smoke canister (half of)	1	0
SS026	unknown	unknown	A	MD	Shell FS smoke canister (half of)	1	0
SS027	unknown	unknown	A	MD	Hand gun part	1	0
SS027	unknown	unknown	B	MD	Shell from M48 drill submunition (half of)	1	0
SS028	unknown	unknown	A	MD	20mm projectile	1	0
SS029	unknown	unknown	A	MD	Machinery part	1	0
SS030	unknown	unknown	A	MD	Frag: bomb	1	0
SS031	unknown	unknown	A	MD	20mm brass casing	1	0
SS031	unknown	unknown	B	MD	20mm projectile part	1	0
SS032	unknown	unknown	A	MD	Mk23 practice bomblet (part of)	1	0

Table C-4: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Range Perimeter

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
SS033	unknown	unknown	A	MD	20mm casing and link	1	0
SS102	unknown	unknown	A	MD	Fuze piece (aluminum)	1	0
SS103	unknown	unknown	A	MD	Fuze piece (aluminum)	1	0
SS103	unknown	unknown	B	MD	Frag (steel)	1	0
SS104	unknown	unknown	A	MD	Missile body (piece)	1	0
SS105	unknown	unknown	A	MD	20mm projectile	1	0
SS106	unknown	unknown	A	MD	Frag (steel)	1	0
SS107	unknown	unknown	A	MD	Coupler (aluminum)	1	0
SS107	unknown	unknown	B	MD	20mm casing	1	0
SS108	unknown	unknown	A	MD	Pop flare body (aluminum)	1	0
SS109	unknown	unknown	A	MD	20mm brass casing	2	0
SS109	unknown	unknown	B	MD	Metal scrap	1	0
SS110	unknown	unknown	A	MD	Frag (steel)	1	0
SS111	unknown	unknown	A	MD	Frag: 155mm projectile (large piece)	1	0
SS112	unknown	unknown	A	MD	Flare base	1	0
SS141	2197436.51	6124940.84	A	MD	MD	1	0
SS142	2197168.04	6124877.04	A	MD	MD	1	0
SS143	2197086.40	6124815.06	A	MD	MD	1	0
SS144	2196788.52	6124827.55	A	MD	MD	1	0
SS145	2196778.69	6124787.65	A	MD	MD	1	0
SS146	2196670.16	6124749.38	A	MD	MD	1	0
SS147	2196630.14	6124732.19	A	MD	MD	1	0
SS148	2196607.65	6124759.36	A	MD	MD	1	0
SS149	2196540.55	6124776.17	A	MD	MD	1	0
SS150	2196481.72	6124766.28	A	MD	MD	1	0
SS151	2196434.49	6124797.13	A	MD	MD	1	0
SS152	2196541.32	6124818.47	A	MD	MD	1	0
SS153	2196492.16	6124842.26	A	MD	MD	1	0
SS154	2196483.32	6124852.35	A	MD	MD	1	0
SS155	2196450.96	6124840.06	A	MD	MD	1	0
SS156	2196364.45	6124613.12	A	MD	MD	1	0
SS157	2196276.23	6124577.54	A	MD	MD	1	0
SS158	2195936.42	6124440.10	A	MD	MD	1	0
SS159	2195950.72	6124513.83	A	MD	MD	1	0
SS160	2196169.07	6124585.82	A	MD	MD	1	0
SS161	2196841.68	6124855.19	A	MD	MD	1	0
SS162	2197414.81	6124948.58	A	MD	MD	1	0
SS163	2196266.28	6124473.26	A	MD	MD	1	0
SS165	2196652.17	6124645.54	A	MD	MD	1	0
SS167	2196739.37	6124648.72	A	MD	MD	1	0
SS168	2196771.26	6124667.70	A	MD	MD	1	0
SS170	2196817.58	6124687.20	A	MD	MD	1	0
SS171	2196835.34	6124709.55	A	MD	MD	1	0
SS172	2196867.31	6124701.72	A	MD	MD	1	0
SS173	2196887.58	6124717.51	A	MD	MD	1	0
SS174	2196916.18	6124689.61	A	MD	MD	1	0
SS175	2196902.99	6124729.03	A	MD	MD	1	0
SS176	2196935.05	6124719.89	A	MD	MD	1	0
SS177	2196983.86	6124710.53	A	MD	MD	1	0
SS179	2197191.07	6124781.53	A	MD	MD	1	0
SS180	2197244.91	6124791.56	A	MD	MD	1	0
SS181	2197379.49	6124828.19	A	MD	MD	1	0
SS182	2197469.85	6124864.82	A	MD	MD	1	0
SS183	2197519.06	6124870.11	A	MD	MD	1	0
SS184	2197611.75	6124903.36	A	MD	MD	1	0
SS185	2197569.22	6124950.61	A	MD	MD	1	0
SS186	2197550.48	6124878.43	A	MD	MD	1	0
SS187	2197296.28	6124862.77	A	MD	MD	1	0
SS188	2197262.17	6124857.25	A	MD	MD	1	0
SS189	2197168.55	6124811.98	A	MD	MD	1	0

Table C-4: Results of Munitions and Explosives of Concern Range Investigation, El Toro Site 1, Range Perimeter

Field Identifier	Northing	Easting	Item	Type	Description	Quantity	Depth (inches bgs)
SS190	2197151.75	6124810.22	A	MD	MD	1	0
SS191	2197106.74	6124800.64	A	MD	MD	1	0
SS192	2197100.17	6124785.86	A	MD	MD	1	0
SS193	2197073.30	6124795.15	A	MD	MD	1	0
SS194	2197060.40	6124768.47	A	MD	MD	1	0
SS195	2196994.78	6124757.32	A	MD	MD	1	0
SS196	2196953.57	6124760.40	A	MD	MD	1	0
SS197	2196858.98	6124746.41	A	MD	MD	1	0
SS198	2196800.53	6124724.14	A	MD	MD	1	0
SS199	2196774.42	6124736.60	A	MD	MD	1	0
SS200	2196667.59	6124710.77	A	MD	MD	1	0
SS201	2196779.11	6124690.79	A	MD	MD	1	0
SS202	2196758.92	6124688.33	A	MD	MD	1	0
SS203	2196647.36	6124665.03	A	MD	MD	1	0
SS204	2196605.71	6124659.84	A	MD	MD	1	0
SS205	2196624.33	6124672.27	A	MD	MD	1	0
SS206	2196581.68	6124614.29	A	MD	MD	1	0
SS207	2196570.07	6124653.60	A	MD	MD	1	0
SS208	2196554.83	6124611.13	A	MD	MD	1	0
SS209	2196523.30	6124630.93	A	MD	MD	1	0
SS210	2196415.26	6124554.72	A	MD	MD	1	0
SS211	2196363.55	6124514.80	A	MD	MD	1	0
SS212	2196337.83	6124530.34	A	MD	MD	1	0
SS213	2196335.24	6124506.55	A	MD	MD	1	0
SS214	2196273.77	6124514.55	A	MD	MD	1	0
SS215	2196417.03	6124659.41	A	MD	MD	1	0
SS216	2196393.55	6124744.54	A	MD	MD	1	0
SS217	2196373.41	6124759.33	A	MD	MD	1	0
SS218	2196507.70	6124795.67	A	MD	MD	1	0
SS219	2196450.05	6124641.30	A	MD	MD	1	0
SS220	2196480.62	6124861.21	A	MD	MD	1	0
SS221	2196665.19	6124799.65	A	MD	MD	1	0

Total MEC recovered during field investigation: **0**
Total MD recovered during field investigation: **176**
Total Non-MEC scrap recovered during field investigation: **49**

Attachment D
Detonation Records, and Explosives Turn-In and Accountability Documentation

EARTH TECH DEMOLITION SHOT RECORD

Site Name/Location: El Toro Site 1 1 OF 4 SIMULTANEOUS SHOTS (A)		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: (2) 40mm Grenades ; (1) 40 mm Projectile	Firing Method: Electric	Time of Shot: 1220
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 Feet	Temp: 70 Wind Dir./Speed: S-N @ 5 mph Ceiling: Clear Clouds/$ Sun: Sunny	
Type and Amount of Tamping Used: 60 Sandbags IAW Army Engineering Specifications	Mat or Other Protection Used (list): N/A	
Seismographic/Sound Level Meter Used: Yes ☒ No ☐	Readings/Results: 110 db @ Peak (150 FT)	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(1)	Time Fuze	
Det Cord (Branch Line)	10 FT	Squibs	
Det Cord (Main Line) ; Suppl Branches	195 FT	Black/Smokeless Powder	
Electric Detonator	(2) To MAIN Line	Two Component	
~~Non-El~~ Detonator, Elect For Test	(2)	Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

Site Name/Location: El Toro Site 1 2 OF 4 SIMULTANEOUS SHOTS		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: (1) 5" Zuni Warhead	Firing Method: Electric	Time of Shot: 1220
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 FEET	Temp: 70 Wind Dir./Speed: S-N @ 5 mph Ceiling: Clear Clouds/$ Sun: Sunny	
Type and Amount of Tamping Used: 225 Sandbags IAW Army Engineering Specifications	Mat or Other Protection Used (list): N/A	
Seismographic / Sound Level Meter Used: Yes ☐ No ☐	Readings/Results:	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(2)	Time Fuze	
Det Cord (Branch Line)	(2) 10 FT	Squibs	
Det Cord (Main Line)	N/A	Black/Smokeless Powder	
Non-electric Detonator		Two Component	
Non-El Detonator		Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

TOTAL Explosives
295 FT Det Cord
6 Boosters, 3/4 Lb
4 Elect. Caps

EARTH TECH
A tyco INTERNATIONAL COMPANY

EARTH TECH DEMOLITION SHOT RECORD

Site Name/Location: El Toro Site 1 3 OF 4 SIMULTANEOUS SHOTS		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: (1) 5" Zuni Warhead	Firing Method: Electric	Time of Shot: 1220
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 Feet	Temp: 70 Ceiling: Clear	Wind Dir./Speed: S-N @ 5 mph Clouds/$ Sun: Sunny
Type and Amount of Tamping Used: 225 Sandbags IAW Army Engineering Specifications		Mat or Other Protection Used (list): N/A
Seismographic/Sound Level Meter Used: Yes ☐ No ☐	Readings/Results:	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(2)	Time Fuze	
Det Cord (Branch Line)	(2) 10 FT	Squibs	
Det Cord (Main Line)		Black/Smokeless Powder	
Electric Detonator		Two Component	
Non-El Detonator		Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

Site Name/Location: El Toro Site 1 4 OF 4 SIMULTANEOUS SHOTS		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: (1) 904 Fuze, (1) M103 Fuze, (9) M30 Series Submunitions, (2) 40 MM CARTS, 1/4 lb Smokeless Powder	Firing Method: Electric	Time of Shot: 1220
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 FEET	Temp: 70 Ceiling: Clear	Wind Dir./Speed: S-N @ 5 mph Clouds/$ Sun: Sunny
Type and Amount of Tamping Used: 150 Sandbags IAW Army Engineering Specifications		Mat or Other Protection Used (list): N/A
Seismographic / Sound Level Meter Used: Yes ☐ No ☐	Readings/Results:	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(1)	Time Fuze	
Det Cord (Branch Line)	(1) 10 FT	Squibs	
Det Cord ~~(Main Line)~~ SPECIAL SHOT	(4) 10 FT	Black/Smokeless Powder	
Non-electric Detonator		Two Component	
Non-El Detonator		Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

EARTH TECH DEMOLITION SHOT RECORD

Site Name/Location: El Toro Site 1 1 OF 2 Simultaneous shots (B)		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: 2.75" RKT WHD 3" AA NAVAL Projectile, 25Lb bomblet	Firing Method: Electric	Time of Shot: 1507
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 Feet	Temp: 70 Wind Dir./Speed: S-N @ 5 mph Ceiling: Clear Clouds/$ Sun: Sunny	
Type and Amount of Tamping Used: 250 Sandbags IAW Army Engineering Specifications		Mat or Other Protection Used (list): N/A
Seismographic/Sound Level Meter Used: Yes ☒ No ☐	Readings/Results: UNKNOWN	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(2)	Time Fuze	
Det Cord (Branch Line)	(2) 10 FT	Squibs	
Det Cord (Main Line)	15 FT	Black/Smokeless Powder	
Electric Detonator ON MAINLINE	(2)	Two Component	
Non-El Detonator		Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

Site Name/Location: El Toro Site 1 2 OF 2 Simultaneous shots		Date: 4/4/2002
Shot Location (OB/OD Range or Grid No.): Northern Range	Demolition Supervisor: Buzz Barton	State License # (if applicable): 8274
Type of UXO/OE Destroyed, Vented, or Burned: (1) 5" Zuni Warhead	Firing Method: Electric	Time of Shot: 1507
Direction and Distance to Nearest Building, Road, Utility Line, etc.: 776 FEET	Temp: 70 Wind Dir./Speed: S-N @ 5 mph Ceiling: Clear Clouds/$ Sun: Sunny	
Type and Amount of Tamping Used: 225 Sandbags IAW Army Engineering Specifications		Mat or Other Protection Used (list): N/A
Seismographic / Sound Level Meter Used: Yes ☐ No ☐	Readings/Results:	

Demolition Materials Used

Description	Amount	Description	Amount
¾ LB Booster Charge	(2)	Time Fuze	
Det Cord (Branch Line)	(2) 10 FT	Squibs	
Det Cord (Main Line)		Black/Smokeless Powder	
Non-electric Detonator		Two Component	
Non-El Detonator		Other (list)	

Certification

I certify that the explosives listed were used for their intended purpose, and that the UXO/OE listed were rendered inert/destroyed.

Signature of Demolition Supervisor: Buzz E Barton Date: 4/4/2002

Total Explosives
55' Det Cord
4 Boosters, ¾ Lb
2 Elect Caps

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

ALPHA EXPLOSIVES since 1906

A Dyno Nobel Distributor

P.O. BOX 310
LINCOLN, CALIFORNIA 95648
TELEPHONE (916) 645-3377

04/05/02

STRAIGHT BILL OF LADING

NON-NEGOTIABLE

SOLD TO
EARTH TECH, INC
ATTN: PHILLIP L. UFKES
1461 EAST COOLEY DRIVE
COLTON, CA 92324

SHIP TO
EARTH TECH, INC
ATTN: BUZZ BARTON
EL TORO MARINE BASE
IRVINE, CA (ORANGE COUNTY)

ATF #: C/O ALPHA EXP ATF 9CA006193 Expiration: 02/01/03

ORDER NO.	ORDER DATE	CUSTOMER NO.	SALES PERSON	PURCHASE ORDER NO.	SHIP VIA	SHIP DATE	ROUTE
21613	04/04/02	ETE300	RC	PER BUZZ	ALPHA TRUCK	04/04/02	

QTY RETURNED	UNIT	QTY SHIPPED	ITEM NUMBER	PROPER SHIPPING NAME / ITEM DESCRIPTION	HAZARD CLASS	UN NUMBER	PKG. GROUP	DOT EXEMPTION	SHIP UNIT	SHIPPED QUANTITY
				BOOSTERS, WITHOUT DETONATORS	1.1D	UN0042	II		CS	1
				ERG 112						
				65/CS						
	EA	65	Lot 14N001J1	CAST BOOSTER D35 3/4#					CS	1
				CORD, DETONATING, FLEXIBLE	1.1D	UN0065	II		CS	1
				ERG 112						
	FT	2,000	Lot 29MY01G1	REINFORCED PRIMACORD 50GR					CS	1
				DETONATORS, ELECTRIC FOR BLASTING	1.4B	UN0255	II		CS	1
				ERG 114						
				250/CS 25/CTN						
	EA	25	Lot 06MA02P1	ELEC SUPER 12' #3					CS	0
				*** No DOT shipping # ***						
	HR	8	*DELCH	DELIVERY CHARGE					HR	8
	HR	6	*STANDBY	DRIVER STANDBY CHARGES					HR	6
				EMERGENCY CONTACT: 1/800/535-5053						

Remaining ~~2~~ ~~165~~ 1650 FT Primer Cord
53 Boosters
19 Caps, Elect.

FEDERAL LICENSE NO. 9CA015269H11327
FEDERAL LICENSE NO. 9CA031200B06193
U.S. DOT NO. 118279
HAZ. MAT. LIC. NO. HMX 35151

THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION.

FOR ALPHA DYNO NOBEL, INC. BY

RECEIVED BY: [signature]
TITLE: Master
DATE: 04/04/2002

CUSTOMER COPY

Attachment E
Munitions and Explosives of Concern Risk Evaluation Worksheets

EXPLOSIVES SAFETY RISK TOOL (NORTHERN EOD RANGE)

Based on information gathered from the Field Investigation, the Project Team can now assess baseline explosives safety risk. To use the following worksheet, start at the top of each scale and assign the first score that applies. In some cases, the score at the bottom of each scale will encompass all the scores above it.

ACCESSIBILITY ASSESSMENT

Depth Below Surface = 5	1) All OE > 10 feet. 2) All OE > 4 feet. 3) All OE > 2 feet. 4) All OE ≥ 1 foot. 5) Any OE < 1 foot.	X Actual Data ___ Best Professional Judgment
Migration/Erosion = 3	1) Very Stable: no OE will migrate 2) Minor Migration: OE not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes); extreme natural events (e.g., tornado) may cause migration 3) Moderate Migration: OE may surface over long period of time and/or through recurring natural events 4) Significant Migration: Recurring and extreme natural events will bring OE to surface 5) Highly Dynamic: OE will surface within first recurring review	___ Actual Data X Best Professional Judgment
Level of Activity (Intrusion) = 3	1) Non-intrusive: on surface only 2) Minor Intrusion: active on surface and with hand tool to 1 foot 3) Moderate Intrusion: ground disturbance with equipment to 2 feet 4) Significant Intrusion: ground disturbance with equipment to 4 feet 5) Highly Intrusive: ground disturbance more than 4 feet	___ Actual Data X Best Professional Judgment
Use above scores to give an **Accessibility Score: 5** (Conversion is weighted for depth with migration and intrusion as modifiers)	1) Depth = 1, Migration ≤ 2, Intrusion ≤ 2 2) Depth = 1, Migration ≤ 5, Intrusion ≤ 5 or Depth = 2, Migration ≤ 3, Intrusion ≤ 3 3) Depth = 2, Migration ≤ 5, Intrusion ≤ 5 or Depth = 3, Migration ≤ 4, Intrusion ≤ 4 or Depth = 4, Migration ≤ 2, Intrusion ≤ 2 4) Depth ≤ 4, Migration ≤ 5, Intrusion ≤ 5 5) Depth = 5, Migration ≤ 5, Intrusion ≤ 5	

Note:

Actual Data: *Information contained in documents, surveys or researched documentation. Actual Data is based on fact (data collected from the Field Investigation) and is weighted higher than Best Professional Judgment.*

Best Professional Judgment: *Decisions based on reviewing all available information or documentation. This decision is based on expertise and experience to form a conclusion rather than fact.*

OVERALL HAZARD ASSESSMENT		
OE Hazard Type = 5	1) Explosives substance or article, very or extremely insensitive (DOD Class 1 Divisions 1.5 and 1.6)[1] 2) Moderate fire, no blast or fragment (1.4) 3) Mass fire, minor blast, or fragment (1.3) 4) Non-mass explosion, fragment producing (1.2) 5) Mass explosion (1.1)	X Actual Data ___ Best Professional Judgment
Fuzing = 1	1) Non-fuzed (low sensitivity) 2) Fuzed (high sensitivity)	X Actual Data ___ Best Professional Judgment
Amount of Energetic Material (Impact Scale) = 1	1) < 0.5 pound 2) 0.5 to 1 pound 3) 1 to 10 pounds 4) 10 to 100 pounds 5) > 100 pounds	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Overall Hazard Score: 5**	1) Overall OE Hazard = 1, Energetic Material ≤ 3 2) Overall OE Hazard ≤ 2, Energetic Material ≤ 4 3) Overall OE Hazard ≤ 3, Energetic Material ≤ 5 4) Overall OE Hazard ≤ 4, Energetic Material ≤ 5 5) Overall OE Hazard ≤ 5, Energetic Material ≤ 5 **(Overall OE Hazard = OE Hazard Type + Fuzing Maximum Score = 5, Minimum Score = 1)**	

[1] DoD Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin, DoD 1998

EXPOSURE ASSESSMENT		
Frequency of Entry = 2	1) Rare: ≤ 1 entry/month 2) Occasional: 2-8 entries/month 3) Often: 9-15 entries/month 4) Frequent: 16-22 entries/month 5) Very Frequent: > 22 entries/month *(One entry = one person visiting per day over course of month regardless of how many entries per day)*	___ Actual Data X Best Professional Judgment
OE Density = 1	1) < 2 per acre 2) 2-10 per acre 3) 11-50 per acre 4) 50-100 per acre 5) > 100 per acre	X Actual Data ___ Best Professional Judgment
Intensity of Activity = 3	1) Very Low: < 1 hour/day and light activity 2) Low: ≤ 3 hours/day and light activity 3) Moderate: ≤ 6 hours/day and light/moderate activity 4) High: ≤ 9 hours/day or moderate activity 5) Very High: > 9 hours/day or heavy activity *(e.g., Light = walking, hiking & bird watching; Moderate = bicycling, horse back riding, etc.; High = off-roading in motorized vehicles)*	___ Actual Data X Best Professional Judgment
Portability = 5	1) Not Portable 2) Portable by motorized vehicle/livestock (very low portability) 3) Portable by 2 adults (low portability) 4) Portable by 1 adult (moderately portable) 5) Portable by a child (easily portable)	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Exposure Score: 2**	1) Frequency ≤ 2, Density ≤ 2, Intensity ≤ 4, Portability ≤ 4 2) Frequency ≤ 3, Density ≤ 3, Intensity ≤ 5, Portability ≤ 5 3) Frequency ≤ 4, Density ≤ 4, Intensity ≤ 5, Portability ≤ 5 4) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 4, Portability ≤ 4 5) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 5, Portability ≤ 5	

EXPLOSIVES SAFETY RISK ASSESSMENT	
Record the Accessibility, Overall Hazard, and Exposure Scores here and use them to give an Explosives Safety Risk score: Accessibility = 5 Overall Hazard = 5 Exposure = 2 **Explosives Safety Risk: E**	A) Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure ≤ 2 B) Accessibility ≤ 2, Overall Hazard ≤ 5, Exposure ≤ 2 or Accessibility ≤ 3, Overall Hazard ≤ 3, Exposure ≤ 3 C) Accessibility ≤ 4, Overall Hazard ≤ 3, Exposure ≤ 4 or Accessibility ≤ 3, Overall Hazard ≤ 5, Exposure ≤ 3 or Accessibility = 5, Overall Hazard ≤ 3, Exposure ≤ 2 or Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure = 5 D) Accessibility ≤ 4, Overall Hazard ≤ 5, Exposure ≤ 4 or Accessibility ≤ 5, Overall Hazard ≤ 3, Exposure ≤ 5 E) Accessibility ≤ 5, Overall Hazard ≤ 5, Exposure ≤ 5

EXPLOSIVES SAFETY RISK TOOL (SOUTHERN EOD RANGE)

Based on information gathered from the Field Investigation, the Project Team can now assess baseline explosives safety risk. To use the following worksheet, start at the top of each scale and assign the first score that applies. In some cases, the score at the bottom of each scale will encompass all the scores above it.

ACCESSIBILITY ASSESSMENT

Depth Below Surface = N/A	1) All OE > 10 feet. 2) All OE > 4 feet. 3) All OE > 2 feet. 4) All OE ≥ 1 foot. 5) Any OE < 1 foot.	X Actual Data ___ Best Professional Judgment
Migration/Erosion = 3	1) Very Stable: no OE will migrate 2) Minor Migration: OE not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes); extreme natural events (e.g., tornado) may cause migration 3) Moderate Migration: OE may surface over long period of time and/or through recurring natural events 4) Significant Migration: Recurring and extreme natural events will bring OE to surface 5) Highly Dynamic: OE will surface within first recurring review	___ Actual Data X Best Professional Judgment
Level of Activity (Intrusion) = 3	1) Non-intrusive: on surface only 2) Minor Intrusion: active on surface and with hand tool to 1 foot 3) Moderate Intrusion: ground disturbance with equipment to 2 feet 4) Significant Intrusion: ground disturbance with equipment to 4 feet 5) Highly Intrusive: ground disturbance more than 4 feet	___ Actual Data X Best Professional Judgment
Use above scores to give an **Accessibility Score: 2** (Conversion is weighted for depth with migration and intrusion as modifiers)	1) Depth = 1, Migration ≤ 2, Intrusion ≤ 2 2) Depth = 1, Migration ≤ 5, Intrusion ≤ 5 or Depth = 2, Migration ≤ 3, Intrusion ≤ 3 3) Depth = 2, Migration ≤ 5, Intrusion ≤ 5 or Depth = 3, Migration ≤ 4, Intrusion ≤ 4 or Depth = 4, Migration ≤ 2, Intrusion ≤ 2 4) Depth ≤ 4, Migration ≤ 5, Intrusion ≤ 5 5) Depth = 5, Migration ≤ 5, Intrusion ≤ 5	

Note:

Actual Data: *Information contained in documents, surveys or researched documentation. Actual Data is based on fact (data collected from the Field Investigation) and is weighted higher than Best Professional Judgment.*

Best Professional Judgment: *Decisions based on reviewing all available information or documentation. This decision is based on expertise and experience to form a conclusion rather than fact.*

OVERALL HAZARD ASSESSMENT		
OE Hazard Type = 3	1) Explosives substance or article, very or extremely insensitive (DOD Class 1 Divisions 1.5 and 1.6)[1] 2) Moderate fire, no blast or fragment (1.4) 3) Mass fire, minor blast, or fragment (1.3) 4) Non-mass explosion, fragment producing (1.2) 5) Mass explosion (1.1)	X Actual Data ___ Best Professional Judgment
Fuzing = 1	1) Non-fuzed (low sensitivity) 2) Fuzed (high sensitivity)	X Actual Data ___ Best Professional Judgment
Amount of Energetic Material (Impact Scale) = 1	1) < 0.5 pound 2) 0.5 to 1 pound 3) 1 to 10 pounds 4) 10 to 100 pounds 5) > 100 pounds	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Overall Hazard Score: 3**	1) Overall OE Hazard = 1, Energetic Material ≤ 3 2) Overall OE Hazard ≤ 2, Energetic Material ≤ 4 3) Overall OE Hazard ≤ 3, Energetic Material ≤ 5 4) Overall OE Hazard ≤ 4, Energetic Material ≤ 5 5) Overall OE Hazard ≤ 5, Energetic Material ≤ 5 **(Overall OE Hazard = OE Hazard Type + Fuzing Maximum Score = 5, Minimum Score = 1)**	

[1] DoD Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin, DoD 1998

EXPOSURE ASSESSMENT		
Frequency of Entry = 2	1) Rare: ≤ 1 entry/month 2) Occasional: 2-8 entries/month 3) Often: 9-15 entries/month 4) Frequent: 16-22 entries/month 5) Very Frequent: > 22 entries/month *(One entry = one person visiting per day over course of month regardless of how many entries per day)*	___ Actual Data X Best Professional Judgment
OE Density = 1	1) < 2 per acre 2) 2-10 per acre 3) 11-50 per acre 4) 50-100 per acre 5) > 100 per acre	X Actual Data ___ Best Professional Judgment
Intensity of Activity = 3	1) Very low: < 1 hour/day and light activity 2) Low: ≤ 3 hours/day and light activity 3) Moderate: ≤ 6 hours/day and light/moderate activity 4) High: ≤ 9 hours/day or moderate activity 5) Very High: > 9 hours/day or heavy activity *(e.g., Light = walking, hiking & bird watching; Moderate = bicycling, horse back riding, etc.; High = off-roading in motorized vehicles)*	___ Actual Data X Best Professional Judgment
Portability = 5	1) Not Portable 2) Portable by motorized vehicle/livestock (very low portability) 3) Portable by 2 adults (low portability) 4) Portable by 1 adult (moderately portable) 5) Portable by a child (easily portable)	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Exposure Score: 2**	1) Frequency ≤ 2, Density ≤ 2, Intensity ≤ 4, Portability ≤ 4 2) Frequency ≤ 3, Density ≤ 3, Intensity ≤ 5, Portability ≤ 5 3) Frequency ≤ 4, Density ≤ 4 , Intensity ≤ 5, Portability ≤ 5 4) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 4, Portability ≤ 4 5) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 5, Portability ≤ 5	

EXPLOSIVES SAFETY RISK ASSESSMENT	
Record the Accessibility, Overall Hazard, and Exposure Scores here and use them to give an Explosives Safety Risk score: Accessibility = 2 Overall Hazard = 3 Exposure = 2 **Explosives Safety Risk: A**	A) Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure ≤ 2 B) Accessibility ≤ 2, Overall Hazard ≤ 5, Exposure ≤ 2 or Accessibility ≤ 3, Overall Hazard ≤ 3, Exposure ≤ 3 C) Accessibility ≤ 4, Overall Hazard ≤ 3, Exposure ≤ 4 or Accessibility ≤ 3, Overall Hazard ≤ 5, Exposure ≤ 3 or Accessibility = 5, Overall Hazard ≤ 3, Exposure ≤ 2 or Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure = 5 D) Accessibility ≤ 4, Overall Hazard ≤ 5, Exposure ≤ 4 or Accessibility ≤ 5, Overall Hazard ≤ 3, Exposure ≤ 5 E) Accessibility ≤ 5, Overall Hazard ≤ 5, Exposure ≤ 5

EXPLOSIVES SAFETY RISK TOOL (BUFFER ZONE)

Based on information gathered from the Field Investigation, the Project Team can now assess baseline explosives safety risk. To use the following worksheet, start at the top of each scale and assign the first score that applies. In some cases, the score at the bottom of each scale will encompass all the scores above it.

ACCESSIBILITY ASSESSMENT

Depth Below Surface = N/A	1) All OE > 10 feet. 2) All OE > 4 feet. 3) All OE > 2 feet. 4) All OE ≥ 1 foot. 5) Any OE < 1 foot.	X Actual Data ___ Best Professional Judgment
Migration/Erosion = 3	1) Very Stable: no OE will migrate 2) Minor Migration: OE not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes); extreme natural events (e.g., tornado) may cause migration 3) Moderate Migration: OE may surface over long period of time and/or through recurring natural events 4) Significant Migration: Recurring and extreme natural events will bring OE to surface 5) Highly Dynamic: OE will surface within first recurring review	___ Actual Data X Best Professional Judgment
Level of Activity (Intrusion) = 3	1) Non-intrusive: on surface only 2) Minor Intrusion: active on surface and with hand tool to 1 foot 3) Moderate Intrusion: ground disturbance with equipment to 2 feet 4) Significant Intrusion: ground disturbance with equipment to 4 feet 5) Highly Intrusive: ground disturbance more than 4 feet	___ Actual Data X Best Professional Judgment
Use above scores to give an **Accessibility Score: 2** (Conversion is weighted for depth with migration and intrusion as modifiers)	1) Depth = 1, Migration ≤ 2, Intrusion ≤ 2 2) Depth = 1, Migration ≤ 5, Intrusion ≤ 5 or Depth = 2, Migration ≤ 3, Intrusion ≤ 3 3) Depth = 2, Migration ≤ 5, Intrusion ≤ 5 or Depth = 3, Migration ≤ 4, Intrusion ≤ 4 or Depth = 4, Migration ≤ 2, Intrusion ≤ 2 4) Depth ≤ 4, Migration ≤ 5, Intrusion ≤ 5 5) Depth = 5, Migration ≤ 5, Intrusion ≤ 5	

Note:

Actual Data: *Information contained in documents, surveys or researched documentation. Actual Data is based on fact (data collected from the Field Investigation) and is weighted higher than Best Professional Judgment.*

Best Professional Judgment: *Decisions based on reviewing all available information or documentation. This decision is based on expertise and experience to form a conclusion rather than fact.*

OVERALL HAZARD ASSESSMENT		
OE Hazard Type = 3	1) Explosives substance or article, very or extremely insensitive (DOD Class 1 Divisions 1.5 and 1.6)[1] 2) Moderate fire, no blast or fragment (1.4) 3) Mass fire, minor blast, or fragment (1.3) 4) Non-mass explosion, fragment producing (1.2) 5) Mass explosion (1.1)	X Actual Data ___ Best Professional Judgment
Fuzing = 1	1) Non-fuzed (low sensitivity) 2) Fuzed (high sensitivity)	X Actual Data ___ Best Professional Judgment
Amount of Energetic Material (Impact Scale) = 1	1) < 0.5 pound 2) 0.5 to 1 pound 3) 1 to 10 pounds 4) 10 to 100 pounds 5) > 100 pounds	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Overall Hazard Score: 3**	1) Overall OE Hazard = 1, Energetic Material ≤ 3 2) Overall OE Hazard ≤ 2, Energetic Material ≤ 4 3) Overall OE Hazard ≤ 3, Energetic Material ≤ 5 4) Overall OE Hazard ≤ 4, Energetic Material ≤ 5 5) Overall OE Hazard ≤ 5, Energetic Material ≤ 5 **(Overall OE Hazard = OE Hazard Type + Fuzing Maximum Score = 5, Minimum Score = 1)**	

[1] DoD Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin, DoD 1998

EXPOSURE ASSESSMENT		
Frequency of Entry = 2	1) Rare: ≤ 1 entry/month 2) Occasional: 2-8 entries/month 3) Often: 9-15 entries/month 4) Frequent: 16-22 entries/month 5) Very Frequent: > 22 entries/month *(One entry = one person visiting per day over course of month regardless of how many entries per day)*	___ Actual Data X Best Professional Judgment
OE Density = 1	1) < 2 per acre 2) 2-10 per acre 3) 11-50 per acre 4) 50-100 per acre 5) > 100 per acre	X Actual Data ___ Best Professional Judgment
Intensity of Activity = 3	1) Very Low: < 1 hour/day and light activity 2) Low: ≤ 3 hours/day and light activity 3) Moderate: ≤ 6 hours/day and light/moderate activity 4) High: ≤ 9 hours/day or moderate activity 5) Very High: > 9 hours/day or heavy activity *(e.g., Light = walking, hiking & bird watching; Moderate = bicycling, horse back riding, etc.; High = off-roading in motorized vehicles)*	___ Actual Data X Best Professional Judgment
Portability = 5	1) Not Portable 2) Portable by motorized vehicle/livestock (very low portability) 3) Portable by 2 adults (low portability) 4) Portable by 1 adult (moderately portable) 5) Portable by a child (easily portable)	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Exposure Score: 2**	1) Frequency ≤ 2, Density ≤ 2, Intensity ≤ 4, Portability ≤ 4 2) Frequency ≤ 3, Density ≤ 3, Intensity ≤ 5, Portability ≤ 5 3) Frequency ≤ 4, Density ≤ 4, Intensity ≤ 5, Portability ≤ 5 4) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 4, Portability ≤ 4 5) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 5, Portability ≤ 5	

EXPLOSIVES SAFETY RISK ASSESSMENT	
Record the Accessibility, Overall Hazard, and Exposure Scores here and use them to give an Explosives Safety Risk score: Accessibility = 2 Overall Hazard = 3 Exposure = 2 **Explosives Safety Risk: A**	A) Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure ≤ 2 B) Accessibility ≤ 2, Overall Hazard ≤ 5, Exposure ≤ 2 or Accessibility ≤ 3, Overall Hazard ≤ 3, Exposure ≤ 3 C) Accessibility ≤ 4, Overall Hazard ≤ 3, Exposure ≤ 4 or Accessibility ≤ 3, Overall Hazard ≤ 5, Exposure ≤ 3 or Accessibility = 5, Overall Hazard ≤ 3, Exposure ≤ 2 or Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure = 5 D) Accessibility ≤ 4, Overall Hazard ≤ 5, Exposure ≤ 4 or Accessibility ≤ 5, Overall Hazard ≤ 3, Exposure ≤ 5 E) Accessibility ≤ 5, Overall Hazard ≤ 5, Exposure ≤ 5

EXPLOSIVES SAFETY RISK TOOL (RANGE PERIMETER)

Based on information gathered from the Field Investigation, the Project Team can now assess baseline explosives safety risk. To use the following worksheet, start at the top of each scale and assign the first score that applies. In some cases, the score at the bottom of each scale will encompass all the scores above it.

ACCESSIBILITY ASSESSMENT

Depth Below Surface = N/A	1) All OE > 10 feet. 2) All OE > 4 feet. 3) All OE > 2 feet. 4) All OE ≥ 1 foot. 5) Any OE < 1 foot.	X Actual Data ___ Best Professional Judgment
Migration/Erosion = 3	1) Very Stable: no OE will migrate 2) Minor Migration: OE not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes); extreme natural events (e.g., tornado) may cause migration 3) Moderate Migration: OE may surface over long period of time and/or through recurring natural events 4) Significant Migration: Recurring and extreme natural events will bring OE to surface 5) Highly Dynamic: OE will surface within first recurring review	___ Actual Data X Best Professional Judgment
Level of Activity (Intrusion) = 3	1) Non-intrusive: on surface only 2) Minor Intrusion: active on surface and with hand tool to 1 foot 3) Moderate Intrusion: ground disturbance with equipment to 2 feet 4) Significant Intrusion: ground disturbance with equipment to 4 feet 5) Highly Intrusive: ground disturbance more than 4 feet	___ Actual Data X Best Professional Judgment
Use above scores to give an **Accessibility Score: 2** (Conversion is weighted for depth with migration and intrusion as modifiers)	1) Depth = 1, Migration ≤ 2, Intrusion ≤ 2 2) Depth = 1, Migration ≤ 5, Intrusion ≤ 5 or Depth = 2, Migration ≤ 3, Intrusion ≤ 3 3) Depth = 2, Migration ≤ 5, Intrusion ≤ 5 or Depth = 3, Migration ≤ 4, Intrusion ≤ 4 or Depth = 4, Migration ≤ 2, Intrusion ≤ 2 4) Depth ≤ 4, Migration ≤ 5, Intrusion ≤ 5 5) Depth = 5, Migration ≤ 5, Intrusion ≤ 5	

Note:

Actual Data: *Information contained in documents, surveys or researched documentation. Actual Data is based on fact (data collected from the Field Investigation) and is weighted higher than Best Professional Judgment.*

Best Professional Judgment: *Decisions based on reviewing all available information or documentation. This decision is based on expertise and experience to form a conclusion rather than fact.*

OVERALL HAZARD ASSESSMENT		
OE Hazard Type = 3	1) Explosives substance or article, very or extremely insensitive (DOD Class 1 Divisions 1.5 and 1.6)[1] 2) Moderate fire, no blast or fragment (1.4) 3) Mass fire, minor blast, or fragment (1.3) 4) Non-mass explosion, fragment producing (1.2) 5) Mass explosion (1.1)	X Actual Data ___ Best Professional Judgment
Fuzing = 1	1) Non-fuzed (low sensitivity) 2) Fuzed (high sensitivity)	X Actual Data ___ Best Professional Judgment
Amount of Energetic Material (Impact Scale) = 1	1) < 0.5 pound 2) 0.5 to 1 pound 3) 1 to 10 pounds 4) 10 to 100 pounds 5) > 100 pounds	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Overall Hazard Score: 3**	1) Overall OE Hazard = 1, Energetic Material ≤ 3 2) Overall OE Hazard ≤ 2, Energetic Material ≤ 4 3) Overall OE Hazard ≤ 3, Energetic Material ≤ 5 4) Overall OE Hazard ≤ 4, Energetic Material ≤ 5 5) Overall OE Hazard ≤ 5, Energetic Material ≤ 5 **(Overall OE Hazard = OE Hazard Type + Fuzing Maximum Score = 5, Minimum Score = 1)**	

[1] DoD Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin, DoD 1998

EXPOSURE ASSESSMENT		
Frequency of Entry = 2	1) Rare: ≤ 1 entry/month 2) Occasional: 2-8 entries/month 3) Often: 9-15 entries/month 4) Frequent: 16-22 entries/month 5) Very Frequent: > 22 entries/month *(One entry = one person visiting per day over course of month regardless of how many entries per day)*	___ Actual Data X Best Professional Judgment
OE Density = 1	1) < 2 per acre 2) 2-10 per acre 3) 11-50 per acre 4) 50-100 per acre 5) > 100 per acre	X Actual Data ___ Best Professional Judgment
Intensity of Activity = 3	1) Very Low: < 1 hour/day and light activity 2) Low: ≤ 3 hours/day and light activity 3) Moderate: ≤ 6 hours/day and light/moderate activity 4) High: ≤ 9 hours/day or moderate activity 5) Very High: > 9 hours/day or heavy activity *(e.g., Light = walking, hiking & bird watching; Moderate = bicycling, horse back riding, etc.; High = off-roading in motorized vehicles)*	___ Actual Data X Best Professional Judgment
Portability = 5	1) Not Portable 2) Portable by motorized vehicle/livestock (very low portability) 3) Portable by 2 adults (low portability) 4) Portable by 1 adult (moderately portable) 5) Portable by a child (easily portable)	X Actual Data ___ Best Professional Judgment
Use above scores to give an **Exposure Score: 2**	1) Frequency ≤ 2, Density ≤ 2, Intensity ≤ 4, Portability ≤ 4 2) Frequency ≤ 3, Density ≤ 3, Intensity ≤ 5, Portability ≤ 5 3) Frequency ≤ 4, Density ≤ 4, Intensity ≤ 5, Portability ≤ 5 4) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 4, Portability ≤ 4 5) Frequency ≤ 5, Density ≤ 5, Intensity ≤ 5, Portability ≤ 5	

EXPLOSIVES SAFETY RISK ASSESSMENT	
Record the Accessibility, Overall Hazard, and Exposure Scores here and use them to give an Explosives Safety Risk score: Accessibility = 2 Overall Hazard = 3 Exposure = 2 **Explosives Safety Risk: A**	A) Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure ≤ 2 B) Accessibility ≤ 2, Overall Hazard ≤ 5, Exposure ≤ 2 or Accessibility ≤ 3, Overall Hazard ≤ 3, Exposure ≤ 3 C) Accessibility ≤ 4, Overall Hazard ≤ 3, Exposure ≤ 4 or Accessibility ≤ 3, Overall Hazard ≤ 5, Exposure ≤ 3 or Accessibility = 5, Overall Hazard ≤ 3, Exposure ≤ 2 or Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure = 5 D) Accessibility ≤ 4, Overall Hazard ≤ 5, Exposure ≤ 4 or Accessibility ≤ 5, Overall Hazard ≤ 3, Exposure ≤ 5 E) Accessibility ≤ 5, Overall Hazard ≤ 5, Exposure ≤ 5

Appendix D
IRP Site 1 Explosive Safety Submission

FINAL EXPLOSIVE SAFETY SUBMISSION

Environmental and Construction Support for Munitions and Explosives of Concern
Installation Restoration Program Site 1
Explosive Ordnance Disposal Range
Former Marine Corps Air Station, El Toro, California

Environmental Remedial Action
Contract Number N62474-98-D-2076
Contract Task Order 0109

Document Control Number 9130
Revision 0

March 7, 2005

Submitted to:

Base Realignment and Closure
Program Management Office West
1230 Columbia Street, Suite 1100
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Submitted by:

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DRAFT EXPLOSIVE SAFETY SUBMISSION

Environmental and Construction Support for Munitions and Explosives of Concern
Installation Restoration Program Site 1
Explosive Ordnance Disposal Range
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March 7, 2005

Prepared by:

3/7/05

William Bacon
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Date

3-7-05

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Date

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Acronyms and Abbreviations

AEDA	Ammunition, Explosives, & Dangerous Articles
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DDESB	Department of the Defense Explosive Safety Board
DOD	Department of the Defense
DON	Department of the Navy
EOD	Explosive Ordnance Disposal
EP	Engineer Pamphlet
ESQD	Explosive Safety Quantity-Distance
ESS	Explosive Safety Submission
FBI	Federal Bureau of Investigation
HE	high explosive
HTW	hazardous and toxic waste
IRP	Installation Restoration Program
Kg	kilogram
MCAS	Marine Corps Air Station
MCO	Marine Corps Order
MEC	munitions and explosives of concern
MGFD	munitions with the greatest fragmentation distance
msl	mean sea level
SUXOS	Senior UXO Supervisor
TP	Technical Pamphlet
TNT	trinitrotoluene
USAESCH	United States Army Engineering and Support Center, Huntsville
UXO	unexploded ordnance

1.0 Background

The purpose of this Explosive Safety Submission (ESS) is to gain approval to use munitions and explosives of concern (MEC) construction support and anomaly avoidance techniques at Installation Restoration Program (IRP) Site 1, Explosive Ordnance Disposal (EOD) Range at the former Marine Corps Air Station (MCAS), El Toro, California. The ESS has been prepared in accordance with the Department of the Navy (DON), Marine Corps Ammunition Management and Explosives Safety Policy Manual, Marine Corps Order (MCO) P8020.10B (DON, 2004). The types of field activities to be performed at IRP Site 1 consist of the following:

- Road construction and repair
- Fence installation, locating and installing temporary trailer and above ground electrical power
- Aquifer Testing – subsurface geophysical surveying, installation of soil borings, monitoring and extraction wells, soil sampling and analysis, groundwater monitoring, groundwater pump testing, aboveground groundwater storage
- Groundwater Treatability Study – on-site bench-scale treatability studies
- Groundwater Treatment – temporary skid-mounted pilot-scale treatment systems, trenching (conveyance piping), discharge of treated groundwater.

1.1 Site Background

IRP Site 1 has been used for EOD oriented training since 1952 and the detonation of a large variety of munitions (Bechtel, 1995). Use of the EOD Range has been discontinued with the closure of MCAS El Toro in July 1999. The majority of recent military EOD training took place at the Northern EOD Range. The Orange County Sheriff's Department and other federal agencies conducted demolition training primarily at the Southern EOD Range (Bechtel, 1995). Several demolition pits, a range building, and a former observation bunker exist at the site. The range limit derived from archival records was 25 lbs net explosive weight (new) tamped.

Military ordnance used at the site included hand grenades, land mines, cluster bombs, smoke bombs, and rocket warheads. Civilian and commercial explosives, such as dynamite and plastic and gelatinous explosives were also used at the site. Munitions were detonated in trenches and pits, which were continually filled with soil and then re-excavated.

1.2 Site Location

MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1).

MCAS El Toro covers approximately 4,738 acres. Land use around the MCAS includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the Base Realignment and Closure (BRAC) Act.

IRP Site 1 is located in the northeast portion of MCAS El Toro in the foothills of the Santa Ana Mountains (Figure 2). IRP Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above mean sea level (MSL). IRP Site 1 includes the Northern EOD Range (approximately 737,250 square feet [16.9 acres]) and the Southern EOD Range (approximately 721,600 square feet [16.6 acres]), and an approximate 40-acre buffer zone, for a total of 73.7 acres (Bechtel, 1995) (Figure 2).

The various environmental and construction activities will primarily occur in the central region of the site within both the Northern and Southern EOD Range.

1.3 Land Use Restrictions

Previously, IRP Site 1 was going to be transferred to the Federal Bureau of Investigation (FBI) to be used for purposes similar in nature to the past demolition training. The DON was planning to allow access and use of approximately 3.3-acres in the southern portion of the site prior to the completion of the environmental activities required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Currently, the portions of the property will not be transferred and access to the entire property will be restricted until the completion of the CERCLA process. There are no current plans to develop the property. Once the CERCLA process is completed and a Record of Decision is in place, options for land Use Restrictions may be implemented.

1.4 Removal Depth

The majority of the planned environmental activities will be carried out using anomaly avoidance techniques (i.e., moving to different locations whenever a magnetometer indicates an anomaly in a precursor sweep of the area prior to any soil penetration). If any activity such as road building is required and anomaly avoidance is infeasible, construction support techniques will be employed to preclude encountering MEC. Since the goal of the road building activities is to provide a level surface prior to placing road base material, the maximum depth of the road construction activity will be 12 inches below ground surface. In these cases a 2 foot MEC free buffer surrounding and below the construction footprint will be created using hand held geophysical instruments to investigate subsurface anomalies prior to commencement of construction. The 2 foot buffer surrounding the construction footprint will also be cleared to 2 feet below ground surface.

1.5 Start and Completion Dates

The aquifer testing, groundwater treatablity studies and groundwater treatment activities will commence after the approval of the work plan and will take approximately 1 year or longer depending upon the number of groundwater treatment options evaluated. Road construction, fence installation, and other construction activities will occur within that timeframe and commence when required by a Task Order.

2.0 Munitions and Explosives of Concern

2.1 Reason for MEC

IRP Site 1 has been used since 1952 as a military EOD training site and demolition training area for other federal and state agencies (Bechtel, 1995).

2.2 Amount and Type of MEC

In 2002, Earth Tech conducted a characterization study and hazard analysis by intrusively investigating statistically significant portions of the four areas; the Northern EOD Range, Southern EOD Range, Buffer Zone, and Range Perimeter (Earth Tech, 2002). There investigation revealed the presence of the following 4 items of MEC in the Northern Range:

- 1 Flex-linear shaped charge;
- 2-40-mm cartridge primer
- 1/4-lb Smokeless powder.

The maximum depth of MEC scrap was 96 inches below ground surface at one of the demolition pits. No MEC was encountered in any of the other three sites.

According to Earth Tech study, the explosives safety risk at IRP Site 1 was assessed as moderate to high. They concluded that due to the potential for buried MEC, there is an elevated risk present in the Northern EOD Range. There is a slightly elevated risk for buried MEC within the Southern EOD Range caused by the potential for kick-outs. It was determined that the site was adequately characterized and no additional evaluation was required.

2.3 Munitions with the Greatest Fragmentation Distance (MGFD)

Archival records do not completely identify the munitions which were used for EOD training besides the standard blasting caps, detonating cord, donor explosives such as trinitrotoluene (TNT) blocks, and various shape charges. However, it was and is common practice as part of EOD demolition training to use projectiles as targets for various EOD tools and explosive techniques such as countercharging with C4 demolition charges or penetrating the projectile with a flexilinear or other type shape charge. Therefore, the largest fragmenting explosive that could reasonably be employed in EOD training would be a 5-inch 54 caliber high explosive (HE) projectile with 7.59 lb net explosive weight. This would be on the margin of usefulness for training because of its size, but would be within the range limit parameters and therefore is considered possible. From the Department of Defense Explosive Safety Board (DDESB) Technical Pamphlet (TP) 16, Appendix B, Page B1, an 5-inch 54 caliber Mk 41 projectile has a hazardous fragmentation distance of 358 feet which conforms to the requirement to maintain

exposure of no more than 1 fragment per 600 square feet for an accidental/unintentional detonation. Therefore, an Explosive Safety Quantity-Distance (ESQD) will be established at this distance surrounding any work site or activity (Figure 3). Even though work activities will occur at individual areas within the Northern and Southern EOD Ranges, the overall work site will be defined to encompass the entire Northern and Southern EOD Ranges. If a larger munition is encountered an amendment to this ESS will be requested and the ESQD modified accordingly.

3.0 Frost Line/Munitions Migration

Given the Southern California location of this site, frost line is not an issue. However, during heavy rains some movement of MEC could occur.

4.0 Clearance Techniques

It is not the intent to effect a removal action at IRP site 1. Rather the objective is to ensure that all Hazardous and Toxic Waste (HTW) associated activities such a soil sampling, drilling, and minor construction such as fence repair and road maintenance are conducted in a safe manner by applying the appropriate MEC/anomaly avoidance, and construction support techniques appropriate to the specific task to be executed. Methods to be employed are described in the subsequent sub paragraphs. Active duty EOD personnel will be requested to recover or remove any MEC or energetic material encountered whenever such techniques are applied and expose such an item. The responding EOD team point of contact for MCAS El Toro is the 710th EOD Team, P.O. Box 6376, San Diego, California (619-553-8500).

The entire range perimeter is encompassed by a fence and access to the site is control at the southern end of IRP Site 1 by a locked gate. During any MEC/anomaly avoidance or construction support activities, UXO teams will be allowed into the site and a person will be stationed at the gate to prevent non-essential personnel from entering the site. It is anticipated that only one task or activity will commence at any given time. If it is necessary to perform multiple tasks during a given period, the ESQD distance of 358 feet will apply. If this distance can not be met, one activity will be delayed until the other finishes and those personnel have moved far enough away or have left the site.

4.1 MEC/Anomaly Avoidance

The vast majority of HTW related support would be either avoiding surface MEC or a subsurface anomaly that could be MEC. Unexploded ordnance (UXO) technicians will provide escort for personnel transiting the site and will delineate using tape or pin flags, safe travel routes for personnel and vehicles. For fence posts, borings, wells, and soil sampling activities, anomaly avoidance techniques will be applied. The avoidance techniques that will be followed for each type of sampling required are described in the United States Army Engineering and Support Center, Huntsville (USAESCH) Engineering Pamphlet (EP) 75-1-2, MEC Support During HTW and Construction Activities (USAESCH, 2004). The site-specific work plan generated for each activity will delineate the specific techniques to be implemented. In general, a UXO Team will perform a visual surface sweep aided by hand-held magnetometers in the construction footprint and with an additional 2-foot buffer around the perimeter. Any inert MEC scrap will be removed and any surface MEC encountered will be marked with a red pin flag and active duty EOD will be contacted to respond. Before ground penetration is allowed, UXO technicians will use hand held magnetometers starting at the surface and repeating every two feet to detect any magnetic anomalies. After verification that no anomalies are present, excavation will continue for the next

two foot until the depth of desire ground penetration is achieved. If an anomaly is detected a new site must be chosen no closer than 5 feet.

4.2 Methodology for Construction Support

In those cases where movement to a new site is not possible, UXO construction support techniques will be employed in accordance with USAESCH EP 75-1-2. This will entail the same basic process as anomaly avoidance with the exception that any anomaly encountered will be investigated by the two-person UXO team. If MEC is encountered which possess energetic material, active duty military EOD personnel will be requested to respond and dispose of the item. They will follow the applicable procedures contained in the Joint Service EOD 60 Series publication system for that individual munition.

4.3 Geophysical Instruments

The UXO teams will utilize Schonstedt GA-52CX or GA-72CD magnetometers or equivalent. These magnetometers will be operated in accordance with the manufacturers operating instructions. Additionally, a magnetometer test plot will be established and utilized to ensure that the magnetometer(s) are functioning properly prior to each use.

4.4 Inert MEC Scrap

Any MEC scrap encountered will be properly examined by both UXO technicians and placed in a sealable container. The sealable container will be locked within Building 795 which is located along the eastern border of IRP Site 1 in the Southern EOD Range. As required by the Department of Defense (DOD) 4160.21-m-1, the Shaw senior UXO supervisor (SUXOS) and a government representative will both sign the DD 1348-1A form, which will contain the statement "This certifies and verifies that the Ammunition, Explosives, & Dangerous Articles (AEDA) Residue, Range Residue and/or Explosive Contaminated Property listed has been 100-percent properly inspected and to the best of our knowledge and belief, are inert and/or free of explosives or other dangerous materials." Ultimately, the scrap will be sent to a smelter (FACT International), who will provide a letter certifying receipt and disposal.

5.0 Technical Support

The UXO Team overseeing the various activities will be comprised of a minimum of two UXO technicians qualified in accordance with USAESCH EP 1110-1-18 and listed in the Huntsville UXO technician credentials database. The United States Army EOD units under the operational control of the 52nd Ordnance Group at Fort Gillem, Georgia will be used to provide EOD support. The responding EOD team point of contact for MCAS El Toro is the 710th EOD Team, P.O. Box 6376, San Diego, California (619-553-8500).

6.0 Stakeholder/Public Involvement

DON and base personnel have been involved with the planning and procedures to be employed. Regulatory parties involved with the environmental issues at IRP Site 1 have been notified as to the site status. No public involvement is required.

7.0 Maps

Several maps have been referenced throughout and included at the back of the document. The figures include a facility location map (Figure 1), a site plan showing the Northern and Southern EOD Ranges where the work activities will occur (Figure 2), and a figure indicating the maximum ESQD Arcs from the perimeter of the work site (Northern and Southern EOD Ranges) for an unintentional detonation of the MGFD (Figure 3). The area surrounding IRP Site 1 was part of a Federal-to-Federal transfer to the Federal Aviation Agency. The bulk of the area is managed for the Federal Aviation Agency by the United States Fish and Wildlife Services as a California Gnatcatcher Habitat. The military currently retains possession and control of IRP Site 1.

8.0 Magazines

Magazines will not be required at the site and none are encumbered by the ESQD of the site.

9.0 Amendments and Corrections

Any required changes will be implemented in accordance with MCO P8020.10B, Appendix E (DON, 2004).

10.0 References

Bechtel National, Inc., 1995, *Final Work Plan Phase II Remedial Investigation/Feasibility Study*, San Diego, Ca.

Department of Navy, 2004, *Marine Corps Order P8020.10B, Marine Corps Ammunition Management and Explosives Safety Policy Manual,* Washington DC, May 17.

Earth Tech, 2002, *Preliminary Draft Technical Memorandum, Ordnance and Explosives Range Evaluation at IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California*, Honolulu, HI, October.

United States Army Engineering and Support Center, Huntsville, 2004, *Engineering Pamphlet (EP) 75-1-2, Munitions and Explosive of Concern (MEC) Support During Hazardous, Toxic, and Radioactive Waste and Construction Activities*, August.

Figures

M60050_003916
MCAS EL TORO
SSIC NO. 5090.3.A

SENSITIVE RECORD

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FIGURE 1 – VICINITY MAP
IRP SITE 1

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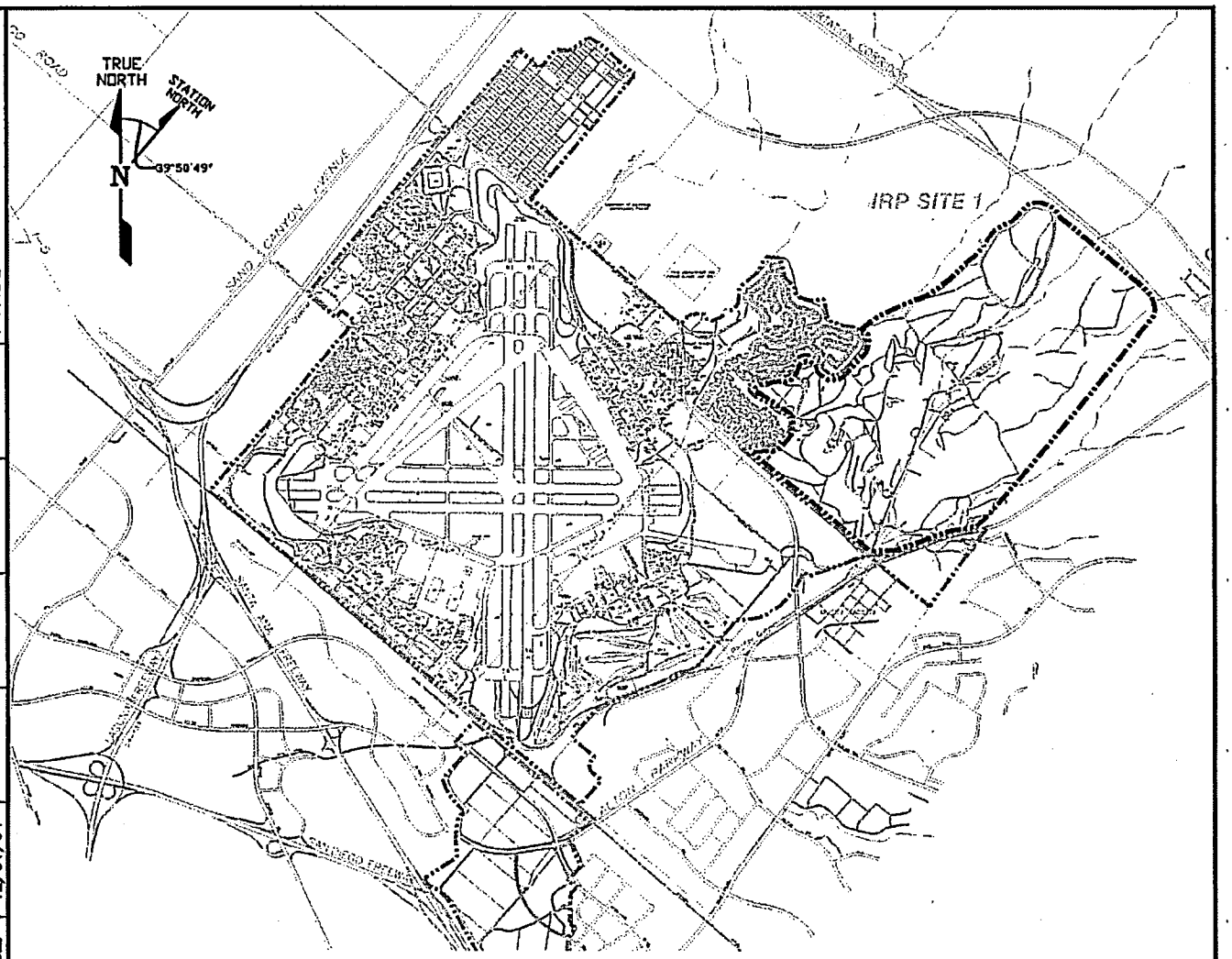
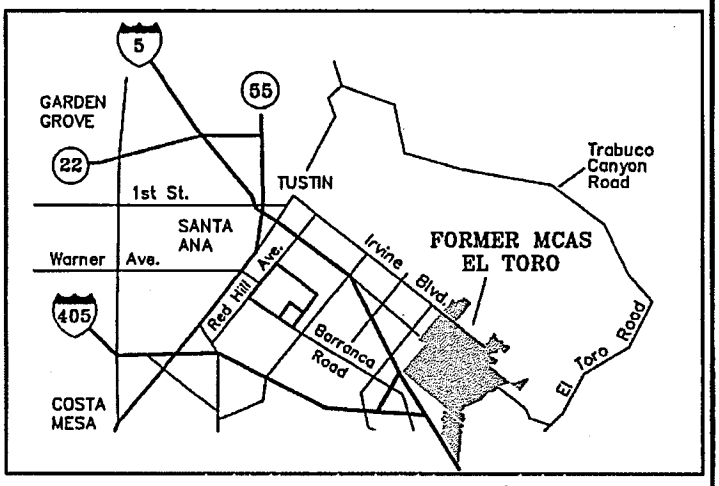




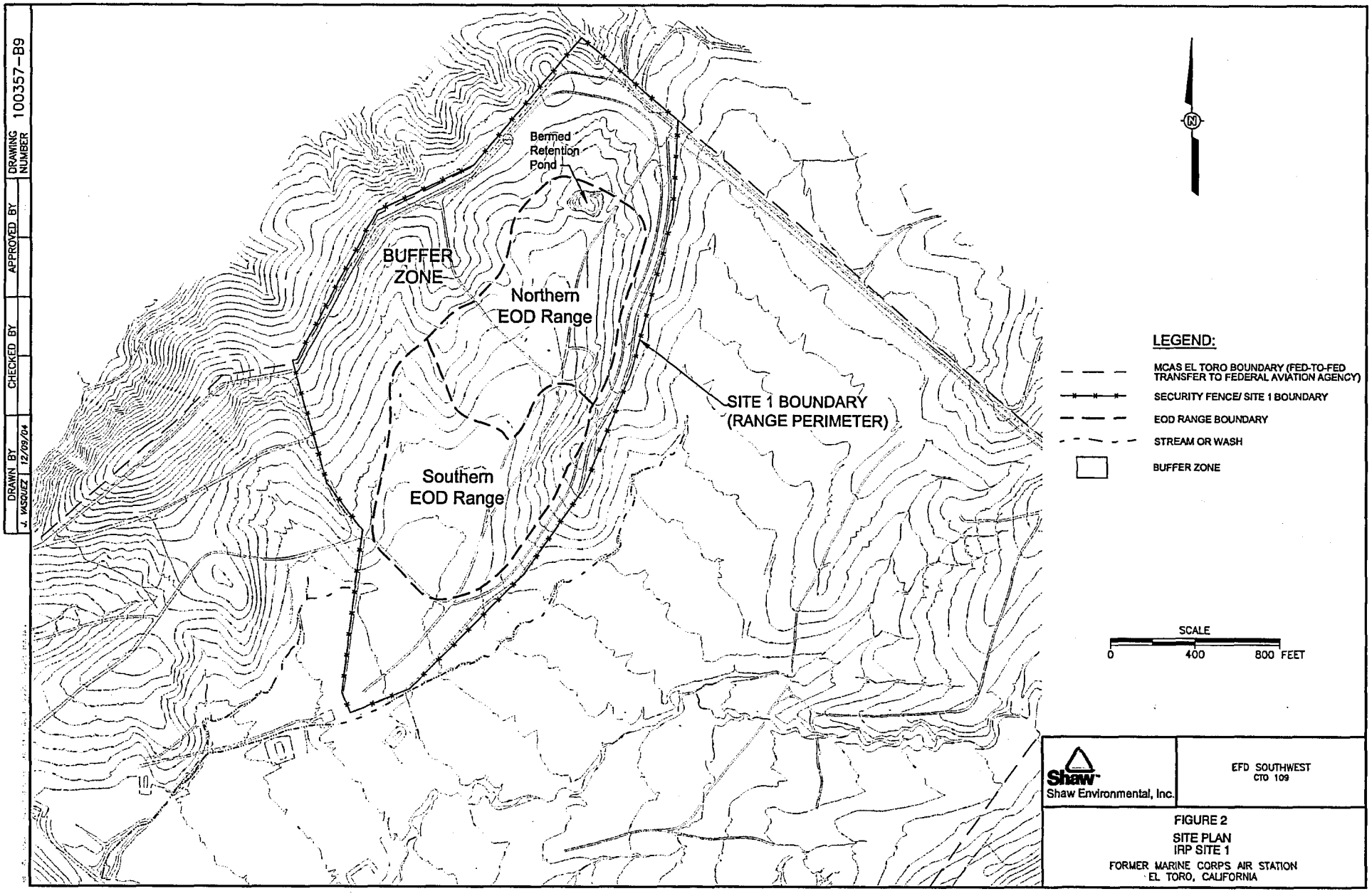
SCALE

0 4,000 8,000 FEET

Shaw Environmental, Inc.

EFD SOUTHWEST
CTO 109

FIGURE 1
VICINITY MAP
IRP SITE 1
FORMER MARINE CORPS AIR STATION
EL TORO, CALIFORNIA


Bermed Retention Pond
BUFFER ZONE
Northern EOD Range
Southern EOD Range
SITE 1 BOUNDARY (RANGE PERIMETER)
N
LEGEND:
MCAS EL TORO BOUNDARY (FED-TO-FED TRANSFER TO FEDERAL AVIATION AGENCY)
SECURITY FENCE/ SITE 1 BOUNDARY
EOD RANGE BOUNDARY
STREAM OR WASH
BUFFER ZONE
SCALE
0
400
800 FEET
Shaw
Shaw Environmental, Inc.
EFD SOUTHWEST
CTO 109
FIGURE 2
SITE PLAN
IRP SITE 1
FORMER MARINE CORPS AIR STATION
EL TORO, CALIFORNIA
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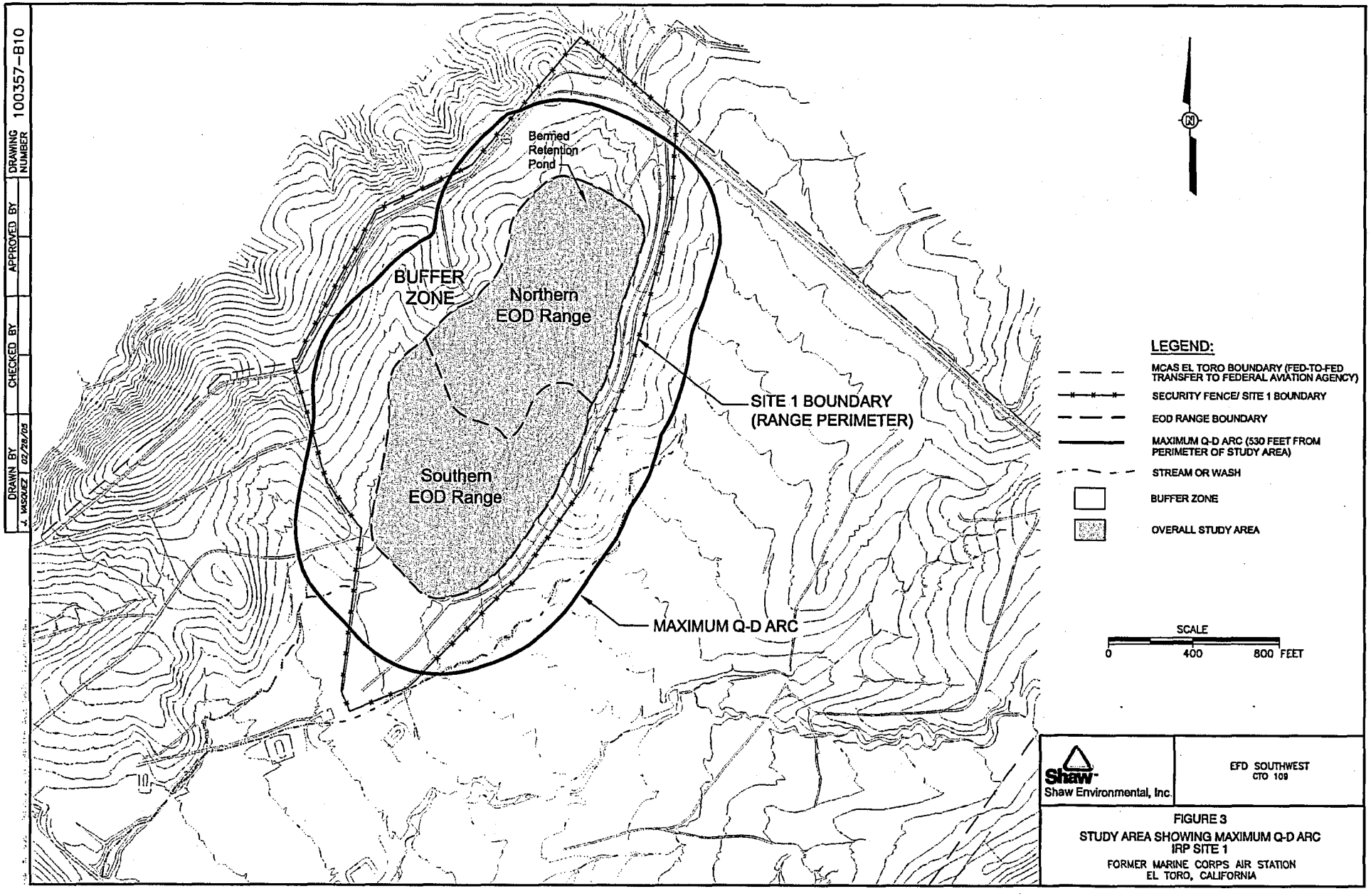

FIGURE 3
STUDY AREA SHOWING MAXIMUM Q-D ARC
IRP SITE 1
FORMER MARINE CORPS AIR STATION
EL TORO, CALIFORNIA

Appendix E
Analytical Results

Table E-1. Site 1 Pre RI Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-HA01 1 to 1.5 feet bgs LD110	01-HA01 4 feet bgs LD111	01-HA02 1 to 1.5 feet bgs LD112	01-HA02 4 feet bgs LD113	01-HA03 1 to 1.5 feet bgs LD114	01-HA03 4 feet bgs LD115	01-HA04 1 to 1.5 feet bgs LD116	01-HA04 4 feet bgs LD117	01-HA05 1 to 1.5 feet bgs LD120	01-HA05 4.5 feet bgs LD121	01-HA06 1 to 1.5 feet bgs LD122	01-HA06 4.5 feet bgs LD123	01-HA07 1 to 1.5 feet bgs LD125	01-HA07 4 feet bgs LD126	01-HA08 1 to 1.5 feet bgs LD127	01-HA08 3.5 feet bgs LD128
VOCs																		
1,1,1,2-Tetrachloroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,1,2,2-Tetrachloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
1,1-Dichloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,1-Dichloroethene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,2-Dichloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,2-Dichloropropane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
1,2-Dichlorotetrafluoroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	SW8260B	ug/kg	14 U	14 U	13 U	15 U	15 U	16 U	14 U	13 U	15 U	15 UJ	14 UJ	14 UJ	14 U	15 U	16 U	14 U
2-Hexanone	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
4-Methyl-2-Pentanone	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
Acetone	SW8260B	ug/kg	110 U	110 U	17 J	15 J	120 U	120 U	110 U	100 U	110 U	110 R	110 R	110 R	110 U	110 U	120 U	24 J
Benzene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Bromodichloromethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Bromoform	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Bromomethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
Butane, 2-Methoxy-2-Methyl-	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
Carbon Tetrachloride	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Chlorobenzene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Chlorodibromomethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Chloroethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
Chloroform	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Chloromethane	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 UJ	5.4 UJ	5.5 UJ	5.5 U	5.7 U	6.2 U	5.5 U
Cis-1,2-Dichloroethene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Cis-1,3-Dichloropropene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Dichlorodifluoromethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Methyl Tert-Butyl Ether	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Propane, 2-Ethoxy-2-Methyl-	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.6 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Tert-Butyl Alcohol	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Toluene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Trans-1,2-Dichloroethene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Trans-1,3-Dichloropropene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Trichloroethene	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Trichlorofluoromethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	SW8260B	ug/kg	5.6 U	5.5 U	4.8 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
Total Xylenes	SW8260B	ug/kg	5.6 U	5.5 U	5.5 U	5.7 U	5.9 U	6.1 U	5.6 U	5.1 U	5.6 U	5.8 U	5.4 U	5.5 U	5.5 U	5.7 U	6.2 U	5.5 U
SVOCs																		
1,2,4-Trichlorobenzene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
1,2-Dichlorobenzene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
1,3-Dichlorobenzene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
1,4-Dichlorobenzene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2,4,5-Trichlorophenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2,4,6-Trichlorophenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2,4-Dichlorophenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2,4-Dimethylphenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2,4-Dinitrophenol	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
2,4-Dinitrotoluene	SW8270C	ug/kg	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 R	530 R	NA	NA	530 R
2,6-Dinitrotoluene	SW8270C	ug/kg	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 R	530 R	NA	NA	530 R
2-Chloronaphthalene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2-Chlorophenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2-Methylnaphthalene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2-Methylphenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
2-Nitroaniline	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
2-Nitrophenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
3,3'-Dichlorobenzidine	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
3-Nitroaniline	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
4,6-Dinitro-2-Methylphenol	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
4-Bromophenyl Phenyl Ether	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
4-Chloro-3-Methylphenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
4-Chloroaniline	SW8270C	ug/kg	1100 U	1100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1100 U	1100 U	NA	NA	1100 U
4-Chlorophenyl Phenyl Ether	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
4-Methylphenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
4-Nitroaniline	SW8270C	ug/kg	2600 UJ	2700 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 UJ	2600 UJ	NA	NA	2700 UJ
4-Nitrophenol	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
Acenaphthene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Acenaphthylene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U

Table E-1. Site 1 Pre RI Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-HA01 1 to 1.5 feet bgs LD110	01-HA01 4 feet bgs LD111	01-HA02 1 to 1.5 feet bgs LD112	01-HA02 4 feet bgs LD113	01-HA03 1 to 1.5 feet bgs LD114	01-HA03 4 feet bgs LD115	01-HA04 1 to 1.5 feet bgs LD116	01-HA04 4 feet bgs LD117	01-HA05 1 to 1.5 feet bgs LD120	01-HA05 4.5 feet bgs LD121	01-HA06 1 to 1.5 feet bgs LD122	01-HA06 4.5 feet bgs LD123	01-HA07 1 to 1.5 feet bgs LD125	01-HA07 4 feet bgs LD126	01-HA08 1 to 1.5 feet bgs LD127	01-HA08 3.5 feet bgs LD128
Anthracene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Benz(A)Anthracene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Benzo(A)Pyrene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Benzo(B)Fluoranthene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Benzo(G,H,I)Perylene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Benzo(K)Fluoranthene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Bis(2-Chloro-1-Methylethyl)Ether	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Bis(2-Chloroethoxy)Methane	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Bis(2-Chloroethyl)Ether	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Bis(2-Ethylhexyl)Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Butyl Benzyl Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Carbazole	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Chrysene	SW8270C	ug/kg	530 UJ	540 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 UJ	530 UJ	NA	NA	530 UJ
Dibenz(A,H)Anthracene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Dibenzofuran	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Diethyl Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	72 J	NA	NA	530 U
Dimethyl Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Di-N-Butyl Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Di-N-Octyl Phthalate	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Fluoranthene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Fluorene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Hexachlorobenzene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Hexachlorobutadiene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Hexachlorocyclopentadiene	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
Hexachloroethane	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Indeno(1,2,3-Cd)Pyrene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Isophorone	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Naphthalene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Nitrobenzene	SW8270C	ug/kg	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 R	530 R	NA	NA	530 R
N-Nitroso-Di-N-Propylamine	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
N-Nitrosodiphenylamine	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Pentachlorophenol	SW8270C	ug/kg	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2700 U	2600 U	NA	NA	2700 U
Phenanthrene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Phenol	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Pyrene	SW8270C	ug/kg	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	530 U	NA	NA	530 U
Explosives																		
1,3,5-Trinitrobenzene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
1,3-Dinitrobenzene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
2,4,6-Trinitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
2,4-Dinitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
2,6-Dinitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
2-Amino-4,6-Dinitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
2-Nitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
3-Nitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
4-Amino-2,6-Dinitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
4-Nitrotoluene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
Methyl-2,4,6-Trinitrophenylnitramine	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
Nitrobenzene	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	SW8330	ug/kg	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	220 U	210 U	NA	NA	210 U
Hydrocarbons																		
Motor Oil	M8015E	mg/kg	28	11 U	34	6 J	7 J	0.7 J	9 J	13	7 J	5 J	6 J	11 U	24	2	4	3
Diesel	SW8015E	mg/kg	5 J	11 U	6 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	1 J	11 U	4 J	11 U	11 U	11 U
Gasoline	SW8015V	mg/kg	0.2 J	0.1 J	0.1 J	11 U	11 U	11 U	11 U	11 U	11 U	14 U	10 U	11 U	0.1 J	13 U	12 U	11 U
General Chemistry																		
Perchlorate	CLO4METH	ug/kg	21 U	22 U	21 U	22 U	21 U	22 U	21 U	21 U	22 U	22 U	22 U	22 U	21 U	29	110	210
Nitrate	CLO4METH	ug/kg	970	220 U	NA	NA	NA	NA	NA	2700	NA	NA	NA	220 U	246	NA	NA	450
PH	SW9040	pH unit	7.37	8.67	7.04	7.28	6.97	8.61	7.02	7.13	8.64	8.78	8.12	8.97	6.78	6.94	6.77	6.75
Metals																		
Aluminum	SW6010B	mg/kg	5770	3580	NA	NA	NA	NA	NA	6760	NA	NA	NA	4500	6440	NA	NA	7290
Antimony	SW6010B	mg/kg	0.2 UJ	5.4 U	NA	NA	NA	NA	NA	5.3 U	NA	NA	NA	0.21 UJ	5.3 U	NA	NA	5.3 U
Arsenic	SW6010B	mg/kg	0.71	0.45 UJ	NA	NA	NA	NA	NA	1.1	NA	NA	NA	0.34 UJ	0.83	NA	NA	0.85
Barium	SW6010B	mg/kg	34.5	30.1	NA	NA	NA	NA	NA	37.2	NA	NA	NA	30.1	36.6	NA	NA	32.2
Beryllium	SW6010B	mg/kg	0.19	0.36	NA	NA	NA	NA	NA	0.2	NA	NA	NA	0.28	0.19	NA	NA	0.23
Cadmium	SW6010B	mg/kg	0.15 UJ	0.02 UJ	NA	NA	NA	NA	NA	5.2	NA	NA	NA	0.054 UJ	0.28	NA	NA	0.045 UJ
Calcium	SW6010B	mg/kg	2090	2900	NA	NA	NA	NA	NA	2490	NA	NA	NA	12800	2400	NA	NA	2430
Chromium	SW6010B	mg/kg	4.1	1.8	NA	NA	NA	NA	NA	4.1	NA	NA	NA	4	3.4	NA	NA	4.2
Cobalt	SW6010B	mg/kg	1.3	0.67	NA	NA	NA	NA	NA	1.5	NA	NA	NA	0.93	1.3	NA	NA	1.4
Copper	SW6010B	mg/kg	3.9	0.36 UJ	NA	NA	NA	NA	NA	7	NA	NA	NA	3.1	30.4	NA	NA	1.9
Iron	SW6010B	mg/kg	3260	2190	NA	NA	NA	NA	NA	4460	NA	NA	NA	4730	3590	NA	NA	3820
Lead	SW6010B	mg/kg	9.5	0.68	NA	NA	NA	NA	NA	9.8	NA	NA	NA	1.3	13.6	NA	NA	2
Magnesium	SW6010B	mg/kg	1100	1030	NA	NA	NA	NA	NA	1290	NA	NA	NA	1140	1200	NA	NA	1350
Manganese	SW6010B	mg/kg	42.7	25.8	NA	NA	NA	NA	NA	84	NA	NA	NA	45.4	64.1	NA	NA	69
Mercury	SW7470A	mg/kg	0.53	0.22 U	NA	NA	NA	NA	NA	0.074 J	NA	NA	NA	0.22 U	0.083 J	NA	NA	0.21 UJ
Nickel	SW6010B	mg/kg	1.8	0.84	NA	NA	NA	NA	NA	96	NA	NA	NA	2.1	1.6	NA	NA	1.9

Table E-1. Site 1 Pre RI Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-HA01 1 to 1.5 feet bgs LD110	01-HA01 4 feet bgs LD111	01-HA02 1 to 1.5 feet bgs LD112	01-HA02 4 feet bgs LD113	01-HA03 1 to 1.5 feet bgs LD114	01-HA03 4 feet bgs LD115	01-HA04 1 to 1.5 feet bgs LD116	01-HA04 4 feet bgs LD117	01-HA05 1 to 1.5 feet bgs LD120	01-HA05 4.5 feet bgs LD121	01-HA06 1 to 1.5 feet bgs LD122	01-HA06 4.5 feet bgs LD123	01-HA07 1 to 1.5 feet bgs LD125	01-HA07 4 feet bgs LD126	01-HA08 1 to 1.5 feet bgs LD127	01-HA08 3.5 feet bgs LD128
Potassium	SW6010B	mg/kg	433	430	NA	NA	NA	NA	NA	769	NA	NA	NA	614	564	NA	NA	475
Selenium	SW6010B	mg/kg	1 UJ	0.79 UJ	NA	NA	NA	NA	NA	1.5	NA	NA	NA	1.8	1.4	NA	NA	1.1 UJ
Silver	SW6010B	mg/kg	0.53 U	0.54 U	NA	NA	NA	NA	NA	0.53 U	NA	NA	NA	0.55 U	0.53 U	NA	NA	0.53 U
Sodium	SW6010B	mg/kg	33.4 UJ	35.8 UJ	NA	NA	NA	NA	NA	110 U	NA	NA	NA	90.4	11.9 UJ	NA	NA	28.2 UJ
Thallium	SW6010B	mg/kg	0.53 U	0.54 U	NA	NA	NA	NA	NA	0.48 UJ	NA	NA	NA	0.55 U	0.53 U	NA	NA	0.53 U
Vanadium	SW6010B	mg/kg	5.9	4.1	NA	NA	NA	NA	NA	6.7	NA	NA	NA	5.6	5.9	NA	NA	5.5
Zinc	SW6010B	mg/kg	21.9	5.7	NA	NA	NA	NA	NA	772	NA	NA	NA	10.6	50.2	NA	NA	8.6
Dioxins																		
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	3.5 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	113	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	2.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	8.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.36 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.41 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	ng/kg	7.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	15.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	2.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	1.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal			**0.67**															
Total 2,3,7,8-TCDD TEQ (Bird)			**0.7**															

Note: All soil concentrations are on a dry weight basis.

Table E-1. Site 1 Pre RI Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-HA09 1 to 1.5 feet bgs LD129	01-HA09 1 to 1.5 feet bgs (dup) LD130	01-HA09 4 feet bgs LD131	01-HA10 1 to 1.5 feet bgs LD132	01-HA10 4.5 feet bgs LD133	01-HA11 1 to 1.5 feet bgs LD134	01-HA11 3 feet bgs LD135	01-HA12 1 to 1.5 feet bgs LD136	01-HA12 3.5 feet bgs LD137	01-HA13 1 to 1.5 feet bgs LD138	01-HA13 4 feet bgs LD139	01-HA14 1 to 1.5 feet bgs LD141	01-HA14 4 feet bgs LD142	01-SS01 0 feet bgs LD143	01-SS02 0 feet bgs LD144	01-SS03 0 feet bgs LD145
VOCs																		
1,1,1,2-Tetrachloroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
1,1,2,2-Tetrachloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
1,1,2-Trichloro-1,2,2-Trifluoroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
1,1-Dichloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
1,1-Dichloroethene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
1,2-Dichloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 R	6.2 R	5.7 R	5.8 R	5.5 R	6 R	6.1 R	5.3 U	5.3 U	NA	NA	NA
1,2-Dichloropropane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
1,2-Dichlorotetrafluoroethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	SW8260B	ug/kg	14 U	15 U	16 U	14 U	8.8 U	10 U	9.2 U	9.4 U	8.9 U	9.8 U	9.9 U	8.6 U	8.6 U	NA	NA	NA
2-Hexanone	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
4-Methyl-2-Pentanone	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
Acetone	SW8260B	ug/kg	110 U	120 U	120 UJ	12 J	110 UJ	120 UJ	110 UJ	120 UJ	110 UJ	120 UJ	120 UJ	110 UJ	110 UJ	NA	NA	NA
Benzene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Bromodichloromethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Bromoform	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Bromomethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
Butane, 2-Methoxy-2-Methyl-	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 UJ	6.2 UJ	5.7 UJ	5.8 UJ	5.5 UJ	6 UJ	6.1 UJ	5.3 UJ	5.3 UJ	NA	NA	NA
Carbon Tetrachloride	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Chlorobenzene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Chlorodibromomethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Chloroethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
Chloroform	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Chloromethane	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
Cis-1,2-Dichloroethene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Cis-1,3-Dichloropropene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Dichlorodifluoromethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Methyl Tert-Butyl Ether	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Propane, 2-Ethoxy-2-Methyl-	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Tert-Butyl Alcohol	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Toluene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Trans-1,2-Dichloroethene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Trans-1,3-Dichloropropene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Trichloroethene	SW8260B	ug/kg	5.6 U	5.8 U	6.1 UJ	5.5 UJ	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 UJ	5.3 UJ	NA	NA	NA
Trichlorofluoromethane	SW8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
Total Xylenes	SW8260B	ug/kg	5.6 U	5.8 U	6.1 U	5.5 U	5.4 U	6.2 U	5.7 U	5.8 U	5.5 U	6 U	6.1 U	5.3 U	5.3 U	NA	NA	NA
SVOCs																		
1,2,4-Trichlorobenzene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	SW8270C	ug/kg	530 R	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	SW8270C	ug/kg	530 R	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	SW8270C	ug/kg	1100 U	1100 U	1100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	SW8270C	ug/kg	2600 UJ	2600 UJ	2700 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table E-1. Site 1 Pre RI Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-HA09 1 to 1.5 feet bgs LD129	01-HA09 1 to 1.5 feet bgs (dup) LD130	01-HA09 4 feet bgs LD131	01-HA10 1 to 1.5 feet bgs LD132	01-HA10 4.5 feet bgs LD133	01-HA11 1 to 1.5 feet bgs LD134	01-HA11 3 feet bgs LD135	01-HA12 1 to 1.5 feet bgs LD136	01-HA12 3.5 feet bgs LD137	01-HA13 1 to 1.5 feet bgs LD138	01-HA13 4 feet bgs LD139	01-HA14 1 to 1.5 feet bgs LD141	01-HA14 4 feet bgs LD142	01-SS01 0 feet bgs LD143	01-SS02 0 feet bgs LD144	01-SS03 0 feet bgs LD145
Anthracene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz(A)Anthracene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	SW8270C	ug/kg	530 U	530 U	540 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloro-1-Methylethyl)Ether	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	SW8270C	ug/kg	530 UJ	530 UJ	540 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(A,H)Anthracene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	SW8270C	ug/kg	530 U	530 U	250 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	SW8270C	ug/kg	71 J	530 U	971	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	SW8270C	ug/kg	530 U	530 U	220 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-Cd)Pyrene	SW8270C	ug/kg	530 U	530 U	540 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	SW8270C	ug/kg	530 R	530 R	540 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	SW8270C	ug/kg	2600 U	2600 U	2700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	SW8270C	ug/kg	530 U	530 U	540 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives																		
1,3,5-Trinitrobenzene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-2,4,6-Trinitrophenylnitramine	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	SW8330	ug/kg	210 U	210 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons																		
Motor Oil	M8015E	mg/kg	13	9	12	17	11	7	2	7	10	5	2	5	19	59	15	37
Diesel	SW8015E	mg/kg	4 J	6 J	7 J	11 U	11 U	11 U	11 U	13	11 U	11 U	1 J	11 U	2 J	12	2 J	27
Gasoline	SW8015V	mg/kg	9.9 U	11 U	9.9 U	11 U	11 U	10 U	10 U	9.8 U	10 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
General Chemistry																		
Perchlorate	CLO4METH	ug/kg	21 U	21 U	22 U	21 U	21 U	21 U	22 U	21 U	22 U	21 U	21 U	21 U	22 U	20 U	320	20 U
Nitrate	CLO4METH	ug/kg	2600	2000	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PH	SW9040	pH unit	7.06	7.28	7.94	6.95	7.01	6.88	7.2	7.15	7.32	6.72	8.88	6.62	6.54	5.89	6.46	6.32
Metals																		
Aluminum	SW6010B	mg/kg	5790	5480	5410	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	SW6010B	mg/kg	0.57 UJ	1.1 UJ	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	SW6010B	mg/kg	0.7	0.94	0.94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	SW6010B	mg/kg	54.1	53.5	46.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	SW6010B	mg/kg	0.16	0.17	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	SW6010B	mg/kg	0.85	1.4	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	SW6010B	mg/kg	2690	2660	2570	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	SW6010B	mg/kg	3.5	4.8	5.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	SW6010B	mg/kg	1.1	1.1	0.97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	SW6010B	mg/kg	56.7	107	234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	SW6010B	mg/kg	3290	3120	3150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	SW6010B	mg/kg	44	133	67	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	SW6010B	mg/kg	1140	993	1050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	SW6010B	mg/kg	61.4	67.2	47.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	SW7470A	mg/kg	3.6	10.6	2.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	SW6010B	mg/kg	2.1	2.4	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Potassium	SW6010B	mg/kg	715	638	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	SW6010B	mg/kg	0.88 UJ	0.69 UJ	0.74 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	SW6010B	mg/kg	0.53 U	0.53 U	0.54 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	SW6010B	mg/kg	36.9 UJ	66.5	149	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	SW6010B	mg/kg	0.53 U	0.53 U	0.54 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	SW6010B	mg/kg	5.5	5.4	5.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	SW6010B	mg/kg	123	177	481	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins																		
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	11.1	32.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5 U	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	297	426	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8 U	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	6.2	16.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	14	34.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8 U	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.7 U	0.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.76 J	3.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.5 U	0.7 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.3 U	1.4 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.4 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.5 U	2.4 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.4 U	0.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.3 U	1.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.4 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.4 U	0.71 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	ng/kg	18.6	36.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 U	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	38	119	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8 U	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	9.5	12.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	4.1	10.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	0.75	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	0.5 U	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	0.4 U	1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal			**1.07**	**2.22**										**0.6**				
Total 2,3,7,8-TCDD TEQ (Bird)			**1.19**	**2.64**										**0.78**				

Note: All soil concentrations are on a dry weight basis.

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP01 LE001 1 to 1.5 feet bgs	01-DP01 LE002 5 feet bgs	01-DP02 LE003 1 to 1.5 feet bgs	01-DP02 LE004 5 feet bgs	01-DP03 LE005 1 to 1.5 feet bgs	01-DP03 LE006 5 feet bgs	01-DP04 LE007 1 to 1.5 feet bgs	01-DP04 LE008 5 feet bgs	01-DP05 LE009 1 to 1.5 feet bgs	01-DP05 LE010 1 to 1.5 feet bgs	01-DP05 LE011 5 feet bgs	01-DP06 LE013 1 to 1.5 feet bgs	01-DP06 LE014 1 to 1.5 feet bgs (dup)	01-DP06 LE015 5 feet bgs	01-DP07 LE016 1 to 1.5 feet bgs
VOCs																	
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,1-Dichloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,1-Dichloroethene	8260B	ug/kg	6.5 U	5.1 U	4.8 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,2-Dichloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,2-Dichloropropane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	65 UJ	51 U	46 U	47 U	49 U	49 UJ	55 UJ	58 UJ	69 UJ	62 UJ	59 UJ	63 UJ	72 UJ	55 UJ	50 UJ
2-Hexanone	8260B	ug/kg	65 U	51 U	46 U	47 U	49 U	49 U	55 U	58 U	69 U	62 U	59 U	63 U	72 U	55 U	50 U
4-Methyl-2-Pentanone	8260B	ug/kg	65 U	51 U	46 U	47 U	49 U	49 U	55 U	58 U	69 U	62 U	59 U	63 U	72 U	55 U	50 U
Acetone	8260B	ug/kg	130 R	100 R	93 R	95 R	98 R	98 R	110 R	120 R	140 R	120 R	120 R	130 R	140 R	110 R	100 R
Benzene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Bromodichloromethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Bromoform	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Bromomethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Carbon Tetrachloride	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Chlorobenzene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Chlorodibromomethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Chloroethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Chloroform	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Chloromethane	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Cis-1,2-Dichloroethene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Cis-1,3-Dichloropropene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Toluene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Trans-1,2-Dichloroethene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Trans-1,3-Dichloropropene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Trichloroethene	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
Total Xylenes	8260B	ug/kg	6.5 U	5.1 U	4.6 U	4.7 U	4.9 U	4.9 U	5.5 U	5.8 U	6.9 U	6.2 U	5.9 U	6.3 U	7.2 U	5.5 U	5 U
SVOCs																	
1,2,4-Trichlorobenzene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
1,2-Dichlorobenzene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
1,3-Dichlorobenzene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
1,4-Dichlorobenzene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2,4,5-Trichlorophenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2,4,6-Trichlorophenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2,4-Dichlorophenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2,4-Dimethylphenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2,4-Dinitrophenol	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
2,4-Dinitrotoluene	8270C	ug/kg	370 R	390 R	370 R	370 R	380 R	350 R	370 R	370 R	430 R	390 R	370 R	390 R	370 R	390 R	370 R
2,6-Dinitrotoluene	8270C	ug/kg	370 R	390 R	370 R	370 R	380 R	350 R	370 R	370 R	430 R	390 R	370 R	390 R	370 R	390 R	370 R
2-Chloronaphthalene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2-Chlorophenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2-Methylnaphthalene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2-Methylphenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
2-Nitroaniline	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
2-Nitrophenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
3,3'-Dichlorobenzidine	8270C	ug/kg	500 U	520 U	500 U	500 U	520 U	470 U	500 U	500 U	580 U	530 U	500 U	530 U	510 U	530 U	500 U
3-Nitroaniline	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
4-Chloro-3-Methylphenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
4-Chloroaniline	8270C	ug/kg	750 U	780 U	750 U	750 U	770 U	700 U	750 U	750 U	870 U	780 U	740 U	880 U	830 U	870 U	820 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
4-Methylphenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP01 LE001 1 to 1.5 feet bgs	01-DP01 LE002 5 feet bgs	01-DP02 LE003 1 to 1.5 feet bgs	01-DP02 LE004 5 feet bgs	01-DP03 LE005 1 to 1.5 feet bgs	01-DP03 LE006 5 feet bgs	01-DP04 LE007 1 to 1.5 feet bgs	01-DP04 LE008 5 feet bgs	01-DP05 LE009 1 to 1.5 feet bgs	01-DP05 LE010 1 to 1.5 feet bgs	01-DP05 LE011 5 feet bgs	01-DP06 LE013 1 to 1.5 feet bgs	01-DP06 LE014 1 to 1.5 feet bgs (dup)	01-DP06 LE015 5 feet bgs	01-DP07 LE016 1 to 1.5 feet bgs
4-Nitroaniline	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
4-Nitrophenol	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
Acenaphthene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Acenaphthylene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Anthracene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Benz(A)Anthracene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Benzo(A)Pyrene	8270C	ug/kg	45 U	47 U	45 U	45 U	47 U	43 U	45 U	45 U	52 U	48 U	45 U	47 U	45 U	47 U	44 U
Benzo(B)Fluoranthene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Benzo(G,H,I)Perylene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Benzo(K)Fluoranthene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	570 U	590 U	560 U	560 U	580 U	530 U	570 U	570 U	660 U	590 U	560 U	590 U	560 U	580 U	560 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	570 U	590 U	560 U	560 U	580 U	530 U	570 U	570 U	660 U	590 U	560 U	590 U	560 U	580 U	560 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	570 U	590 U	560 U	560 U	580 U	530 U	570 U	570 U	660 U	590 U	560 U	590 U	560 U	580 U	560 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	570 U	590 U	560 U	560 U	580 U	530 U	570 U	570 U	660 U	590 U	560 U	590 U	560 U	580 U	560 U
Butyl Benzyl Phthalate	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Carbazole	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Chrysene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Dibenz(A,H)Anthracene	8270C	ug/kg	62 U	55 U	62 U	62 U	64 U	59 U	62 U	62 U	72 U	65 U	62 U	43 U	40 U	42 U	40 U
Dibenzofuran	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Diethyl Phthalate	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Dimethyl Phthalate	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Di-N-Butyl Phthalate	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Di-N-Octyl Phthalate	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Fluoranthene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Fluorene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Hexachlorobenzene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Hexachlorobutadiene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Hexachlorocyclopentadiene	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
Hexachloroethane	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Isophorone	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Naphthalene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Nitrobenzene	8270C	ug/kg	370 R	370 R	370 R	370 R	380 R	350 R	370 R	370 R	430 R	390 R	370 R	390 R	370 R	390 R	370 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
N-Nitrosodiphenylamine	8270C	ug/kg	440 U	460 U	440 U	440 U	460 U	420 U	450 U	440 U	510 U	470 U	440 U	390 U	370 U	390 U	370 U
Pentachlorophenol	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1900 U	1800 U	1900 U	1900 U	2200 U	2000 U	1900 U	2000 U	1800 U	1900 U	1800 U
Phenanthrene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Phenol	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Pyrene	8270C	ug/kg	370 U	390 U	370 U	370 U	380 U	350 U	370 U	370 U	430 U	390 U	370 U	390 U	370 U	390 U	370 U
Explosives																	
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
1,3-Dinitrobenzene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	740 J	220 U	240 U	220 U	230 U	220 U
2,4-Dinitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
2,6-Dinitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	490 J	220 U	240 U	220 U	230 U	220 U
2-Nitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
3-Nitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	540	220 U	240 U	220 U	230 U	220 U
4-Nitrotoluene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	7380	220 U	240 U	220 U	230 U	220 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
Nitrobenzene	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	240 U	230 U	230 U	230 U	210 U	230 U	230 U	260 U	240 U	220 U	240 U	220 U	230 U	220 U
Hydrocarbons																	
Motor Oil	8015B DRO	mg/kg	11 U	12 U	91	11 U	12 U	11 U	6 J	11 U	5 J	12 U	11 U	4 J	4 J	12 U	11 U
Diesel	8015B DRO	mg/kg	11 U	12 U	28	11 U	12 U	11 U	11 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U	11 U
Gasoline	8015B GRO	mg/kg	0.2 J	10 U	9.4 U	9.4 U	10 U	10 U	9.4 U	10 U	0.1 J	10 U	9.2 U	10 U	9.8 U	11 U	10 U
General Chemistry																	
Perchlorate	E314	ug/kg	23 U	24 U	23 U	23 U	23 U	21 U	23 U	23 U	26 U	24 U	22 U	24 U	22 U	23 U	22 U
Nitrate	300.0	mg/kg	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3
PH	9040	pH unit	8.18	8.77	7.73	8.39	7.61	6.92	7.94	8.45	8.11	8.36	8.43	8.16	8.08	8.49	8.68
Metals																	
Aluminum	6010B	mg/kg	7380	8440	5780	6780	8110	3560	3960	6460	10200	8960	8620	6300 J	5140 J	8710 J	4930 J
Antimony	6010B	mg/kg	23 U	24 U	23 U	23 U	23 U	21 U	23 U	23 U	26 U	24 U	22 U	24 U	22 U	23 U	22 U
Arsenic	6010B	mg/kg	4	3.2	2.8	2.8	3.9	1 UJ	1.4 UJ	2.5	1.9 UJ	4.3	2.4	4.3 UJ	3.1 UJ	4.7	3 UJ
Barium	6010B	mg/kg	100	96.2	92.7	99.4	91	59.6	63.3	77.9	86.9	115	80.4	87.9 J	80.9 J	118 J	83.5 J
Beryllium	6010B	mg/kg	0.91 U	0.94 U	0.9 U	0.9 U	0.93 U	0.85 U	0.91 U	0.91 U	0.28 UJ	0.95 U	0.9 U	0.95 U	0.9 U	0.93 U	0.89 U
Cadmium	6010B	mg/kg	2	2.1	1.4	2	1.9	1.6	1.1	1.5	0.63	1.9	1.1	1.1 J	1.1 J	2.2 J	0.95 J
Calcium	6010B	mg/kg	5690	9940	7940	8840	8050	20400	2920	7390	9560	7230	4600	6150	5130	15200	7610
Chromium	6010B	mg/kg	11.3	13.5	8.5	9.8	11.9	7.2	5.8	8.8	9	14.1	8.5	9.4	7.6	12.3	7.2

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP01 LE001 1 to 1.5 feet bgs	01-DP01 LE002 5 feet bgs	01-DP02 LE003 1 to 1.5 feet bgs	01-DP02 LE004 5 feet bgs	01-DP03 LE005 1 to 1.5 feet bgs	01-DP03 LE006 5 feet bgs	01-DP04 LE007 1 to 1.5 feet bgs	01-DP04 LE008 5 feet bgs	01-DP05 LE009 1 to 1.5 feet bgs	01-DP05 LE010 1 to 1.5 feet bgs	01-DP05 LE011 5 feet bgs	01-DP06 LE013 1 to 1.5 feet bgs	01-DP06 LE014 1 to 1.5 feet bgs (dup)	01-DP06 LE015 5 feet bgs	01-DP07 LE016 1 to 1.5 feet bgs
Cobalt	6010B	mg/kg	5.2	4.8	3.5	4	4.9	2	2.4	4	3	4.4	3.6	3.8	3.5	5.3	3.5
Copper	6010B	mg/kg	7.7	5.9 J	4.7 J	4.7 J	5.8 J	2.1 J	3.1 J	3.4 J	4.1 J	6 J	4 J	5	4.6	7	4.4
Iron	6010B	mg/kg	10400	11400	8270	9050	10800	4760	5470	8880	7830	12100	8450	8980	7900	13300	8420
Lead	6010B	mg/kg	2.8	1.9	2.1	1.8	2	1.2 UJ	5.1	1.7	7.7	2.2	2.5	3.3	4.3	1.6	1.6
Magnesium	6010B	mg/kg	4710	5710	5090	5630	6170	8340	2310	4530	3190	5200	3500	4040	3400	6830	4580
Manganese	6010B	mg/kg	218 J	189 J	165 J	209 J	208 J	116 J	116 J	157 J	111 J	170 J	172 J	168 J	157 J	224 J	156 J
Mercury	7471A	mg/kg	0.078	0.066	0.065	0.053	0.07	0.043	0.061	0.046	0.12	0.1	0.048	0.075 J	0.1 J	0.063 J	0.061 J
Nickel	6010B	mg/kg	12.3	11.8	8	9.7	11	6.6	5.3	7.5	7.4	10.9	7.7	9.8	9.1	13.8	8.8
Potassium	6010B	mg/kg	2100 J	2100 J	1620 J	1830 J	2290 J	956 J	1020 J	1640 J	1170 J	2070 J	1600 J	1590	1490	2480	1540
Selenium	6010B	mg/kg	0.48	2.4 UJ	2.3 UJ	2.3 UJ	2.3 UJ	2.1 UJ	2.3 UJ	2.3 UJ	2.6 UJ	2.4 UJ	0.41 UJ	2.4 UJ	2.2 UJ	2.3 UJ	2.2 UJ
Silver	6010B	mg/kg	2.3 U	2.4 U	2.3 U	2.3 U	2.3 U	2.1 U	2.3 U	2.3 U	2.6 U	2.4 U	2.2 U	2.4 U	2.2 U	2.3 U	2.2 U
Sodium	6010B	mg/kg	91.8 UJ	470 U	29.6 UJ	450 U	470 U	125 UJ	45.8 UJ	28.3 UJ	165 UJ	27.6 UJ	450 U	470 UJ	450 UJ	470 UJ	440 UJ
Thallium	6010B	mg/kg	2.3 U	2.4 UJ	2.3 UJ	2.3 UJ	2.3 UJ	2.1 UJ	2.3 UJ	2.3 UJ	2.6 UJ	2.4 UJ	2.2 U	2.4 UJ	2.2 UJ	2.3 UJ	2.2 UJ
Vanadium	6010B	mg/kg	27.7	35	22.6	26.2	34.2	18.9	13.2	25.3	17.8	32.4	20.8	24.1	18.4	34.8	18.7
Zinc	6010B	mg/kg	36.1	34.3	25.9	29.7	34.6	18	21.7	25.1	28	33.2	27	29.2 J	27.2 J	40.1 J	25.5 J
Dioxins																	
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	NG/KG	NA	NA	0.905	NA	NA	NA	NA	NA	0.179	2.42	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	18.5	NA	NA	NA	NA	NA	2.12	30.5	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	0.454	NA	NA	NA	NA	NA	0.107	0.816	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	2.3	NA	NA	NA	NA	NA	0.423	4.55	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	0.169	NA	NA	NA	NA	NA	0.0668	0.0937 U	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	0.309	NA	NA	NA	NA	NA	0.0854	0.107 U	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	0.0751	NA	NA	NA	NA	NA	0.0644	0.11 U	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	0.201	NA	NA	NA	NA	NA	0.0775	0.103 U	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	0.143	NA	NA	NA	NA	NA	0.0678	0.254	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	0.11	NA	NA	NA	NA	NA	0.057	0.125 U	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	0.0711	NA	NA	NA	NA	NA	0.061	0.236	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	0.0783	NA	NA	NA	NA	NA	0.0517	0.0566 U	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	0.0506	NA	NA	NA	NA	NA	0.0483	0.135 U	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	0.106	NA	NA	NA	NA	NA	0.0521	0.114 U	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	0.139	NA	NA	NA	NA	NA	0.0556	0.0818 UJ	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	NG/KG	NA	NA	0.0622	NA	NA	NA	NA	NA	0.0743	0.0838 U	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	0.0759	NA	NA	NA	NA	NA	0.0884	0.114 U	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	NG/KG	NA	NA	1.23	NA	NA	NA	NA	NA	0.195	2.14	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	2.3	NA	NA	NA	NA	NA	0.761	8.51	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	NG/KG	NA	NA	0.851	NA	NA	NA	NA	NA	0.163	0.778	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	0.363	NA	NA	NA	NA	NA	0.474855	0.749	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	NG/KG	NA	NA	0.49	NA	NA	NA	NA	NA	0.173	0.0818 UJ	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	0.413583	NA	NA	NA	NA	NA	0.399355	0.439832 U	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	NG/KG	NA	NA	0.06525	NA	NA	NA	NA	NA	0.074308	0.083767 U	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	0.299145	NA	NA	NA	NA	NA	0.278158	0.114489 U	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal					**0.34**						**0.23**	**0.28**					
Total 2,3,7,8-TCDD TEQ (Bird)					**0.43**						**0.31**	**0.28**					

Note: All soil concentrations are on a dry weight basis.

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP07 LE017 1 to 1.5 feet bgs	01-DP07 LE018 5 feet bgs	01-DP08 LE019 1 to 1.5 feet bgs	01-DP08 LE020 5 feet bgs	01-DP09 LE021 1 to 1.5 feet bgs	01-DP09 LE022 5 feet bgs	01-DP10 LE023 1 to 1.5 feet bgs	01-DP10 LE024 5 feet bgs	01-DP11 LE025 1 to 1.5 feet bgs	01-DP11 LE026 5 feet bgs	01-DP12 LE027 1 to 1.5 feet bgs	01-DP12 LE028 5 feet bgs	01-DP12 LE029 5 feet bgs (dup)	01-DP13 LE030 1 to 1.5 feet bgs	01-DP13 LE031 5 feet bgs
VOCs																	
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,1-Dichloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,1-Dichloroethene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,2-Dichloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,2-Dichloropropane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	51 UJ	53 UJ	53 UJ	48 UJ	54 UJ	50 UJ	48 UJ	53 UJ	48 UJ	50 UJ	49 UJ	49 UJ	55 UJ	60 R	49 UJ
2-Hexanone	8260B	ug/kg	51 U	53 U	53 U	48 U	54 U	50 U	48 U	53 U	48 U	50 U	49 U	49 U	55 U	60 U	49 U
4-Methyl-2-Pentanone	8260B	ug/kg	51 U	53 U	53 U	48 U	54 U	50 U	48 U	53 U	48 U	50 U	49 U	49 U	55 U	60 U	49 U
Acetone	8260B	ug/kg	100 R	110 R	110 R	96 R	110 R	100 R	95 R	110 R	97 R	100 R	98 R	97 R	110 R	120 R	97 R
Benzene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Bromodichloromethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Bromoform	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Bromomethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Carbon Tetrachloride	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Chlorobenzene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Chlorodibromomethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Chloroethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Chloroform	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Chloromethane	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Cis-1,2-Dichloroethene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Cis-1,3-Dichloropropene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Toluene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Trans-1,2-Dichloroethene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Trans-1,3-Dichloropropene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Trichloroethene	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
Total Xylenes	8260B	ug/kg	5.1 U	5.3 U	5.3 U	4.8 U	5.4 U	5 U	4.8 U	5.3 U	4.8 U	5 U	4.9 U	4.9 U	5.5 U	6 U	4.9 U
SVOCs																	
1,2,4-Trichlorobenzene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
1,2-Dichlorobenzene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
1,3-Dichlorobenzene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
1,4-Dichlorobenzene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2,4,5-Trichlorophenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2,4,6-Trichlorophenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2,4-Dichlorophenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2,4-Dimethylphenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2,4-Dinitrophenol	8270C	ug/kg	1900 U	1800 UJ	1900 U	1900 U	1900 U	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1800 UJ	1800 U	1900 UJ
2,4-Dinitrotoluene	8270C	ug/kg	370 R	370 R	370 R	370 R	390 R	360 R	370 R	360 R	370 R	370 R	360 R	360 R	370 R	370 R	380 R
2,6-Dinitrotoluene	8270C	ug/kg	370 R	370 R	370 R	370 R	390 R	360 R	370 R	360 R	370 R	370 R	360 R	360 R	370 R	370 R	380 R
2-Chloronaphthalene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2-Chlorophenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2-Methylnaphthalene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2-Methylphenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
2-Nitroaniline	8270C	ug/kg	1900 U	1800 U	1900 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1900 U
2-Nitrophenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
3,3'-Dichlorobenzidine	8270C	ug/kg	510 U	500 U	510 U	510 U	530 U	490 U	510 U	490 U	500 U	510 U	490 U	360 U	370 U	370 U	380 U
3-Nitroaniline	8270C	ug/kg	1900 U	1800 U	1900 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1900 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	1900 U	1800 UJ	1900 U	1900 U	1900 U	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1900 UJ	1800 UJ	1800 U	1800 U	1800 U	1900 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
4-Chloro-3-Methylphenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
4-Chloroaniline	8270C	ug/kg	840 U	830 U	830 U	840 U	870 U	810 U	840 U	810 U	830 U	830 U	800 U	710 U	740 U	740 U	760 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
4-Methylphenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP07 LE017 1 to 1.5 feet bgs	01-DP07 LE018 5 feet bgs	01-DP08 LE019 1 to 1.5 feet bgs	01-DP08 LE020 5 feet bgs	01-DP09 LE021 1 to 1.5 feet bgs	01-DP09 LE022 5 feet bgs	01-DP10 LE023 1 to 1.5 feet bgs	01-DP10 LE024 5 feet bgs	01-DP11 LE025 1 to 1.5 feet bgs	01-DP11 LE026 5 feet bgs	01-DP12 LE027 1 to 1.5 feet bgs	01-DP12 LE028 5 feet bgs	01-DP12 LE029 5 feet bgs (dup)	01-DP13 LE030 1 to 1.5 feet bgs	01-DP13 LE031 5 feet bgs
4-Nitroaniline	8270C	ug/kg	1900 U	1800 U	1900 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1900 U	1800 U	1800 UJ	1800 UJ	1800 UJ	1900 UJ
4-Nitrophenol	8270C	ug/kg	1900 U	1800 U	1900 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1900 U
Acenaphthene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Acenaphthylene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Anthracene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Benz(A)Anthracene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Benzo(A)Pyrene	8270C	ug/kg	45 U	45 U	45 U	45 U	47 U	44 U	45 U	44 U	45 U	45 U	43 U	53 U	55 U	55 U	56 U
Benzo(B)Fluoranthene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Benzo(G,H,I)Perylene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Benzo(K)Fluoranthene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	560 U	560 U	560 U	560 U	590 U	550 U	570 U	550 U	560 U	560 U	540 U	540 U	560 U	560 U	570 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	560 U	560 U	560 U	560 U	590 U	550 U	570 U	550 U	560 U	560 U	540 U	540 U	560 U	560 U	570 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	560 U	560 U	560 U	560 U	590 U	550 U	570 U	550 U	560 U	560 U	540 U	540 U	560 U	560 U	570 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	560 U	560 U	560 U	560 U	590 U	550 U	570 U	550 U	560 U	560 U	540 U	540 U	54 J	560 U	570 U
Butyl Benzyl Phthalate	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Carbazole	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Chrysene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Dibenz(A,H)Anthracene	8270C	ug/kg	41 U	40 U	40 U	41 U	390 U	360 U	370 U	360 U	40 U	40 U	39 U	63 U	65 U	65 U	67 U
Dibenzofuran	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Diethyl Phthalate	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	110 J	370 U	360 U	360 U	370 U	370 U	380 U
Dimethyl Phthalate	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Di-N-Butyl Phthalate	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Di-N-Octyl Phthalate	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Fluoranthene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Fluorene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Hexachlorobenzene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Hexachlorobutadiene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Hexachlorocyclopentadiene	8270C	ug/kg	1900 U	1800 UJ	1900 U	1900 U	1900 U	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1900 UJ	1800 UJ	1800 U	1800 U	1800 U	1900 U
Hexachloroethane	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Isophorone	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Naphthalene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Nitrobenzene	8270C	ug/kg	370 R	370 R	370 R	370 R	390 R	360 R	370 R	360 R	370 R	370 R	360 R	360 R	370 R	370 R	380 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
N-Nitrosodiphenylamine	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Pentachlorophenol	8270C	ug/kg	1900 U	1800 U	1900 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1900 U
Phenanthrene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Phenol	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Pyrene	8270C	ug/kg	370 U	370 U	370 U	370 U	390 U	360 U	370 U	360 U	370 U	370 U	360 U	360 U	370 U	370 U	380 U
Explosives																	
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
1,3-Dinitrobenzene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
2,4-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
2-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
3-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
4-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	650	230 U	220 U	650	220 U	2200	220 U	220 U	220 U	230 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
Nitrobenzene	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	220 U	220 U	230 U	240 U	220 U	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	230 U
Hydrocarbons																	
Motor Oil	8015B DRO	mg/kg	11 U	11 U	11 U	20	12 U	11 U	11 U	11 U	11 U	11 U	86	11 U	3 J	11 U	11 U
Diesel	8015B DRO	mg/kg	11 U	11 U	11 U	8 J	12 U	11 U	11 U	11 U	11 U	11 U	43	11 U	11 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	10 U	13 U	10 U	9.8 U	11 U	10 U	9.7 U	11 U	11 U	9.9 U	10 U	10 U	10 U	10 U	9.9 U
General Chemistry																	
Perchlorate	E314	ug/kg	23 U	22 U	22 U	23 U	24 U	22 U	23 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	23 U
Nitrate	300.0	mg/kg	3	2	2	2	2	3	28	7	3	4	3	3	3	2	2
PH	9040	pH unit	8.49	8.66	8.36	8.58	8.57	8.61	7.47	8.54	8.45	8.45	8.19	8.75	8.69	8.68	8.62
Metals																	
Aluminum	6010B	mg/kg	4640 J	5400 J	5650 J	6330 J	9020 J	4110 J	7080 J	2730 J	6240 J	6510 J	3490 J	3890	3960	5450	8360
Antimony	6010B	mg/kg	23 U	22 U	22 U	23 U	24 U	22 U	23 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	23 U
Arsenic	6010B	mg/kg	3.6 UJ	3.5 UJ	4.5 UJ	3.8 UJ	8.6	2.8 UJ	3.9 UJ	2.4 UJ	3.6 UJ	3.7 UJ	2.8 UJ	2.6 UJ	3.3 UJ	3.9 UJ	4.5 UJ
Barium	6010B	mg/kg	85.7 J	92.1 J	89.6 J	97.8 J	106 J	75.8 J	110 J	100 J	95.4 J	105 J	67.8 J	68.9	120	84.3	109
Beryllium	6010B	mg/kg	0.9 U	0.89 U	0.9 U	0.9 U	0.94 U	0.88 U	0.91 U	0.88 U	0.89 U	0.9 U	0.86 U	0.87 U	0.9 U	0.89 U	0.92 U
Cadmium	6010B	mg/kg	1.2 J	1.1 J	1.5 J	1.4 J	3.7	0.78 J	1.5 J	0.29 J	3.7	1.6 J	0.5	1.1	1.3	1.5	2.1
Calcium	6010B	mg/kg	5220	7450	11400	8620	12300	5160	8100	5340	12200	8470	7830	6300	9210	7150	11300
Chromium	6010B	mg/kg	7.8	8.1	9.1	9.2	22.2	6.5	11.2	4.5	10.2	10.8	5	6.4 J	6.5 J	8.3 J	10.8 J

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP07 LE017 1 to 1.5 feet bgs	01-DP07 LE018 5 feet bgs	01-DP08 LE019 1 to 1.5 feet bgs	01-DP08 LE020 5 feet bgs	01-DP09 LE021 1 to 1.5 feet bgs	01-DP09 LE022 5 feet bgs	01-DP10 LE023 1 to 1.5 feet bgs	01-DP10 LE024 5 feet bgs	01-DP11 LE025 1 to 1.5 feet bgs	01-DP11 LE026 5 feet bgs	01-DP12 LE027 1 to 1.5 feet bgs	01-DP12 LE028 5 feet bgs	01-DP12 LE029 5 feet bgs (dup)	01-DP13 LE030 1 to 1.5 feet bgs	01-DP13 LE031 5 feet bgs
Cobalt	6010B	mg/kg	3.9	3.4	4	4.3	6.6	2.7	4.5	2.5	3.4	3.8	2.8	2.5	3	3.6	5.3
Copper	6010B	mg/kg	5.7	3.9	5.6	4.8	13.7	3.7	6.1	1.8 UJ	4.7	4.9	3.3	3.8 UJ	4.2	5.2	6.9
Iron	6010B	mg/kg	8730	9650	10100	10000	14500	7470	10600	4220	8510	9170	6390	6480	7240	8590	13900
Lead	6010B	mg/kg	4.6	1.4 J	1.6	1.3 J	2.1	1.4 J	1.9 J	0.89 J	1.5 J	1.5 J	1.2 J	1.3	1.7	1.7	1.8
Magnesium	6010B	mg/kg	3730	4210	6550	4600	6060	3240	5290	2600	3980	4720	4270	3170	4860	3890	6430
Manganese	6010B	mg/kg	180 J	156 J	190 J	188 J	228 J	123 J	193 J	107 J	153 J	160 J	136 J	110 J	146 J	153 J	218 J
Mercury	7471A	mg/kg	0.06 J	0.063 J	0.071 J	0.071 J	0.066 J	0.056 J	0.06 J	0.053 J	0.058 J	0.07 J	0.069 J	0.05 J	0.051 J	0.084 J	0.1 J
Nickel	6010B	mg/kg	12.8	7.9	12.7	10.8	26.3	7.8	11.4	5.4	9.3	11	5.4	6.7 J	9 J	9.7 J	12.5 J
Potassium	6010B	mg/kg	1650	1750	1860	1750	2350	1080	2000	619	1490	1460	1100	979 J	1220 J	1490 J	2510 J
Selenium	6010B	mg/kg	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	0.38 J	2.2 U	2.3 U	2.2 U	0.64	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.3 U
Silver	6010B	mg/kg	2.3 U	2.2 U	2.2 U	2.3 U	2.4 U	2.2 U	2.3 U	2.2 U	2.2 U	2.2 U	0.12 UJ	2.2 U	2.2 U	2.2 U	2.3 U
Sodium	6010B	mg/kg	450 UJ	450 UJ	450 UJ	450 UJ	470 UJ	440 UJ	450 UJ	440 UJ	450 UJ	450 UJ	430 UJ	137 UJ	299 UJ	450 U	283 UJ
Thallium	6010B	mg/kg	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.4 UJ	2.2 U	2.3 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.3 U
Vanadium	6010B	mg/kg	17.8	19.8	24.4	24.1	60.9	16.9	28.1	11.8	27.1	26.9	13.3	15.1	18.8	21.2	31
Zinc	6010B	mg/kg	32.1 J	25.7 J	32.1 J	31.2 J	48.9 J	22 J	35.1 J	12.4 J	28.1 J	29.2 J	18.5 J	19.3	21.7	26.1	38.3
Dioxins																	
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.595 UJ	NA	0.0889 U	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	4.6 UJ	NA	1.54 UJ	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.138 UJ	NA	0.101	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.556 UJ	NA	0.396 UJ	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0477 U	NA	0.0721 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0472	NA	0.0422 U	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0415 U	NA	0.0638 U	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0472	NA	0.044	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0438 U	NA	0.0671 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0368 U	NA	0.0491 U	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0393 U	NA	0.0603 U	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0346	NA	0.0403	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0337 U	NA	0.0436 U	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0335 U	NA	0.0447 U	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0409 UJ	NA	0.0367 UJ	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0464 U	NA	0.0493 U	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.0556 U	NA	0.0585 U	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.305 UJ	NA	0.064917 U	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.948 UJ	NA	0.64 UJ	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.253	NA	0.044	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.313179 U	NA	0.42178 U	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.153 UJ	NA	0.077 UJ	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.299015 U	NA	0.379602 U	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.048426 U	NA	0.04933 U	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	0.250228 U	NA	0.306249 U	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal											**0.08**		**0.09**				
Total 2,3,7,8-TCDD TEQ (Bird)											**0.11**		**0.12**				

Note: All soil concentrations are on a dry weight basis.

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP14 LE032 1 to 1.5 feet bgs	01-DP14 LE033 5 feet bgs	01-DP15 LE034 1 to 1.5 feet bgs	01-DP15 LE035 5 feet bgs	01-DP16 LE036 1 to 1.5 feet bgs	01-DP16 LE037 5 feet bgs	01-DP17 LE038 1 to 1.5 feet bgs	01-DP17 LE039 5 feet bgs
VOCs										
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,1-Dichloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,1-Dichloroethene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,2-Dichloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,2-Dichloropropane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	46 UJ	49 UJ	48 UJ	46 UJ	49 UJ	51 UJ	48 UJ	51 UJ
2-Hexanone	8260B	ug/kg	46 U	49 U	48 U	46 U	49 U	51 U	48 U	51 U
4-Methyl-2-Pentanone	8260B	ug/kg	46 U	49 U	48 U	46 U	49 U	51 U	48 U	51 U
Acetone	8260B	ug/kg	92 R	98 R	96 R	92 R	97 R	100 R	96 R	100 R
Benzene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Bromodichloromethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Bromoform	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Bromomethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Carbon Tetrachloride	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Chlorobenzene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Chlorodibromomethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Chloroethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Chloroform	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Chloromethane	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Cis-1,2-Dichloroethene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Cis-1,3-Dichloropropene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Toluene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Trans-1,2-Dichloroethene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Trans-1,3-Dichloropropene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Trichloroethene	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
Total Xylenes	8260B	ug/kg	4.6 U	4.9 U	4.8 U	4.6 U	4.9 U	5.1 U	4.8 U	5.1 U
SVOCs										
1,2,4-Trichlorobenzene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
1,2-Dichlorobenzene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
1,3-Dichlorobenzene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
1,4-Dichlorobenzene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2,4,5-Trichlorophenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2,4,6-Trichlorophenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2,4-Dichlorophenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2,4-Dimethylphenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2,4-Dinitrophenol	8270C	ug/kg	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1700 UJ	1900 UJ	1800 UJ	1700 UJ
2,4-Dinitrotoluene	8270C	ug/kg	360 R	380 R	370 R	370 R	350 R	370 R	370 R	350 R
2,6-Dinitrotoluene	8270C	ug/kg	360 R	380 R	370 R	370 R	350 R	370 R	370 R	350 R
2-Chloronaphthalene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2-Chlorophenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2-Methylnaphthalene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2-Methylphenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
2-Nitroaniline	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
2-Nitrophenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
3,3'-Dichlorobenzidine	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
3-Nitroaniline	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
4-Chloro-3-Methylphenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
4-Chloroaniline	8270C	ug/kg	720 U	750 U	730 U	730 U	700 U	740 U	730 U	690 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
4-Methylphenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP14 LE032 1 to 1.5 feet bgs	01-DP14 LE033 5 feet bgs	01-DP15 LE034 1 to 1.5 feet bgs	01-DP15 LE035 5 feet bgs	01-DP16 LE036 1 to 1.5 feet bgs	01-DP16 LE037 5 feet bgs	01-DP17 LE038 1 to 1.5 feet bgs	01-DP17 LE039 5 feet bgs
4-Nitroaniline	8270C	ug/kg	1800 UJ	1900 UJ	1800 UJ	1800 UJ	1700 UJ	1900 UJ	1800 UJ	1700 UJ
4-Nitrophenol	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
Acenaphthene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Acenaphthylene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Anthracene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Benz(A)Anthracene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Benzo(A)Pyrene	8270C	ug/kg	54 U	56 U	54 U	54 U	52 U	55 U	55 U	51 U
Benzo(B)Fluoranthene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Benzo(G,H,I)Perylene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Benzo(K)Fluoranthene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	550 U	570 U	550 U	550 U	530 U	560 U	560 U	520 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	550 U	570 U	550 U	550 U	530 U	560 U	560 U	520 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	550 U	570 U	550 U	550 U	530 U	560 U	560 U	520 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	550 U	570 U	550 U	550 U	530 U	560 U	560 U	520 U
Butyl Benzyl Phthalate	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Carbazole	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Chrysene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Dibenz(A,H)Anthracene	8270C	ug/kg	64 U	66 U	64 U	64 U	61 U	65 U	65 U	61 U
Dibenzofuran	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Diethyl Phthalate	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Dimethyl Phthalate	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Di-N-Butyl Phthalate	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Di-N-Octyl Phthalate	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Fluoranthene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Fluorene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Hexachlorobenzene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Hexachlorobutadiene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Hexachlorocyclopentadiene	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
Hexachloroethane	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Isophorone	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Naphthalene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Nitrobenzene	8270C	ug/kg	360 R	380 R	370 R	370 R	350 R	370 R	370 R	350 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
N-Nitrosodiphenylamine	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Pentachlorophenol	8270C	ug/kg	1800 U	1900 U	1800 U	1800 U	1700 U	1900 U	1800 U	1700 U
Phenanthrene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Phenol	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Pyrene	8270C	ug/kg	360 U	380 U	370 U	370 U	350 U	370 U	370 U	350 U
Explosives										
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
1,3-Dinitrobenzene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2,4-Dinitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2,6-Dinitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
2-Nitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
3-Nitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
4-Nitrotoluene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
Nitrobenzene	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	230 U	220 U	220 U	210 U	220 U	220 U	210 U
Hydrocarbons										
Motor Oil	8015B DRO	mg/kg	11 U	11 U	3 J	11 U	11 U	11 U	11 U	10 U
Diesel	8015B DRO	mg/kg	11 U	11 U	11 U	11 U	11 U	11 U	11 U	10 U
Gasoline	8015B GRO	mg/kg	9.6 U	9.5 U	9.3 U	9.3 U	9.3 U	10 U	9.2 U	11 U
General Chemistry										
Perchlorate	E314	ug/kg	22 U	23 U	22 U	22 U	21 U	22 U	22 U	21 U
Nitrate	300.0	mg/kg	2	2	3	2	2	2	2	3
PH	9040	pH unit	8.97	8.74	8.38	8.46	8.51	8.62	8.45	8.43
Metals										
Aluminum	6010B	mg/kg	4330	4770	4570	6110	5090	4610	5610	2980
Antimony	6010B	mg/kg	22 U	23 U	22 U	22 U	21 U	22 U	22 U	21 U
Arsenic	6010B	mg/kg	3.2 UJ	3.9 UJ	3.7 UJ	4.1 UJ	2.9 UJ	3.3 UJ	3.1 UJ	2.8 UJ
Barium	6010B	mg/kg	91.4	84.8	70.9	93	90.8	71.5	88.6	61.6
Beryllium	6010B	mg/kg	0.88 U	0.91 U	0.89 U	0.89 U	0.85 U	0.9 U	0.89 U	0.84 U
Cadmium	6010B	mg/kg	1.8	2.2	1.4	2	1.6	1.7	1.7	1
Calcium	6010B	mg/kg	12000	7260	4520	6960	5900	8650	3780	4320
Chromium	6010B	mg/kg	8.6 J	8.1 J	7.5 J	9.6 J	8.3 J	8.1 J	10 J	5.4 J

Table E-2. Site 1 EBS Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP14 LE032 1 to 1.5 feet bgs	01-DP14 LE033 5 feet bgs	01-DP15 LE034 1 to 1.5 feet bgs	01-DP15 LE035 5 feet bgs	01-DP16 LE036 1 to 1.5 feet bgs	01-DP16 LE037 5 feet bgs	01-DP17 LE038 1 to 1.5 feet bgs	01-DP17 LE039 5 feet bgs
Cobalt	6010B	mg/kg	3.3	3.9	3.1	3.8	3.4	3.3	4	2.4
Copper	6010B	mg/kg	6.3	6.2	4.6	6	4.6	4.7	6.5	3.5 UJ
Iron	6010B	mg/kg	7750	9150	7140	10100	7770	7870	8210	5440
Lead	6010B	mg/kg	1.1	1.7	3.4	1.3	1.8	1.3	2	1
Magnesium	6010B	mg/kg	4330	3890	2860	4290	3480	4060	2690	2170
Manganese	6010B	mg/kg	140 J	172 J	130 J	171 J	162 J	133 J	163 J	96.5 J
Mercury	7471A	mg/kg	0.22 U	0.1 J	0.034 J	0.22 U	0.21 U	0.24 J	0.057 J	0.11 J
Nickel	6010B	mg/kg	11.6 J	13.4 J	9.5 J	11.7 J	9.8 J	10.6 J	11.1 J	5.9 J
Potassium	6010B	mg/kg	1370 J	1500 J	1230 J	1670 J	1340 J	1260 J	1330 J	739 J
Selenium	6010B	mg/kg	2.2 U	2.3 U	2.2 U	2.2 U	2.1 U	2.2 U	2.2 U	0.37
Silver	6010B	mg/kg	2.2 U	2.3 U	2.2 U	2.2 U	2.1 U	2.2 U	2.2 U	2.1 U
Sodium	6010B	mg/kg	218 UJ	460 U	440 U	440 U	420 U	51.8 UJ	450 U	420 U
Thallium	6010B	mg/kg	2.2 U	2.3 U	2.2 U	2.2 U	2.1 U	2.2 U	2.2 U	2.1 U
Vanadium	6010B	mg/kg	19.6	20.5	17.7	24.4	19.5	20.3	20.3	13
Zinc	6010B	mg/kg	23	27.8	23.4	28.8	22.6	22.5	28.5	14.5
Dioxins										
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal										
Total 2,3,7,8-TCDD TEQ (Bird)										

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP18 LE060 1 to 1.5 feet bgs	01-DP18 LE061 5 feet bgs	01-DP19 LE062 1 to 1.5 feet bgs	01-DP19 LE063 5 feet bgs	01-DP20 LE064 1 to 1.5 feet bgs	01-DP20 LE065 5 feet bgs	01-DP20 LE066 5 feet bgs (dup)	01-DP21 LE067 1 to 1.5 feet bgs	01-DP21 LE068 5 feet bgs	01-DP24 LE069 1 to 1.5 feet bgs	01-DP24 LE070 5 feet bgs	01-DP25 LE071 1 to 1.5 feet bgs	01-DP25 LE072 5 feet bgs	01-DP22 LE073 1 to 1.5 feet bgs	01-DP22 LE074 5 feet bgs	01-DP23 LE075 1 to 1.5 feet bgs
VOCs																		
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,1-Dichloroethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,1-Dichloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,2-Dichloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,2-Dichloropropane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	110 UJ	190 UJ	140 UJ	100 UJ	110 UJ	130 UJ	140 UJ	98 UJ	180 UJ	140 UJ	160 UJ	150 UJ	140 UJ	180 UJ	95 UJ	92 U
2-Hexanone	8260B	ug/kg	56 U	93 U	71 U	51 U	56 U	65 U	72 U	49 U	89 U	70 U	78 U	75 U	68 U	88 U	47 U	46 U
4-Methyl-2-Pentanone	8260B	ug/kg	56 U	93 U	71 U	51 U	56 U	65 U	72 U	49 U	89 U	2 J	78 U	75 U	68 U	88 U	47 U	46 U
Acetone	8260B	ug/kg	110 UJ	190 UJ	140 UJ	100 UJ	110 UJ	130 UJ	140 UJ	98 UJ	180 UJ	140 UJ	160 UJ	150 UJ	140 UJ	180 UJ	95 UJ	92 UJ
Benzene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Bromodichloromethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Bromoform	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Bromomethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Carbon Tetrachloride	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Chlorobenzene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Chlorodibromomethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Chloroethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Chloroform	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Chloromethane	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Cis-1,2-Dichloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Cis-1,3-Dichloropropene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Toluene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	0.7 J	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Trans-1,2-Dichloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Trans-1,3-Dichloropropene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Trichloroethene	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	5.6 U	9.3 U	7.1 U	5.1 U	5.6 U	6.5 U	7.2 U	4.9 U	8.9 U	7 U	7.8 U	7.5 U	6.8 U	8.8 U	4.7 U	4.6 U
Total Xylenes	8260B	ug/kg	17 U	28 U	21 U	15 U	17 U	19 U	22 U	15 U	27 U	21 U	23 U	23 U	20 U	26 U	14 U	14 U
SVOCs																		
1,2,4-Trichlorobenzene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
1,2-Dichlorobenzene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
1,3-Dichlorobenzene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
1,4-Dichlorobenzene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2,4,5-Trichlorophenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2,4,6-Trichlorophenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2,4-Dichlorophenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2,4-Dimethylphenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2,4-Dinitrophenol	8270C	ug/kg	3000 U	2800 UJ	2700 U	2800 UJ	2700 U	2800 U	2700 U	2700 U	2700 UJ	2900 UJ	2700 UJ	2700 U	2800 UJ	2700 U	2700 U	2700 U
2,4-Dinitrotoluene	8270C	ug/kg	610 R	560 R	530 R	570 R	540 R	560 R	540 R	530 R	530 R	570 R	550 R	540 R	550 R	540 R	540 R	540 R
2,6-Dinitrotoluene	8270C	ug/kg	610 R	560 R	530 R	570 R	540 R	560 R	540 R	530 R	530 R	570 R	550 R	540 R	550 R	540 R	540 R	540 R
2-Chloronaphthalene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2-Chlorophenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2-Methylnaphthalene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2-Methylphenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
2-Nitroaniline	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
2-Nitrophenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
3,3'-Dichlorobenzidine	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
3-Nitroaniline	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
4-Chloro-3-Methylphenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
4-Chloroaniline	8270C	ug/kg	1200 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
4-Methylphenol	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP18	01-DP18	01-DP19	01-DP19	01-DP20	01-DP20	01-DP20	01-DP21	01-DP21	01-DP24	01-DP24	01-DP25	01-DP25	01-DP22	01-DP22	01-DP23
			LE060	LE061	LE062	LE063	LE064	LE065	LE066	LE067	LE068	LE069	LE070	LE071	LE072	LE073	LE074	LE075
Analyte	Analytical Method	Units	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs
4-Nitroaniline	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
4-Nitrophenol	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
Acenaphthene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Acenaphthylene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Anthracene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Benz(A)Anthracene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Benzo(A)Pyrene	8270C	ug/kg	30 U	28 U	27 U	28 U	27 U	28 U	27 U	27 U	27 U	29 U	27 U	27 U	28 U	27 U	27 U	27 U
Benzo(B)Fluoranthene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Benzo(G,H,I)Perylene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Benzo(K)Fluoranthene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	200 U	180 U	170 U	190 U	170 U	180 U	180 U	170 U	170 U	190 U	180 U	180 U	180 U	170 U	180 U	170 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Butyl Benzyl Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Carbazole	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Chrysene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Dibenz(A,H)Anthracene	8270C	ug/kg	44 U	40 U	38 U	41 U	39 U	40 U	39 U	38 U	38 U	41 U	40 U	39 U	40 U	39 U	39 U	39 U
Dibenzofuran	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Diethyl Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Dimethyl Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Di-N-Butyl Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Di-N-Octyl Phthalate	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Fluoranthene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Fluorene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Hexachlorobenzene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Hexachlorobutadiene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Hexachlorocyclopentadiene	8270C	ug/kg	3000 U	2800 U	2700 U	2800 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U
Hexachloroethane	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Isophorone	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Naphthalene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Nitrobenzene	8270C	ug/kg	610 R	560 R	530 R	570 R	540 R	560 R	540 R	530 R	530 R	570 R	550 R	540 R	550 R	540 R	540 R	540 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	54 U	50 U	48 U	51 U	48 U	50 U	49 U	48 U	48 U	51 U	49 U	48 U	50 U	48 U	49 U	48 U
N-Nitrosodiphenylamine	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Pentachlorophenol	8270C	ug/kg	2100 U	1900 U	1800 U	1900 U	1800 U	1900 U	1800 U	1800 U	1800 U	1900 U	1900 U	1800 U	1900 U	1800 U	1800 U	1800 U
Phenanthrene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Phenol	8270C	ug/kg	868	100 J	83 J	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	94 J
Pyrene	8270C	ug/kg	610 U	560 U	530 U	570 U	540 U	560 U	540 U	530 U	530 U	570 U	550 U	540 U	550 U	540 U	540 U	540 U
Explosives																		
1,3,5-Trinitrobenzene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
1,3-Dinitrobenzene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
2,4,6-Trinitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
2,4-Dinitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
2,6-Dinitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
2-Nitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
3-Nitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
4-Nitrotoluene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
Nitrobenzene	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	240 U	220 U	210 U	230 U	210 U	220 U	220 U	210 U	210 U	230 U	220 U	210 U	220 U	210 U	220 U	210 U
Hydrocarbons																		
Motor Oil	8015B DRO	mg/kg	5 J	11 U	17 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	16 J
Diesel	8015B DRO	mg/kg	12 U	11 U	3 J	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	11 U	20 U	13 U	15 U	12 U	13 U	9.6 U	21 U	15 U	14 U	17 U	9.9 U	11 U	16 U	11 U	11 U
General Chemistry																		
Perchlorate	E314	ug/kg	24 UJ	22 UJ	21 UJ	23 UJ	21 UJ	22 UJ	22 U	21 U	21 U	23 U	22 U	43	22 U	21 U	22 U	21 U
Nitrate	300.0	mg/kg	2 J	2.9 J	3.6 J	2.7 J	3.3 J	0.54 J	0.59 J	1.7 J	1 J	0.59 J	0.6 J	2.1 J	1.6 J	2.1 J	0.74 J	2.6 J
PH	9040	pH unit	7.78	7.28	6.76	7.26	5.01	7.02	8.77	8.52	7.6	7.43	8.02	8.64	9.26	8.74	8.63	8.39
Metals																		
Aluminum	6010B	mg/kg	4040	4600	5130	2210	4920	3180	2130	3490	5710	4860	4510	3440	3720	5110	2460	6640
Antimony	6010B	mg/kg	3.6 U	3.4 U	3.2 U	3.4 U	3.2 U	3.3 U	3.3 U	3.2 U	3.2 U	3.4 U	3.3 U	3.2 U	3.3 U	3.2 U	3.3 U	3.2 U
Arsenic	6010B	mg/kg	0.54 UJ	0.35 UJ	0.49 UJ	0.35 UJ	0.29 UJ	0.28 UJ	0.31 UJ	0.43 UJ	0.43 UJ	0.63	0.61	0.36 UJ	0.41 UJ	0.68	0.38 UJ	0.78
Barium	6010B	mg/kg	24.4	29.8	29	21.3	22.8	21.9	22.2	30	34.8	49.1	38.2	32.3	24.3	30.4	25.4	58.6
Beryllium	6010B	mg/kg	0.16	0.18	0.22	0.17	0.2	0.26	0.2	0.17	0.17	0.27	0.28	0.17	0.25	0.23	0.17	0.41
Cadmium	6010B	mg/kg	0.24 UJ	0.22 UJ	0.21 UJ	0.013 J	0.21 UJ	0.22 UJ	0.06 J	0.019 J	0.21 UJ	0.0073 J	0.22 UJ	0.016 J	0.22 UJ	0.028 J	0.22 UJ	0.21 UJ
Calcium	6010B	mg/kg	1890	2050	3250	3920	2190	4280	9680	1970	2120	3370	2900	3970	4830	8290	2440	5890
Chromium	6010B	mg/kg	2.7	3.3	2.8	1.4	2.3	1.5	0.99	2.4	3	3.8	3.4	2	2.6	3.3	1.2	4

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP18	01-DP18	01-DP19	01-DP19	01-DP20	01-DP20	01-DP20	01-DP21	01-DP21	01-DP24	01-DP24	01-DP25	01-DP25	01-DP22	01-DP22	01-DP23
			LE060	LE061	LE062	LE063	LE064	LE065	LE066	LE067	LE068	LE069	LE070	LE071	LE072	LE073	LE074	LE075
Analyte	Analytical Method	Units	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs
Cobalt	6010B	mg/kg	1.1	0.86	0.91	0.62	0.61	0.68	0.66	1.1	1.3	1.8	1.1	0.67	0.53	1.1	0.47	1.8
Copper	6010B	mg/kg	2.2	1.2	1.5	0.47	0.81	0.42	0.34	2.5	1.5	2.4	1.3	0.58	0.49	2	0.28 UJ	1.8
Iron	6010B	mg/kg	2790	2750	2820	1780	2180	2150	1680	2570	3270	3770	3310	2300	2200	3090	1510	4380
Lead	6010B	mg/kg	4.8	1.7	4.8	0.86	2.2	1	1.3	3.4	1.8	1.8	1.8	1.2	0.94	4.3	0.69	2.1
Magnesium	6010B	mg/kg	932	1030	1150	802	675	949	729	1000	1220	1450	1210	1030	839	1140	727	1570
Manganese	6010B	mg/kg	46	37.4	32.7	16.9	19.8	25.8	60.1	55.4	51.9	82.1	30.2	23	18.2	53.2	13.6	64.2
Mercury	7471A	mg/kg	0.025 J	0.016 J	0.031 J	0.014 J	0.018 J	0.02 J	0.023 J	0.034 J	0.021 J	0.025 J	0.014 J	0.023 J	0.013 J	0.021 J	0.015 J	0.029 J
Nickel	6010B	mg/kg	1.4	1.5	1.2	0.53	0.75	0.53	1.1	1.4	1.5	1.9	1.5	0.73	0.65	1.8	0.4	1.8
Potassium	6010B	mg/kg	367 J	367 J	467 J	526 J	272 J	618 J	393 J	754 J	588 J	650 J	317 J	569 J	558 J	560 J	245 J	506 J
Selenium	6010B	mg/kg	0.18 UJ	0.34 U	0.32 U	0.16 UJ	0.32 U	0.18 UJ	0.11 UJ	0.16 UJ	0.32 U	0.21 UJ	0.33 U	0.32 U	0.33 U	0.2 UJ	0.33 U	0.32 U
Silver	6010B	mg/kg	0.61 UJ	0.56 UJ	0.53 UJ	0.57 UJ	0.54 UJ	0.56 UJ	0.54 UJ	0.53 UJ	0.53 UJ	0.57 UJ	0.55 UJ	0.54 UJ	0.55 UJ	0.54 UJ	0.54 UJ	0.54 UJ
Sodium	6010B	mg/kg	15.4 J	110 U	110 U	110 U	110 U	6.6 J	110 U	297 J	110 U	110 U	74.4 J	17.4 J	95.8 J	110 U	7.3 J	110 U
Thallium	6010B	mg/kg	0.48 UJ	0.45 UJ	0.43 UJ	0.46 UJ	0.43 UJ	0.45 UJ	0.43 UJ	0.43 UJ	0.42 UJ	0.46 UJ	0.44 UJ	0.43 UJ	0.44 UJ	0.43 UJ	0.43 UJ	0.43 UJ
Vanadium	6010B	mg/kg	5.4	5.3	5.8	4.1	3.9	4.5	3.7	4.8	5.2	7	6.1	5.3	4.9	5.7	3.8	9.4
Zinc	6010B	mg/kg	8.5 J	5.9 J	9 J	5.9 J	6.7 J	5.4 J	5 J	7.4 J	7.8 J	9.8 J	7.2 J	6.8 J	6.5 J	10 J	3.9 J	11.3 J

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP23 LE078 5 feet bgs	01-DP32 LE079 1 to 1.5 feet bgs	01-DP32 LE080 5 feet bgs	01-DP30 LE081 1 to 1.5 feet bgs	01-DP30 LE082 5 feet bgs	01-DP33 LE083 1 to 1.5 feet bgs	01-DP33 LE084 5 feet bgs	01-DP29 LE085 1 to 1.5 feet bgs	01-DP29 LE091 5 feet bgs	01-DP27 LE092 1 to 1.5 feet bgs	01-DP27 LE093 5 feet bgs	01-DP27 LE094 5 feet bgs	01-DP26 LE095 1 to 1.5 feet bgs	01-DP26 LE096 5 feet bgs	01-DP28 LE097 1 to 1.5 feet bgs	01-DP28 LE098 5 feet bgs
VOCs																		
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,1-Dichloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,1-Dichloroethene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,2-Dichloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,2-Dichloropropane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	100 U	130 U	190 U	180 U	150 U	170 U	200 U	9 J	140 U	170 U	160 U	91 U	160 U	170 U	200 U	140 U
2-Hexanone	8260B	ug/kg	50 U	63 U	96 U	90 U	76 U	84 U	100 U	86 U	70 U	84 U	36 J	20 J	36 J	38 U	43 J	70 U
4-Methyl-2-Pentanone	8260B	ug/kg	50 U	63 U	96 U	90 U	76 U	84 U	100 U	86 U	70 U	84 U	82 U	45 U	82 U	87 U	98 U	70 U
Acetone	8260B	ug/kg	100 UJ	130 UJ	190 UJ	180 UJ	150 UJ	170 UJ	200 UJ	170 UJ	140 UJ	170 UJ	160 U	91 U	160 U	170 U	200 U	140 U
Benzene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Bromodichloromethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Bromoform	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Bromomethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	5 U	6.3 U	9.8 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Carbon Tetrachloride	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Chlorobenzene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Chlorodibromomethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Chloroethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Chloroform	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Chloromethane	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Cis-1,2-Dichloroethene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Cis-1,3-Dichloropropene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	9 UJ	4.5 U	8.2 U	9 UJ	9.8 U	7 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Toluene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	0.6 J	0.4 J	0.5 J	8.7 U	0.6 J	0.5 J
Trans-1,2-Dichloroethene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Trans-1,3-Dichloropropene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Trichloroethene	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	5 U	6.3 U	9.6 U	9 U	7.6 U	8.4 U	10 U	8.6 U	7 U	8.4 U	8.2 U	4.5 U	8.2 U	8.7 U	9.8 U	7 U
Total Xylenes	8260B	ug/kg	15 U	19 U	29 U	27 U	23 U	25 U	30 U	26 U	21 U	25 U	25 U	14 U	25 U	26 U	29 U	21 U
SVOCs																		
1,2,4-Trichlorobenzene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
1,2-Dichlorobenzene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
1,3-Dichlorobenzene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
1,4-Dichlorobenzene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2,4,5-Trichlorophenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2,4,6-Trichlorophenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2,4-Dichlorophenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2,4-Dimethylphenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2,4-Dinitrophenol	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 UJ	2900 UJ	2800 UJ
2,4-Dinitrotoluene	8270C	ug/kg	580 R	540 R	550 R	530 R	540 R	530 R	540 R	520 R	530 R	540 R	560 R	550 R	530 R	530 R	570 R	560 R
2,6-Dinitrotoluene	8270C	ug/kg	580 R	540 R	550 R	530 R	540 R	530 R	540 R	520 R	530 R	540 R	560 R	550 R	530 R	530 R	570 R	560 R
2-Chloronaphthalene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2-Chlorophenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2-Methylnaphthalene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2-Methylphenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
2-Nitroaniline	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2800 U
2-Nitrophenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
3,3'-Dichlorobenzidine	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
3-Nitroaniline	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 UJ	2900 UJ	2800 UJ
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 UJ	2900 UJ	2800 UJ
4-Bromophenyl Phenyl Ether	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
4-Chloro-3-Methylphenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
4-Chloroaniline	8270C	ug/kg	1200 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1000 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
4-Methylphenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP23	01-DP32	01-DP32	01-DP30	01-DP30	01-DP33	01-DP33	01-DP29	01-DP29	01-DP27	01-DP27	01-DP27	01-DP25	01-DP26	01-DP28	01-DP28
			LE078	LE079	LE080	LE081	LE082	LE083	LE084	LE085	LE091	LE092	LE093	LE094	LE095	LE096	LE097	LE098
Analyte	Analytical Method	Units	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs
4-Nitroaniline	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 UJ	2900 UJ	2800 UJ
4-Nitrophenol	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2800 U
Acenaphthene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Acenaphthylene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Anthracene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Benz(A)Anthracene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Benzo(A)Pyrene	8270C	ug/kg	29 U	27 U	28 U	27 U	27 U	27 U	27 U	26 U	27 U	27 U	28 U	27 U	27 U	27 U	29 U	28 U
Benzo(B)Fluoranthene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Benzo(G,H,I)Perylene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Benzo(K)Fluoranthene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	190 U	180 U	180 U	170 U	180 U	170 U	180 U	170 U	170 U	180 U	180 U	180 U	170 U	170 U	190 U	180 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Butyl Benzyl Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Carbazole	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 UJ	570 UJ	560 UJ
Chrysene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Dibenz(A,H)Anthracene	8270C	ug/kg	42 U	39 U	40 U	38 U	39 U	38 U	39 U	37 U	38 U	39 U	40 U	39 U	38 U	59 U	63 U	61 U
Dibenzofuran	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Diethyl Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Dimethyl Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Di-N-Butyl Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Di-N-Octyl Phthalate	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Fluoranthene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Fluorene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Hexachlorobenzene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Hexachlorobutadiene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Hexachlorocyclopentadiene	8270C	ug/kg	2900 U	2700 U	2800 U	2700 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	2700 U	2700 U	2700 U	2900 U	2800 U
Hexachloroethane	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Isophorone	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Naphthalene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Nitrobenzene	8270C	ug/kg	580 R	540 R	550 R	530 R	540 R	530 R	540 R	520 R	530 R	540 R	560 R	550 R	530 R	530 R	570 R	560 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	52 U	48 U	50 U	48 U	49 U	48 U	49 U	47 U	48 U	49 U	50 U	49 U	48 U	88 U	94 U	91 U
N-Nitrosodiphenylamine	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Pentachlorophenol	8270C	ug/kg	2000 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1800 U	1800 U	1900 U	1900 U	1900 U	1800 U	1800 U	1900 U	1900 U
Phenanthrene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Phenol	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Pyrene	8270C	ug/kg	580 U	540 U	550 U	530 U	540 U	530 U	540 U	520 U	530 U	540 U	560 U	550 U	530 U	530 U	570 U	560 U
Explosives																		
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
1,3-Dinitrobenzene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
2,4-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
2-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
3-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
4-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
Nitrobenzene	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	220 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	220 U	220 U	210 U	210 U	230 U	220 U
Hydrocarbons																		
Motor Oil	8015B DRO	mg/kg	12 U	11 U	11 U	24	11 U	7 J	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Diesel	8015B DRO	mg/kg	12 U	11 U	11 U	7 J	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	16 U	19 U	21 U	0.1 J	14 U	16 U	13 U	16 U	16 U	14 U	14 U	12 U	15 U	15 U	16 U	16 U
General Chemistry																		
Perchlorate	E314	ug/kg	23 UJ	22 U	22 U	21 U	22 U	33	22 U	21 U	21 U	660	91	22 U	21 U	21 U	23 U	22 U
Nitrate	300.0	mg/kg	0.77 J	0.72 J	0.55 J	0.36 J	0.69 J	10.9 J	2.9	1.2	1.4 J	1.1 J	0.66 J	0.79 J	1.9	0.5 J	1.1 J	1.5 J
PH	9040	pH unit	9.28	8.11	8.78	7.98	8.1	8.05	8.25	7.77	7.71	7.78	8.28	8.28	7.57	7.83	7.93	9.64
Metals																		
Aluminum	6010B	mg/kg	11000	6880	5330	7750	1430	4140	8930	4250	4790	8290	2790	1740	4470	3870	7400	3260
Antimony	6010B	mg/kg	3.5 U	3.2 U	0.24 UJ	0.34 UJ	3.2 U	3.2 U	3.2 U	3.1 U	3.2 U	3.3 U	3.3 U	3.3 U	3.2 U	3.2 UJ	3.4 UJ	3.3 UJ
Arsenic	6010B	mg/kg	2.1	0.67	0.77	0.82	0.25	0.59	0.77	0.55	0.69	0.55	0.44	0.3	0.36	0.46	0.41	0.2
Barium	6010B	mg/kg	129	44.6	23.3	44.9	25.5	30.6	40	49.4	38.2	29	31.4	29.5	23.5	47.3	48.2	29.6
Beryllium	6010B	mg/kg	1.1	0.32	0.21	0.36	0.15	0.29	0.3	0.16	0.17	0.26	0.32	0.11	0.34	0.34 J	0.99 J	0.28 J
Cadmium	6010B	mg/kg	0.044 J	0.1	0.017 UJ	0.12	0.019 UJ	0.11	0.04 UJ	0.15	0.091	0.0067 UJ	0.0089 UJ	0.22 U	0.21 U	0.31	0.057 UJ	0.04 UJ
Calcium	6010B	mg/kg	10900	2580	3450	3650	2930	3310	3460	1890	1820	2360	3030	2870	3370	3390	5830	5000
Chromium	6010B	mg/kg	11.3	3.7	3.2	4.3	0.91	2.5	4.5	3	4.5	3.4	1.8	1.4	1.9	3.3	4.7	2.1

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP23	01-DP32	01-DP32	01-DP30	01-DP30	01-DP33	01-DP33	01-DP29	01-DP29	01-DP27	01-DP27	01-DP27	01-DP26	01-DP26	01-DP28	01-DP28
			LE076	LE079	LE080	LE081	LE082	LE083	LE084	LE085	LE091	LE092	LE093	LE094	LE095	LE096	LE097	LE098
Analyte	Analytical Method	Units	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs
Cobalt	6010B	mg/kg	3.6	1.5	0.66	1.3	0.47	0.81	1.2	1.5	2	0.98	0.57	0.55	0.86	1.3	1.5	0.73
Copper	6010B	mg/kg	3.7	2.3 J	0.76 J	3.7 J	0.38 UJ	1 J	0.97 J	2.5 J	3.3 J	0.71 J	0.27 UJ	0.35 UJ	0.48 UJ	0.64 UJ	1	0.51 UJ
Iron	6010B	mg/kg	11600	3960	2690	3990	1080	2380	3900	3260	3360	3350	2050	1490	2080	2380	5130	2430
Lead	6010B	mg/kg	3.6	1.8 J	1.8 J	8.8 J	0.92 J	4.2 J	3.5 J	1.7 J	4.3 J	1.6 J	0.59 J	0.71 J	1.1 J	2.8 J	1.8 J	0.9 J
Magnesium	6010B	mg/kg	4360	1330	1130	1470	513	997	1570	1050	1100	1310	889	789	1040	861 J	2310 J	1090 J
Manganese	6010B	mg/kg	209	102	14.8	54.4	16.1	42.5	34.1	94.1	80.3	30.9	14.6	12.9	21.5	711	72.8	23.3
Mercury	7471A	mg/kg	0.024 J	0.031 J	0.024 UJ	0.066 J	0.021 UJ	0.045 J	0.04 J	0.034 J	0.095 J	0.031 J	0.024 UJ	0.02 UJ	0.028 J	0.015 UJ	0.013 UJ	0.0095 UJ
Nickel	6010B	mg/kg	4.4	1.9	1.2	2.4	0.45	0.89	1.7	1.7	2.8	1.1	0.46	0.52	0.59	2.2 J	1.6 J	0.73 J
Potassium	6010B	mg/kg	2830 J	571 J	111 J	560 J	221 J	415 J	397 J	714 J	570 J	289 J	303 J	286 J	199 J	332 J	562 J	812 J
Selenium	6010B	mg/kg	0.35 U	0.32 U	0.33 U	0.32 U	0.32 U	0.32 U	0.32 U	0.16	0.32 U	0.33 U	0.33 U	0.33 U	0.32 U	0.57	0.34 U	0.33 U
Silver	6010B	mg/kg	0.58 UJ	0.54 U	0.55 U	0.53 U	0.54 U	0.53 U	0.54 U	0.52 U	0.53 U	0.54 U	0.58 U	0.55 U	0.53 U	0.53 U	0.57 U	0.56 U
Sodium	6010B	mg/kg	185 J	52 UJ	181	51.3 UJ	25.9 UJ	38.4 UJ	52.4 UJ	100 U	110 U	51.5 UJ	39.8 UJ	10.8 UJ	12 UJ	34.4 J	16.2	90.4
Thallium	6010B	mg/kg	0.46 UJ	0.077 UJ	0.44 U	0.43 U	0.43 U	0.42 U	0.43 U	0.42 U	0.43 U	0.44 U	0.45 U	0.44 U	0.43 U	0.43 UJ	0.46 U	0.44 U
Vanadium	6010B	mg/kg	29.6	8.3	7.3	7.3	2.6	5	7.9	5.6	6.5	6.1	4.3	3.9	5.5	7.5	9.9	4.7
Zinc	6010B	mg/kg	37.9 J	9.9	4.2	15.4	3.1	9.3	9.2	8.9	10.9	6.5	5.4	4.2	5.3	5.2 J	13.4 J	7.9 J

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP28	01-DP36	01-DP36	01-DP37	01-DP37	01-DP38	01-DP38	01-DP38	01-DP39	01-DP39	01-DP40	01-DP40	01-DP34	01-DP34	01-DP34
			LE099	LE100	LE101	LE102	LE103	LE104	LE105	LE106	LE107	LE108	LE109	LE110	LE113	LE114	LE115
Analyte	Analytical Method	Units	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)
VOCs																	
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,1-Dichloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,1-Dichloroethene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,2-Dichloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,2-Dichloropropane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	97 U	190 U	230 U	220 U	200 U	200 U	110 U	100 U	150 U	89 U	200 U	160 U	190 UJ	170 UJ	95 UJ
2-Hexanone	8260B	ug/kg	21 J	94 U	50 J	110 U	100 U	44 J	25 J	22 J	73 U	45 U	99 U	82 U	94 U	83 U	48 U
4-Methyl-2-Pentanone	8260B	ug/kg	49 U	94 U	120 U	110 U	100 U	100 U	57 U	50 U	73 U	45 U	99 U	82 U	94 U	83 U	48 U
Acetone	8260B	ug/kg	97 U	190 U	230 U	220 U	200 U	200 U	110 U	100 U	150 U	89 U	200 U	160 U	190 UJ	170 UJ	95 UJ
Benzene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Bromodichloromethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Bromoform	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Bromomethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Carbon Tetrachloride	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Chlorobenzene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Chlorodibromomethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Chloroethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Chloroform	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Chloromethane	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Cis-1,2-Dichloroethene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Cis-1,3-Dichloropropene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Toluene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	0.3 J	0.7 J	8.2 U	9.4 U	8.3 U	0.3 J
Trans-1,2-Dichloroethene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Trans-1,3-Dichloropropene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Trichloroethene	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	4.9 U	9.4 U	12 U	11 U	10 U	10 U	5.7 U	5 U	7.3 U	4.5 U	9.9 U	8.2 U	9.4 U	8.3 U	4.8 U
Total Xylenes	8260B	ug/kg	15 U	28 U	35 U	33 U	30 U	31 U	17 U	15 U	22 U	13 U	30 U	25 U	28 U	25 U	14 U
SVOCs																	
1,2,4-Trichlorobenzene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
1,2-Dichlorobenzene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
1,3-Dichlorobenzene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
1,4-Dichlorobenzene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2,4,5-Trichlorophenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2,4,6-Trichlorophenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2,4-Dichlorophenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2,4-Dimethylphenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2,4-Dinitrophenol	8270C	ug/kg	2800 UJ	2700 UJ	2900 UJ	2700 UJ	2900 UJ	2800 UJ	2700 UJ	2700 UJ	2600 UJ	2700 UJ	2800 UJ	2800 UJ	2900 UJ	2700 UJ	2700 UJ
2,4-Dinitrotoluene	8270C	ug/kg	560 R	540 R	580 R	540 R	580 R	560 R	540 R	540 R	500 R	540 R	550 R	560 R	580 R	540 R	550 R
2,6-Dinitrotoluene	8270C	ug/kg	560 R	540 R	580 R	540 R	580 R	560 R	540 R	540 R	520 R	540 R	550 R	560 R	580 R	540 R	550 R
2-Chloronaphthalene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2-Chlorophenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2-Methylnaphthalene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2-Methylphenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
2-Nitroaniline	8270C	ug/kg	2800 U	2700 U	2900 U	2700 U	2900 U	2800 U	2700 U	2700 U	2600 U	2700 U	2800 U	2800 U	2900 U	2700 U	2700 U
2-Nitrophenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
3,3'-Dichlorobenzidine	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
3-Nitroaniline	8270C	ug/kg	2800 UJ	2700 UJ	2900 UJ	2700 UJ	2900 UJ	2800 UJ	2700 UJ	2700 UJ	2600 UJ	2700 UJ	2800 UJ	2800 UJ	2900 U	2700 U	2700 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2800 UJ	2700 UJ	2900 UJ	2700 UJ	2900 UJ	2800 UJ	2700 UJ	2700 UJ	2600 UJ	2700 UJ	2800 UJ	2800 UJ	2900 U	2700 U	2700 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
4-Chloro-3-Methylphenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
4-Chloroaniline	8270C	ug/kg	1100 U	1100 U	1200 U	1100 U	1200 U	1100 U	1100 U	1100 U	1000 U	1100 U	1100 U	1100 U	1200 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
4-Methylphenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP28 LE099 5 feet bgs (dup)	01-DP36 LE100 1 to 1.5 feet bgs	01-DP36 LE101 5 feet bgs	01-DP37 LE102 1 to 1.5 feet bgs	01-DP37 LE103 5 feet bgs	01-DP38 LE104 1 to 1.5 feet bgs	01-DP38 LE105 5 feet bgs	01-DP38 LE106 5 feet bgs (dup)	01-DP39 LE107 1 to 1.5 feet bgs	01-DP39 LE108 5 feet bgs	01-DP40 LE109 1 to 1.5 feet bgs	01-DP40 LE110 5 feet bgs	01-DP34 LE113 1 to 1.5 feet bgs	01-DP34 LE114 5 feet bgs	01-DP34 LE115 5 feet bgs (dup)
4-Nitroaniline	8270C	ug/kg	2800 UJ	2700 UJ	2900 UJ	2700 UJ	2900 UJ	2800 UJ	2700 UJ	2700 UJ	2800 UJ	2700 UJ	2800 UJ	2800 UJ	2900 U	2700 U	2700 U
4-Nitrophenol	8270C	ug/kg	2800 U	2700 U	2900 U	2700 U	2900 U	2800 U	2700 U	2700 U	2800 U	2700 U	2800 U	2800 U	2900 U	2700 U	2700 U
Acenaphthene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Acenaphthylene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Anthracene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Benz(A)Anthracene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Benzo(A)Pyrene	8270C	ug/kg	28 U	27 U	29 U	27 U	29 U	28 U	27 U	27 U	26 U	27 U	28 U	28 U	29 U	27 U	27 U
Benzo(B)Fluoranthene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Benzo(G,H,I)Perylene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Benzo(K)Fluoranthene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	180 U	170 U	190 U	180 U	190 U	180 U	170 U	180 U	170 U	180 U	180 U	180 U	190 U	180 U	180 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Butyl Benzyl Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Carbazole	8270C	ug/kg	560 UJ	540 UJ	580 UJ	540 UJ	580 UJ	560 UJ	540 UJ	540 UJ	520 UJ	540 UJ	550 UJ	560 UJ	580 U	540 U	550 U
Chrysene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Dibenz(A,H)Anthracene	8270C	ug/kg	61 U	59 U	64 U	60 U	63 U	62 U	59 U	60 U	57 U	60 U	61 U	62 U	42 U	39 U	39 U
Dibenzofuran	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Diethyl Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Dimethyl Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Di-N-Butyl Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Di-N-Octyl Phthalate	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Fluoranthene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Fluorene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Hexachlorobenzene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Hexachlorobutadiene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Hexachlorocyclopentadiene	8270C	ug/kg	2800 U	2700 U	2900 U	2700 U	2900 U	2800 U	2700 U	2700 U	2800 U	2700 U	2800 U	2800 U	2900 U	2700 U	2700 U
Hexachloroethane	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Isophorone	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Naphthalene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Nitrobenzene	8270C	ug/kg	560 R	540 R	580 R	540 R	580 R	560 R	540 R	540 R	520 R	540 R	550 R	560 R	580 R	540 R	550 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	92 U	88 U	95 U	89 U	94 U	92 U	88 U	89 U	86 U	89 U	91 U	92 U	52 U	49 U	49 U
N-Nitrosodiphenylamine	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Pentachlorophenol	8270C	ug/kg	1900 U	1800 U	2000 U	1900 U	2000 U	1900 U	1800 U	1800 U	1800 U	1900 U	1900 U	1900 U	2000 U	1800 U	1900 U
Phenanthrene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Phenol	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	120 J	580 U	540 U	550 U
Pyrene	8270C	ug/kg	560 U	540 U	580 U	540 U	580 U	560 U	540 U	540 U	520 U	540 U	550 U	560 U	580 U	540 U	550 U
Explosives																	
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
1,3-Dinitrobenzene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
2,4-Dinitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
2,6-Dinitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
2-Nitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
3-Nitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
4-Nitrotoluene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
Nitrobenzene	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	210 U	230 U	220 U	230 U	220 U	210 U	220 U	210 U	220 U	220 U	230 U	230 U	220 U	220 U
Hydrocarbons																	
Motor Oil	8015B DRO	mg/kg	11 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	12 U	11 U	11 U
Diesel	8015B DRO	mg/kg	11 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	12 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	11 U	19 U	21 U	19 U	18 U	21 U	11 U	14 U	17 U	11 U	16 U	16 U	19 U	16 U	9.1 U
General Chemistry																	
Perchlorate	E314	ug/kg	22 U	21 U	23 U	22 U	23 U	22 U	21 U	22 U	21 UJ	22 UJ	22 UJ	23 UJ	23 UJ	22 UJ	22 UJ
Nitrate	300.0	mg/kg	0.61 J	0.32 J	0.88 J	5.1	0.49 J	1.5	0.63 J	0.45 J	7	2.5	1.7	0.6 J	1.5 J	0.86 J	0.54 J
PH	9040	pH unit	9.55	8.14	8.19	9.05	9.48	9.09	9.14	9.55	8.28	7.96	9.12	9.34	9.21	8.85	8.73
Metals																	
Aluminum	6010B	mg/kg	4790	9860	6120	5750	2260	3280	2330	1990	2570	4950	4250	3060	12800	3080	3090
Antimony	6010B	mg/kg	3.3 UJ	3.2 UJ	3.5 UJ	3.3 UJ	3.5 UJ	3.4 UJ	3.2 UJ	3.3 UJ	0.098 UJ	3.3 UJ	3.3 UJ	3.4 UJ	0.11 UJ	3.3 UJ	3.3 UJ
Arsenic	6010B	mg/kg	0.31	0.51	0.3	0.54	0.96	0.7	0.24	0.25	0.3	0.41	0.38	0.27	0.94	0.23	0.25
Barium	6010B	mg/kg	52	43.4	31.9	37.9	34.1	44.7	31.6	36.5	38.6	41.3	29.5	25.3	41.1	21.2	23.5
Beryllium	6010B	mg/kg	0.19 J	0.38 J	0.23 J	0.29 J	0.23 J	0.19 J	0.15 J	0.14 J	0.11 J	0.19 J	0.31 J	0.3 J	0.45	0.45	0.46
Cadmium	6010B	mg/kg	0.03 UJ	0.066 UJ	0.056 UJ	0.097 UJ	0.11 UJ	0.056 UJ	0.012 UJ	0.017 UJ	0.28	0.057 UJ	0.11 UJ	0.017 UJ	0.069 UJ	0.22 U	0.22 U
Calcium	6010B	mg/kg	6100	4350	3170	13300	71000	29500	4120	3380	2090	2600	11400	3700	4760	3360	3460
Chromium	6010B	mg/kg	3.6	5.6	4	3.1	1.2	2.4	2.6	1.3	2.1	4.6	2.7	1.6	5.2	2	2

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP28	01-DP36	01-DP38	01-DP37	01-DP37	01-DP38	01-DP38	01-DP38	01-DP39	01-DP39	01-DP40	01-DP40	01-DP34	01-DP34	01-DP34
			LE099	LE100	LE101	LE102	LE103	LE104	LE105	LE106	LE107	LE108	LE109	LE110	LE113	LE114	LE115
Analyte	Analytical Method	Units	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)
Cobalt	6010B	mg/kg	1.7	1.8	1.3	1.1	0.68	0.8	0.51	0.72	0.87	1.7	0.96	0.76	1.7	0.45	0.49
Copper	6010B	mg/kg	1.2	2.2	1.6	1.4	0.48 UJ	0.9 UJ	0.72 UJ	0.43 UJ	11.8	2.2	1.5	0.49 UJ	1.5	0.27 UJ	0.28 UJ
Iron	6010B	mg/kg	4910	5210	3460	3380	1520	2460	2010	1740	2030	3760	2790	1940	5310	1650	1750
Lead	6010B	mg/kg	1.1 J	2.1 J	1.5 J	2.3 J	0.89 J	0.98 J	0.75 J	0.59 J	15.1 J	2 J	4.3 J	1.1 J	2.8	0.8	0.94
Magnesium	6010B	mg/kg	2090 J	2040 J	1300 J	1580 J	759 J	909 J	638 J	681 J	654 J	1340 J	1100 J	899 J	2190 J	958 J	971 J
Manganese	6010B	mg/kg	46.3	83.8	53.5	68.1	164	27.8	15.5	21.2	44	82.8	56.7	22.8	68.4	13.4	13.6
Mercury	7471A	mg/kg	0.0072 UJ	0.018 UJ	0.028 J	0.023 UJ	0.02 UJ	0.02 UJ	0.014 UJ	0.021 UJ	1.5	0.026 J	0.023 UJ	0.048 J	0.025 J	0.0062 J	0.0074 J
Nickel	6010B	mg/kg	1.2 J	2.4 J	1.9 J	1.5 J	1.1 J	1 J	1 J	0.58 J	1.3 J	2.5 J	1.3 J	0.68 J	2.1	0.45 UJ	0.48 UJ
Potassium	6010B	mg/kg	1550 J	863 J	520 J	748 J	501 J	421 J	475 J	543 J	508 J	726 J	563 J	260 J	413 J	286 J	275 J
Selenium	6010B	mg/kg	0.33 U	0.32 U	0.35 U	0.33 U	0.45 UJ	0.34 U	0.32 U	0.33 U	0.13 UJ	0.33 U	0.33 U	0.34 U	0.35 U	0.33 U	0.33 U
Silver	6010B	mg/kg	0.56 U	0.54 U	0.58 U	0.54 U	0.58 U	0.58 U	0.54 U	0.54 U	0.52 U	0.54 U	0.55 U	0.56 U	0.58 U	0.54 U	0.55 U
Sodium	6010B	mg/kg	110 U	23.5	120 U	110 U	7.2	110 U	110 U	110 UJ	100 UJ	110 UJ	110 UJ	110 UJ	73.8	43.3	60
Thallium	6010B	mg/kg	0.45 U	0.43 U	0.47 U	0.44 U	0.093 UJ	0.45 U	0.43 U	0.43 U	0.42 U	0.44 U	0.44 U	0.45 U	0.46 U	0.44 U	0.44 U
Vanadium	6010B	mg/kg	10.1	8.9	6.7	6.5	4.3	5.7	4.3	4.2	4.2	7.2	5.6	4.8	8.6	3.5	3.9
Zinc	6010B	mg/kg	16.4 J	12.2 J	8.1 J	9.4 J	4.8 J	6.7 J	5.4 J	5.4 J	22.7 J	8.5 J	8.9 J	5 J	11.7 J	4.6 J	4.7 J

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP42 LE116 1 to 1.5 feet bgs	01-DP42 LE117 5 feet bgs	01-DP43 LE118 1 to 1.5 feet bgs	01-DP43 LE119 5 feet bgs	01-DP44 LE120 1 to 1.5 feet bgs	01-DP44 LE121 5 feet bgs	01-DP48 LE122 1 to 1.5 feet bgs	01-DP48 LE123 5 feet bgs	01-DP47 LE124 1 to 1.5 feet bgs	01-DP47 LE125 5 feet bgs	01-DP47 LE126 5 feet bgs (dup)	01-DP46 LE127 1 to 1.5 feet bgs	01-DP46 LE128 5 feet bgs	01-DP50 LE129 1 to 1.5 feet bgs	01-DP50 LE130 3.5 feet bgs	01-DP51 LE131 1 to 1.5 feet bgs
VOCs																		
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,1-Dichloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,1-Dichloroethene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,2-Dichloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,2-Dichloropropane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	150 UJ	160 UJ	170 UJ	160 UJ	170 UJ	160 UJ	200 UJ	120 UJ	120 UJ	200 UJ	140 UJ	170 UJ	160 UJ	160 UJ	150 UJ	160 UJ
2-Hexanone	8260B	ug/kg	75 U	79 U	87 U	82 U	84 U	80 U	98 U	59 U	100 U	100 U	70 U	83 U	80 U	80 U	74 U	80 U
4-Methyl-2-Pentanone	8260B	ug/kg	75 U	79 U	87 U	82 U	84 U	80 U	98 U	59 U	100 U	100 U	70 U	83 U	80 U	80 U	74 U	80 U
Acetone	8260B	ug/kg	150 UJ	160 UJ	170 UJ	160 UJ	170 UJ	160 UJ	200 UJ	120 UJ	200 UJ	200 U	140 U	170 U	160 U	160 U	150 U	160 U
Benzene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Bromodichloromethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Bromoform	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Bromomethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Carbon Tetrachloride	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Chlorobenzene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Chlorodibromomethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Chloroethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Chloroform	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Chloromethane	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Cis-1,2-Dichloroethene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Cis-1,3-Dichloropropene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Toluene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	0.5 J	0.7 J	8 U	8 U	0.5 J	0.7 J
Trans-1,2-Dichloroethene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Trans-1,3-Dichloropropene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Trichloroethene	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	7.5 U	7.9 U	8.7 U	8.2 U	8.4 U	8 U	9.8 U	5.9 U	10 U	10 U	7 U	8.3 U	8 U	8 U	7.4 U	8 U
Total Xylenes	8260B	ug/kg	23 U	24 U	26 U	24 U	25 U	24 U	29 U	18 U	31 U	30 U	21 U	25 U	24 U	24 U	22 U	24 U
SVOCs																		
1,2,4-Trichlorobenzene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
1,2-Dichlorobenzene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
1,3-Dichlorobenzene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
1,4-Dichlorobenzene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2,4,5-Trichlorophenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2,4,6-Trichlorophenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2,4-Dichlorophenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2,4-Dimethylphenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2,4-Dinitrophenol	8270C	ug/kg	2700 UJ	2700 U	2700 U	2800 U	2600 U	2600 UJ	2700 U	3200 U	2700 UJ	2700 UJ	2700 UJ	2700 UJ	2700 UJ	2700 UJ	2700 UJ	2600 UJ
2,4-Dinitrotoluene	8270C	ug/kg	540 R	540 R	530 R	550 R	520 R	520 R	540 R	640 R	540 R	550 R	540 R	540 R	540 R	540 R	530 R	520 R
2,6-Dinitrotoluene	8270C	ug/kg	540 R	540 R	530 R	550 R	520 R	520 R	540 R	640 R	540 R	550 R	540 R	540 R	540 R	540 R	530 R	520 R
2-Chloronaphthalene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 UJ	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2-Chlorophenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2-Methylnaphthalene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2-Methylphenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
2-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2600 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2600 U
2-Nitrophenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
3,3'-Dichlorobenzidine	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
3-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2600 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2600 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2600 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 UJ	2700 UJ	2600 UJ
4-Bromophenyl Phenyl Ether	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 UJ	550 U	540 U	540 U	540 U	540 U	530 U	520 U
4-Chloro-3-Methylphenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
4-Chloroaniline	8270C	ug/kg	1100 U	1100 U	1100 U	1100 U	1000 U	1000 U	1100 U	1300 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U	1000 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
4-Methylphenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP42 LE116 1 to 1.5 feet bgs	01-DP42 LE117 5 feet bgs	01-DP43 LE118 1 to 1.5 feet bgs	01-DP43 LE119 5 feet bgs	01-DP44 LE120 1 to 1.5 feet bgs	01-DP44 LE121 5 feet bgs	01-DP48 LE122 1 to 1.5 feet bgs	01-DP48 LE123 5 feet bgs	01-DP47 LE124 1 to 1.5 feet bgs	01-DP47 LE125 5 feet bgs	01-DP47 LE126 5 feet bgs (dup)	01-DP46 LE127 1 to 1.5 feet bgs	01-DP46 LE128 5 feet bgs	01-DP50 LE129 1 to 1.5 feet bgs	01-DP50 LE130 3.5 feet bgs	01-DP51 LE131 1 to 1.5 feet bgs
4-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2600 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2600 U
4-Nitrophenol	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2800 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 UJ	2700 UJ	2600 UJ
Acenaphthene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Acenaphthylene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Anthracene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Benz(A)Anthracene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Benzo(A)Pyrene	8270C	ug/kg	27 U	27 U	27 U	28 U	26 U	26 U	27 U	32 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	26 U
Benzo(B)Fluoranthene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Benzo(G,H,I)Perylene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Benzo(K)Fluoranthene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	180 U	180 U	170 U	180 U	170 U	170 U	180 U	210 U	170 U	180 U	180 U	180 U	180 U	180 U	170 U	170 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Butyl Benzyl Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Carbazole	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Chrysene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 UJ	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Dibenz(A,H)Anthracene	8270C	ug/kg	39 U	39 U	38 U	40 U	37 U	37 U	39 U	48 U	39 U	39 U	39 U	39 U	39 U	39 U	38 U	37 U
Dibenzofuran	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Diethyl Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Dimethyl Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Di-N-Butyl Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Di-N-Octyl Phthalate	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Fluoranthene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Fluorene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Hexachlorobenzene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Hexachlorobutadiene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Hexachlorocyclopentadiene	8270C	ug/kg	2700 U	2700 U	2700 U	2800 U	2600 U	2600 U	2700 U	3200 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2700 U	2600 U
Hexachloroethane	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Isophorone	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Naphthalene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Nitrobenzene	8270C	ug/kg	540 R	540 R	530 R	550 R	520 R	520 R	540 R	640 R	540 R	550 R	540 R	540 R	540 R	540 R	530 R	520 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	49 U	48 U	48 U	50 U	46 U	47 U	49 U	58 U	48 U	49 U	49 U	49 U	48 U	49 U	48 U	47 U
N-Nitrosodiphenylamine	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Pentachlorophenol	8270C	ug/kg	1800 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	2200 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1800 U	1800 U
Phenanthrene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Phenol	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	590 J	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Pyrene	8270C	ug/kg	540 U	540 U	530 U	550 U	520 U	520 U	540 U	640 U	540 U	550 U	540 U	540 U	540 U	540 U	530 U	520 U
Explosives																		
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
1,3-Dinitrobenzene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
2,4-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
2-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
3-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
4-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
Nitrobenzene	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	220 U	210 U	220 U	210 U	210 U	220 U	260 U	210 U	220 U	220 U	220 U	210 U	220 U	210 U	210 U
Hydrocarbons																		
Motor Oil	8015B DRO	mg/kg	6 J	11 U	11 U	11 U	10 U	10 U	11 U	13 U	11 U	11 U	11 U	6 J	11 U	6 J	11 U	10 U
Diesel	8015B DRO	mg/kg	11 U	11 U	11 U	11 U	10 U	3 J	11 U	13 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	10 U
Gasoline	8015B GRO	mg/kg	15 U	16 U	15 U	9.5 U	16 U	15 U	16 U	24 U	16 U	21 U	12 U	16 U	17 U	14 U	20 U	16 U
General Chemistry																		
Perchlorate	E314	ug/kg	22 UJ	22 UJ	21 UJ	22 UJ	21 UJ	21 UJ	22 UJ	26 UJ	21 UJ	22 U	22 U	22 U	21 U	22 U	21 U	21 U
Nitrate	300.0	mg/kg	1.2 J	1.6 J	1.1 J	0.59 J	1.3 J	0.77 J	0.98 J	0.58 J	0.97 J	0.64 J	0.72 J	1.1 J	0.63 J	0.77 J	0.68 J	1 J
PH	9040	pH unit	8.45	8.35	8.49	8.1	7.7	7.78	7.82	7.69	7.8	8.02	7.76	7.29	6.9	6.78	7.01	6.48
Metals																		
Aluminum	6010B	mg/kg	11500	8360	7020	7870	6550	4530	6740	9090	4790	9850	10400	7370	9530	5530	9580	4520
Antimony	6010B	mg/kg	0.11 UJ	0.16 UJ	3.2 UJ	3.3 UJ	3.1 UJ	0.15 UJ	0.13 UJ	0.14 UJ	0.19 UJ	0.14 UJ	0.16 UJ	3.2 U	0.2 UJ	0.11 UJ	3.2 U	3.1 U
Arsenic	6010B	mg/kg	0.63	0.65	0.39	0.65	0.39	0.3	0.52	0.57	0.33	0.77	0.82	0.47	0.54	0.87	1.6	0.28
Barium	6010B	mg/kg	45.8	35.8	41.6	42.2	39.3	28.8	44.2	51.9	32.6	56.4	52.5	50	57.2	39.1	59.3	32.1
Beryllium	6010B	mg/kg	0.35	0.15	0.28	0.38	0.22	0.18	0.31	0.44	0.16	0.4	0.4	0.3	0.32	0.067	0.29	0.16
Cadmium	6010B	mg/kg	0.029 UJ	0.22 U	0.069 UJ	0.051 UJ	0.085 UJ	0.06 UJ	0.097 UJ	0.049 UJ	0.081 UJ	0.085 UJ	0.043 UJ	0.087 UJ	0.084 UJ	0.032 UJ	0.21 U	0.16
Calcium	6010B	mg/kg	2890	1720	3460	3780	2550	2190	3150	3780	2180	3760	3760	3620	2940	1360	1830	1860
Chromium	6010B	mg/kg	6.4	5.3	3.9	4.5	3.5	3	4	5.2	2.8	5.5	5.5	4.2	6.3	5.4	6.2	2.9

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP42	01-DP42	01-DP43	01-DP43	01-DP44	01-DP44	01-DP48	01-DP48	01-DP47	01-DP47	01-DP47	01-DP46	01-DP46	01-DP50	01-DP50	01-DP51
			LE116	LE117	LE118	LE119	LE120	LE121	LE122	LE123	LE124	LE125	LE126	LE127	LE128	LE129	LE130	LE131
Analyte	Analytical Method	Units	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	3.5 feet bgs	1 to 1.5 feet bgs
Cobalt	6010B	mg/kg	2	1.4	1.4	1.8	1.4	1.3	1.9	2.1	1.1	3.5	2	1.7	3	2.7	1.3	1.1
Copper	6010B	mg/kg	1.8	0.98 UJ	1.9	1.8	2	1.6	1.8	1.6	1.6	2 J	2 J	2.2 J	2.8 J	2.2 J	1.4 J	1.5 J
Iron	6010B	mg/kg	5950	5590	3950	4610	3660	3000	4390	5480	2840	5310	5440	4050	5960	4700	6660	2860
Lead	6010B	mg/kg	3.1	2.1	1.7	2	1.7	1.5	1.8	2.1	1.5	3.1	2.6	2	2.8	2.1	2.1	1.4
Magnesium	6010B	mg/kg	2000 J	1860 J	1690 J	2120 J	1450 J	1230 J	1770 J	2340 J	1140 J	2170 J	2240 J	1760 J	2010 J	1420 J	1970 J	1080 J
Manganese	6010B	mg/kg	71.5	31.9	77.4	76.1	81	61.8	88.9	80.1	75.4	208 J	74.8 J	94.9 J	226 J	82.2 J	21.2 J	68.9 J
Mercury	7471A	mg/kg	0.049 J	0.04 J	0.024 J	0.0087 J	0.039 J	0.011 J	0.032 J	0.031 J	0.039 J	0.025 J	0.036 J	0.0062 J	0.0077 J	0.02 J	0.027 J	0.039 J
Nickel	6010B	mg/kg	2.5	1.7	2	2.5	1.8	1.8	1.9	2.3	1.4	4	2.5	2.3	4.5	2.5	5.3	1.5
Potassium	6010B	mg/kg	816 J	609 J	743 J	686 J	927 J	713 J	1060 J	839 J	656 J	704 J	713 J	815 J	1110 J	623 J	403 J	702 J
Selenium	6010B	mg/kg	0.32 U	0.32 U	0.32 U	0.33 U	0.31 U	0.31 U	0.32 U	0.39 U	0.32 U	0.33 U	0.33 U	0.32 U	0.32 U	0.32 U	0.32 U	0.31 U
Silver	6010B	mg/kg	0.54 U	0.54 U	0.53 U	0.55 U	0.52 U	0.52 U	0.54 U	0.64 U	0.54 U	0.55 U	0.54 U	0.54 U	0.54 U	0.54 U	0.53 U	0.52 U
Sodium	6010B	mg/kg	36.9	110 UJ	22.3 J	38.7	100 UJ	100 UJ	110 UJ	55.3	110 U	126	113	33.1	28.1	13.4	357	15.7
Thallium	6010B	mg/kg	0.43 U	0.43 U	0.43 U	0.44 U	0.41 U	0.42 U	0.43 U	0.097 UJ	0.43 U	0.1	0.44 U	0.43 U	0.43 U	0.43 U	0.43 U	0.41 U
Vanadium	6010B	mg/kg	11.7	14.6	5.2	7	5.6	5.1	6.8	8	5.1	8.2	8.7	6.8	10.4	10.8	13.1	4.8
Zinc	6010B	mg/kg	13.1 J	10.1 J	10.8 J	11.7 J	10.3 J	8.1 J	11.9 J	14.1 J	8.2 J	11.7 J	12 J	11.1 J	13.9 J	9.9 J	7.8 J	8.5 J

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP51 LE132 5 feet bgs	01-DP52 LE133 1 to 1.5 feet bgs	01-DP52 LE134 5 feet bgs	01-DP56 LE135 1 to 1.5 feet bgs	01-DP56 LE136 5 feet bgs	01-DP55 LE137 1 to 1.5 feet bgs	01-DP55 LE138 5 feet bgs	01-DP54 LE139 1 to 1.5 feet bgs	01-DP53 LE142 1 to 1.5 feet bgs	01-DP53 LE143 5 feet bgs	01-DP49 LE144 1 to 1.5 feet bgs	01-DP49 LE145 5 feet bgs	01-DP49 LE146 5 feet bgs (dup)	01-DP45 LE147 1 to 1.5 feet bgs	01-DP45 LE148 5 feet bgs	01-DP41 LE149 1 to 1.5 feet bgs
VOCs																		
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,1-Dichloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,1-Dichloroethene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,2-Dichloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,2-Dichloropropane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	150 UJ	120 UJ	150 UJ	160 UJ	130 UJ	120 UJ	120 UJ	150 UJ	150 UJ	150 UJ	6 J	130 UJ	160 UJ	150 UJ	160 UJ	170 UJ
2-Hexanone	8260B	ug/kg	75 U	62 U	76 U	80 U	63 U	61 U	58 U	76 U	73 U	73 U	76 U	63 U	80 U	75 U	81 U	84 U
4-Methyl-2-Pentanone	8260B	ug/kg	75 U	62 U	76 U	80 U	63 U	61 U	58 U	76 U	73 U	73 U	76 U	63 U	80 U	75 U	81 U	84 U
Acetone	8260B	ug/kg	150 U	120 U	150 U	160 U	130 U	120 U	120 U	150 U	150 U	150 U	150 U	130 U	160 U	150 U	160 U	170 U
Benzene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Bromodichloromethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Bromoform	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Bromomethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Carbon Tetrachloride	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Chlorobenzene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Chlorodibromomethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Chloroethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Chloroform	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Chloromethane	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Cis-1,2-Dichloroethene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Cis-1,3-Dichloropropene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Toluene	8260B	ug/kg	0.5 J	6.2 U	7.6 U	8 U	0.5 J	0.5 J	0.5 J	0.6 J	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Trans-1,2-Dichloroethene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Trans-1,3-Dichloropropene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Trichloroethene	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	7.5 U	6.2 U	7.6 U	8 U	6.3 U	6.1 U	5.8 U	7.6 U	7.3 U	7.3 U	7.6 U	6.3 U	8 U	7.5 U	8.1 U	8.4 U
Total Xylenes	8260B	ug/kg	22 U	19 U	23 U	24 U	19 U	18 U	17 U	23 U	22 U	22 U	23 U	19 U	24 U	23 U	24 U	25 U
SVOCs																		
1,2,4-Trichlorobenzene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
1,2-Dichlorobenzene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
1,3-Dichlorobenzene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
1,4-Dichlorobenzene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2,4,5-Trichlorophenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2,4,6-Trichlorophenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2,4-Dichlorophenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2,4-Dimethylphenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2,4-Dinitrophenol	8270C	ug/kg	2800 UJ	2600 UJ	2700 UJ	2600 UJ	2700 UJ	2600 UJ	2800 UJ	2700 UJ	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
2,4-Dinitrotoluene	8270C	ug/kg	570 R	510 R	550 R	520 R	540 R	510 R	560 R	530 R	520 R	560 R	610 R	560 R	550 R	620 R	550 R	570 R
2,6-Dinitrotoluene	8270C	ug/kg	570 R	510 R	550 R	520 R	540 R	510 R	560 R	530 R	520 R	560 R	610 R	560 R	550 R	620 R	550 R	570 R
2-Chloronaphthalene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2-Chlorophenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2-Methylnaphthalene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2-Methylphenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
2-Nitroaniline	8270C	ug/kg	2800 U	2600 U	2700 U	2600 U	2700 U	2600 U	2800 U	2700 U	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
2-Nitrophenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
3,3'-Dichlorobenzidine	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
3-Nitroaniline	8270C	ug/kg	2800 U	2600 U	2700 U	2600 U	2700 U	2600 U	2800 U	2700 U	2600 UJ	2800 UJ	3000 UJ	2800 UJ	2800 UJ	3100 UJ	2800 UJ	2800 UJ
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2800 UJ	2600 UJ	2700 UJ	2600 UJ	2700 UJ	2600 UJ	2800 UJ	2700 UJ	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
4-Chloro-3-Methylphenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
4-Chloroaniline	8270C	ug/kg	1100 U	1000 U	1100 U	1000 U	1100 U	1000 U	1100 U	1100 U	1000 U	1100 U	1200 U	1100 U	1100 U	1200 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
4-Methylphenol	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP51 LE132 5 feet bgs	01-DP52 LE133 1 to 1.5 feet bgs	01-DP52 LE134 5 feet bgs	01-DP56 LE135 1 to 1.5 feet bgs	01-DP56 LE136 5 feet bgs	01-DP55 LE137 1 to 1.5 feet bgs	01-DP55 LE138 5 feet bgs	01-DP54 LE139 1 to 1.5 feet bgs	01-DP53 LE142 1 to 1.5 feet bgs	01-DP53 LE143 5 feet bgs	01-DP49 LE144 1 to 1.5 feet bgs	01-DP49 LE145 5 feet bgs	01-DP49 LE146 5 feet bgs (dup)	01-DP45 LE147 1 to 1.5 feet bgs	01-DP45 LE148 5 feet bgs	01-DP41 LE149 1 to 1.5 feet bgs
4-Nitroaniline	8270C	ug/kg	2800 U	2600 U	2700 U	2600 U	2700 U	2600 U	2800 U	2700 U	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
4-Nitrophenol	8270C	ug/kg	2800 UJ	2600 UJ	2700 UJ	2600 UJ	2700 UJ	2600 UJ	2800 UJ	2700 UJ	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
Acenaphthene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Acenaphthylene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Anthracene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Benz(A)Anthracene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Benzo(A)Pyrene	8270C	ug/kg	28 U	26 U	27 U	26 U	27 U	26 U	28 U	27 U	26 U	28 U	30 U	28 U	28 U	31 U	28 U	28 U
Benzo(B)Fluoranthene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Benzo(G,H,I)Perylene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Benzo(K)Fluoranthene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	190 U	170 U	180 U	170 U	180 U	170 U	180 U	170 U	170 U	180 U	200 U	180 U	180 U	200 U	180 U	190 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Butyl Benzyl Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Carbazole	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Chrysene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Dibenz(A,H)Anthracene	8270C	ug/kg	41 U	37 U	40 U	38 U	39 U	37 U	40 U	38 U	57 U	62 U	67 U	62 U	61 U	68 U	61 U	63 U
Dibenzofuran	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Diethyl Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Dimethyl Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Di-N-Butyl Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Di-N-Octyl Phthalate	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Fluoranthene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Fluorene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Hexachlorobenzene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Hexachlorobutadiene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Hexachlorocyclopentadiene	8270C	ug/kg	2800 U	2600 U	2700 U	2600 U	2700 U	2600 U	2800 U	2700 U	2600 U	2800 U	3000 U	2800 U	2800 U	3100 U	2800 U	2800 U
Hexachloroethane	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Isophorone	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Naphthalene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Nitrobenzene	8270C	ug/kg	570 R	510 R	550 R	520 R	540 R	510 R	560 R	530 R	520 R	560 R	610 R	560 R	550 R	620 R	550 R	570 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	51 U	46 U	49 U	47 U	48 U	46 U	51 U	48 U	65 U	92 U	99 U	92 U	91 U	100 U	90 U	93 U
N-Nitrosodiphenylamine	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Pentachlorophenol	8270C	ug/kg	1900 U	1700 U	1900 U	1800 U	1800 U	1800 U	1900 U	1800 U	1800 U	1900 U	2100 U	1900 U	1900 U	2100 U	1900 U	1900 U
Phenanthrene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Phenol	8270C	ug/kg	1200	260 J	550 U	520 U	540 U	510 U	560 U	530 U	130 J	390 J	610 U	560 U	380 J	620 U	220 J	570 U
Pyrene	8270C	ug/kg	570 U	510 U	550 U	520 U	540 U	510 U	560 U	530 U	520 U	560 U	610 U	560 U	550 U	620 U	550 U	570 U
Explosives																		
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
1,3-Dinitrobenzene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
2,4-Dinitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
2,6-Dinitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
2-Nitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
3-Nitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
4-Nitrotoluene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
Nitrobenzene	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	200 U	220 U	210 U	220 U	210 U	220 U	210 U	210 U	220 U	240 U	220 U	220 U	250 U	220 U	230 U
Hydrocarbons																		
Motor Oil	8015B DRO	mg/kg	11 U	11	9 J	9 J	11 U	10 U	11 U	11 U	10 U	11 U	5 J	11 U	11 U	12 U	11 U	11 U
Diesel	8015B DRO	mg/kg	11 U	10 U	11 U	10 U	11 U	10 U	11 U	11 U	10 U	11 U	6 J	11 U	11 U	12 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	17 U	14 U	14 U	19 U	14 U	14 U	14 U	15 U	14 U	15 U	17 U	9.9 U	15 U	12 U	14 U	15 U
General Chemistry																		
Perchlorate	E314	ug/kg	23 U	20 U	22 U	21 U	22 U	21 U	22 U	21 U	21 U	22 U	24 U	22 U	22 U	25 U	22 U	23 U
Nitrate	300.0	mg/kg	0.8 J	0.79 J	0.52 J	1 J	0.75 J	2 J	3.4 J	0.64 J	0.8	0.74	3.2	0.96	1.2	1.6	0.87	2
PH	9040	pH unit	6.42	8.18	8.38	8.45	8.38	8.52	7.75	8.22	7.19	7.49	8.19	9.09	8.91	7.04	7.47	8.73
Metals																		
Aluminum	6010B	mg/kg	7740	6950	10800	3460	8990	2940	904	2970	4110	7070	6240	5190	5660	7900	10400	6250
Antimony	6010B	mg/kg	0.12 UJ	0.18 UJ	0.17 UJ	0.21 UJ	3.2 U	0.15 UJ	3.4 U	3.2 U	0.095 UJ	3.4 U	3.6 U	3.4 U	3.3 U	3.7 U	3.3 U	3.4 U
Arsenic	6010B	mg/kg	0.36	2.2	4	1.9	4.6	0.7	0.15	1.8	0.5 UJ	0.68	0.72	0.17 UJ	0.18 UJ	0.61	0.71	1
Barium	6010B	mg/kg	39.3	85.1	106	61.4	108	31.2	30.8	62.5	33.7	47.3	51.1	33.4	35.5	44.2	43.6	44.2
Beryllium	6010B	mg/kg	0.25	0.09	0.019 UJ	0.022 UJ	0.02 UJ	0.047	0.22 U	0.12	0.051	0.22	0.34	0.14	0.19	0.38	0.44	0.28
Cadmium	6010B	mg/kg	0.031 UJ	1.3	2.4	1.3	2.2	0.12 UJ	0.099 UJ	0.38	0.21 UJ	0.22 UJ	0.038 J	0.22 UJ	0.22 UJ	0.036 J	0.22 UJ	0.046 J
Calcium	6010B	mg/kg	2620	4050	10900	4870	9750	2440	677	2190	2210 J	3750 J	10500 J	4350 J	4720 J	4580 J	4600 J	30000 J
Chromium	6010B	mg/kg	4.7	8.5	16.2	6	11.7	3.5	0.77	6.2	3.1	7.7	4.8	3	3.6	4.8	5.5	4.2

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP51	01-DP52	01-DP52	01-DP56	01-DP56	01-DP55	01-DP55	01-DP54	01-DP53	01-DP53	01-DP49	01-DP49	01-DP49	01-DP45	01-DP45	01-DP41
			LE132	LE133	LE134	LE135	LE136	LE137	LE138	LE139	LE142	LE143	LE144	LE145	LE146	LE147	LE148	LE149
Analyte	Analytical Method	Units	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs (dup)	1 to 1.5 feet bgs	5 feet bgs	1 to 1.5 feet bgs
Cobalt	6010B	mg/kg	1.1	2.4	4.7	2	4.5	1.4	0.23	0.32	1.6	1.9	2.2	1.2	1.2	1.9	2	1.5
Copper	6010B	mg/kg	1.8 J	4.7 J	8.4 J	3.3 J	7.2 J	1.2 J	0.28 UJ	1.4 J	1.2	1.8	2.2	0.55	0.56	2.1	1.4	1.2
Iron	6010B	mg/kg	4090	7830	13500	5380	13400	2540	697	3000	3460	5210	5100	3510	3900	5290	5950	4570
Lead	6010B	mg/kg	1.8	2.9	2.7	1	2.5	1.4	0.28	0.91	1.7	1.9	2.7	0.84	0.9	6.5	2.2	3
Magnesium	6010B	mg/kg	1640 J	2890 J	6230 J	2510 J	5710 J	914 J	239 J	1060 J	1320 J	1920 J	2120 J	1490 J	1650 J	1970 J	2130 J	1820 J
Manganese	6010B	mg/kg	32.4 J	99.8 J	239 J	108 J	205 J	42.7 J	17 J	15.4 J	43.9 J	56.9 J	90.7 J	28.8 J	32.7 J	77 J	58.6 J	52 J
Mercury	7471A	mg/kg	0.022 J	0.039 J	0.018 J	0.033 J	0.037 J	0.03 J	0.049 J	0.071 J	0.0063 UJ	0.01 UJ	0.22	0.018 UJ	0.022 UJ	0.045 J	0.035 J	0.039 J
Nickel	6010B	mg/kg	1.9	7	17.3	6.6	11.9	2.3	0.42 UJ	3.6	1.2 J	3 J	2.4 J	1.1 J	1.2 J	2.1 J	2.1 J	1.9 J
Potassium	6010B	mg/kg	530 J	1580 J	2470 J	1110 J	2730 J	353 J	125 J	252 J	529 J	715 J	835 J	804 J	945 J	755 J	414 J	970 J
Selenium	6010B	mg/kg	0.34 U	0.31 U	0.7	0.31 U	0.32 U	0.31 U	0.34 U	0.32 U	0.31 U	0.34 U	0.36 U	0.34 U	0.33 U	0.37 U	0.33 U	0.12 UJ
Silver	6010B	mg/kg	0.57 U	0.51 U	0.55 U	0.52 U	0.54 U	0.51 U	0.56 U	0.53 U	0.52 UJ	0.56 UJ	0.61 UJ	0.56 UJ	0.55 UJ	0.62 UJ	0.55 UJ	0.57 UJ
Sodium	6010B	mg/kg	29.1	18.7	110 U	100 U	110 U	100 U	110 U	248	100 U	110 UJ	120 UJ	110 UJ	110 UJ	120 UJ	20.1 J	110 UJ
Thallium	6010B	mg/kg	0.46 U	0.41 U	0.44 U	0.42 U	0.43 U	0.41 U	0.45 U	0.43 U	0.42 U	0.45 U	0.48 U	0.45 U	0.44 U	0.5 U	0.44 U	0.45 U
Vanadium	6010B	mg/kg	7.6	19.2	38.9	14.4	30.8	8.3	1.8	8.3	9	12.5	10.8	7.5	8.4	9.5	10.5	10
Zinc	6010B	mg/kg	9.7 J	22.4 J	39.5 J	16.8 J	38.6 J	6.3 J	1.9 J	7 J	8.4 J	12.3 J	14.3 J	10.3 J	11.4 J	14.2 J	11.8 J	13.4 J

Note: All soil concentrations are on a dry weight basis.

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-DP41 LE150 5 feet bgs	01-DP35 LE151 1 to 1.5 feet bgs	01-DP35 LE152 5 feet bgs	01-DP35 LE153 5 feet bgs	01-DP31 LE154 1 to 1.5 feet bgs	01-DP31 LE155 5 feet bgs
VOCs								
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,1-Dichloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,1-Dichloroethene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,2-Dichloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,2-Dichloropropane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	150 UJ	130 UJ	120 UJ	140 UJ	140 UJ	130 UJ
2-Hexanone	8260B	ug/kg	76 U	66 U	62 U	71 U	71 U	66 U
4-Methyl-2-Pentanone	8260B	ug/kg	76 U	66 U	62 U	71 U	71 U	66 U
Acetone	8260B	ug/kg	150 U	130 U	120 U	140 U	140 U	130 U
Benzene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Bromodichloromethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Bromoform	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Bromomethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Carbon Tetrachloride	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Chlorobenzene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Chlorodibromomethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Chloroethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Chloroform	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Chloromethane	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Cis-1,2-Dichloroethene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Cis-1,3-Dichloropropene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.13 U	7.1 U	6.6 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Toluene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Trans-1,2-Dichloroethene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Trans-1,3-Dichloropropene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Trichloroethene	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	7.6 U	6.6 U	6.2 U	7.1 U	7.1 U	6.6 U
Total Xylenes	8260B	ug/kg	23 U	20 U	19 U	21 U	21 U	20 U
SVOCs								
1,2,4-Trichlorobenzene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
1,2-Dichlorobenzene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
1,3-Dichlorobenzene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
1,4-Dichlorobenzene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2,4,5-Trichlorophenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2,4,6-Trichlorophenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2,4-Dichlorophenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2,4-Dimethylphenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2,4-Dinitrophenol	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
2,4-Dinitrotoluene	8270C	ug/kg	570 R	550 R	550 R	550 R	530 R	540 R
2,6-Dinitrotoluene	8270C	ug/kg	570 R	550 R	550 R	550 R	530 R	540 R
2-Chloronaphthalene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2-Chlorophenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2-Methylnaphthalene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2-Methylphenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
2-Nitroaniline	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
2-Nitrophenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
3,3'-Dichlorobenzidine	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
3-Nitroaniline	8270C	ug/kg	2900 UJ	2800 UJ	2800 UJ	2700 UJ	2700 UJ	2700 UJ
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
4-Chloro-3-Methylphenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
4-Chloroaniline	8270C	ug/kg	1100 U	1100 U	1100 U	1100 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
4-Methylphenol	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP41	01-DP35	01-DP35	01-DP35	01-DP31	01-DP31
			LE150	LE151	LE152	LE153	LE154	LE155
Analyte	Analytical Method	Units	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs
4-Nitroaniline	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
4-Nitrophenol	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
Acenaphthene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Acenaphthylene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Anthracene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Benz(A)Anthracene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Benzo(A)Pyrene	8270C	ug/kg	29 U	28 U	28 U	27 U	27 U	27 U
Benzo(B)Fluoranthene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Benzo(G,H,I)Perylene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Benzo(K)Fluoranthene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	190 U	180 U	180 U	180 U	170 U	180 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Butyl Benzyl Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Carbazole	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Chrysene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Dibenz(A,H)Anthracene	8270C	ug/kg	63 U	61 U	61 U	60 U	58 U	59 U
Dibenzofuran	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Diethyl Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Dimethyl Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Di-N-Butyl Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Di-N-Octyl Phthalate	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Fluoranthene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Fluorene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Hexachlorobenzene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Hexachlorobutadiene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Hexachlorocyclopentadiene	8270C	ug/kg	2900 U	2800 U	2800 U	2700 U	2700 U	2700 U
Hexachloroethane	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Isophorone	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Naphthalene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Nitrobenzene	8270C	ug/kg	570 R	550 R	550 R	550 R	530 R	540 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	94 U	91 U	90 U	89 U	87 U	88 U
N-Nitrosodiphenylamine	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Pentachlorophenol	8270C	ug/kg	1900 U	1900 U	1900 U	1900 U	1800 U	1800 U
Phenanthrene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Phenol	8270C	ug/kg	570 U	170 J	170 J	550 U	280 J	540 U
Pyrene	8270C	ug/kg	570 U	550 U	550 U	550 U	530 U	540 U
Explosives								
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
1,3-Dinitrobenzene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
2,4-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
2-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
3-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
4-Nitrotoluene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
Nitrobenzene	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	220 U	220 U	220 U	210 U	220 U
Hydrocarbons								
Motor Oil	8015B DRO	mg/kg	11 U	5 J	11 U	11 U	19	11 U
Diesel	8015B DRO	mg/kg	11 U	11 U	11 U	11 U	3 J	11 U
Gasoline	8015B GRO	mg/kg	16 U	16 U	12 U	12 U	18 U	13 U
General Chemistry								
Perchlorate	E314	ug/kg	23 U	22 U	22 U	22 U	21 U	22 U
Nitrate	300.0	mg/kg	1.3	2.5	1.1	1.7	5	0.57
PH	9040	pH unit	9.38	8.47	8.74	9.28	7.83	9.08
Metals								
Aluminum	6010B	mg/kg	5100	4390	5630	4200	4460	2690
Antimony	6010B	mg/kg	3.4 U	3.3 U	3.3 U	3.3 U	3.2 U	3.2 U
Arsenic	6010B	mg/kg	0.58 UJ	0.92	0.64	0.35 UJ	0.95	0.32 UJ
Barium	6010B	mg/kg	28.2	42.3	41	33.1	32.8	29.3
Beryllium	6010B	mg/kg	0.27	0.3	0.2	0.3	0.25	0.19
Cadmium	6010B	mg/kg	0.0079 J	0.22 UJ	0.22 UJ	0.22 UJ	0.072 J	0.22 UJ
Calcium	6010B	mg/kg	4890 J	34600 J	13900 J	4140 J	14500 J	4090 J
Chromium	6010B	mg/kg	3.3	3	4.1	2.7	2.4	1.7

Table E-3. Site 1 RI Tier I Investigation Soil Analytical Results

			01-DP41	01-DP35	01-DP35	01-DP35	01-DP31	01-DP31
			LE150	LE151	LE152	LE153	LE154	LE155
Analyte	Analytical Method	Units	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs	5 feet bgs	1 to 1.5 feet bgs	5 feet bgs
Cobalt	6010B	mg/kg	0.77	1.2	1.4	0.97	0.9	0.42
Copper	6010B	mg/kg	0.62	0.97	0.87	0.57	2.9	0.41
Iron	6010B	mg/kg	3220	3100	4480	3400	2650	1610
Lead	6010B	mg/kg	1.2	2.1	1.8	1.3	6	0.63
Magnesium	6010B	mg/kg	1300 J	1300 J	1800 J	1460 J	972 J	596 J
Manganese	6010B	mg/kg	24.5 J	45 J	52.7 J	46.5 J	51 J	19.9 J
Mercury	7471A	mg/kg	0.018 UJ	0.028 UJ	0.017 UJ	0.018 UJ	0.089	0.018 UJ
Nickel	6010B	mg/kg	1 J	1.3 J	1.5 J	1 J	1.1 J	0.57 J
Potassium	6010B	mg/kg	824 J	549 J	1330 J	964 J	485 J	286 J
Selenium	6010B	mg/kg	0.34 U	0.17 UJ	0.33 U	0.33 U	0.1 UJ	0.32 U
Silver	6010B	mg/kg	0.57 UJ	0.55 UJ	0.55 UJ	0.55 UJ	0.53 UJ	0.54 UJ
Sodium	6010B	mg/kg	171	110 UJ	6.6 J	44.1 J	13.7 J	19.5 J
Thallium	6010B	mg/kg	0.46 U	0.44 U	0.44 UJ	0.44 UJ	0.42 UJ	0.43 UJ
Vanadium	6010B	mg/kg	7.8	8.4	9.9	8.1	5.5	3.8
Zinc	6010B	mg/kg	8.9 J	8.5 J	13.2 J	10 J	10.3 J	3.8 J

Note: All soil concentrations are on a dry weight basis.

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T54 LE158 2 feet bgs	01-T51 LE160 2 feet bgs	01-T06 LE161 2 feet bgs	01-T15 LE162 1 foot bgs	01-T14 LE163 1.5 feet bgs	01-T27 LE165 1 foot bgs	01-T13 LE166 1.5 feet bgs	01-T23 LE167 1.5 feet bgs	01-T20 LE169 3 feet bgs	01-T29A LE170 5 feet bgs	01-T29A LE171 3 feet bgs	01-T05 LE172 0.5 feet bgs	01-T5S LE173 0.5 feet bgs	01-T17 LE174 2 feet bgs	01-T23 LE176 3 feet bgs	01-T33 LE177 3 feet bgs	01-T32 LE178 5 feet bgs	01-T32 LE179 1.5 feet bgs	01-T34 LE181 2 feet bgs
VOCs																					
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,1-Dichloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,1-Dichloroethene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,2-Dichloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,2-Dichloropropane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	94 U	90 UJ	99 UJ	100 UJ	120 UJ	89 U	120 U	88 U	93 U	130 U	120000 U	130 U	140 U	120 U	150 U	180 U	95 U	100 U	120000 U
2-Hexanone	8260B	ug/kg	47 U	45 U	50 U	52 U	58 U	45 U	61 U	44 U	46 U	65 U	60000 U	66 U	72 U	59 U	77 U	90 U	48 U	50 U	61000 U
4-Methyl-2-Pentanone	8260B	ug/kg	47 U	45 U	50 U	52 U	58 U	45 U	61 U	44 U	46 U	65 U	60000 U	66 U	72 U	59 U	77 U	90 U	48 U	50 U	61000 U
Acetone	8260B	ug/kg	94 UJ	90 UJ	99 UJ	100 UJ	120 UJ	89 UJ	120 UJ	88 UJ	93 UJ	130 UJ	120000 UJ	130 UJ	140 UJ	120 UJ	150 UJ	180 UJ	95 UJ	100 UJ	120000 UJ
Benzene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	610 J	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	430 J
Bromodichloromethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Bromoform	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Bromomethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Carbon Tetrachloride	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Chlorobenzene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Chlorodibromomethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Chloroethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Chloroform	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	0.6 J	6.1 U	0.5 J	0.7 J	0.7 J	6000 U	0.7 J	7.2 U	0.7 J	0.9 J	0.9 J	4.8 U	0.8 J	6100 U
Chloromethane	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Cis-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Cis-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	14000
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	2 J	4.8 U	5 U	6100 U
Toluene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	0.5 J	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	0.6 J	5 U	41000
Trans-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Trans-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Trichloroethene	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	4.7 U	4.5 U	5 U	5.2 U	5.8 U	4.5 U	6.1 U	4.4 U	4.6 U	6.5 U	6000 U	6.6 U	7.2 U	5.9 U	7.7 U	9 U	4.8 U	5 U	6100 U
Total Xylenes	8260B	ug/kg	14 U	14 U	15 U	16 U	17 U	13 U	18 U	13 U	14 U	20 U	18000 U	20 U	22 U	18 U	23 U	27 U	14 U	15 U	98000
SVOCs																					
1,2,4-Trichlorobenzene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
1,2-Dichlorobenzene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
1,3-Dichlorobenzene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
1,4-Dichlorobenzene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2,4,5-Trichlorophenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2,4,6-Trichlorophenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2,4-Dichlorophenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2,4-Dimethylphenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2,4-Dinitrophenol	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 UJ	2600 UJ	2700 UJ	610000 U
2,4-Dinitrotoluene	8270C	ug/kg	550 R	540 R	520 R	3100	550 R	530 R	520 R	7000	540 R	560 R	120000 R	550 R	550 R	120 J	590 R	590 R	530 R	540 R	120000 R
2,6-Dinitrotoluene	8270C	ug/kg	550 R	540 R	520 R	44 J	550 R	530 R	520 R	540 R	540 R	560 R	120000 R	550 R	550 R	650 R	590 R	590 R	530 R	540 R	120000 R
2-Chloronaphthalene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2-Chlorophenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2-Methylnaphthalene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	270000
2-Methylphenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
2-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 U	2600 U	2700 U	610000 U
2-Nitrophenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
3,3'-Dichlorobenzidine	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 UJ	520 UJ	540 UJ	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
3-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 UJ	2600 UJ	2700 UJ	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 U	2600 U	2700 U	610000 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 UJ	2600 UJ	2700 UJ	610000 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
4-Chloro-3-Methylphenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
4-Chloroaniline	8270C	ug/kg	1100 U	1100 U	1000 U	1100 U	1100 U	1100 U	1000 U	1100 U	1100 U	1100 U	240000 U	1100 U	1100 U	1300 U	1200 U	1200 U	1100 U	1100 U	240000 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
4-Methylphenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T54 LE158 2 feet bgs	01-T51 LE160 2 feet bgs	01-T06 LE161 2 feet bgs	01-T15 LE162 1 foot bgs	01-T14 LE163 1.5 feet bgs	01-T27 LE165 1 foot bgs	01-T13 LE166 1.5 feet bgs	01-T23 LE167 1.5 feet bgs	01-T20 LE169 3 feet bgs	01-T29A LE170 5 feet bgs	01-T29A LE171 3 feet bgs	01-T05 LE172 0.5 feet bgs	01-T5S LE173 0.5 feet bgs	01-T17 LE174 2 feet bgs	01-T23 LE176 3 feet bgs	01-T33 LE177 3 feet bgs	01-T32 LE178 5 feet bgs	01-T32 LE179 1.5 feet bgs	01-T34 LE181 2 feet bgs
4-Nitroaniline	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 U	2600 U	2700 U	610000 U
4-Nitrophenol	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 U	2600 U	2700 U	610000 U
Acenaphthene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Acenaphthylene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Anthracene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Benz(A)Anthracene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Benzo(A)Pyrene	8270C	ug/kg	27 U	27 U	26 U	27 U	27 U	27 U	26 U	27 U	27 U	28 U	2400 U	27 U	27 U	33 U	29 U	30 U	26 U	27 U	6100 U
Benzo(B)Fluoranthene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Benzo(G,H,I)Perylene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Benzo(K)Fluoranthene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	180 U	180 U	170 U	180 U	180 U	170 U	170 U	180 U	180 U	180 U	39000 U	180 U	180 U	210 U	190 U	190 U	170 U	180 U	40000 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	550 U	540 U	520 U	420 J	550 U	530 U	520 U	420 J	110 J	560 UJ	120000 UJ	550 UJ	550 UJ	650 UJ	590 UJ	590 UJ	530 UJ	540 UJ	120000 UJ
Butyl Benzyl Phthalate	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Carbazole	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 UJ	520 UJ	540 UJ	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Chrysene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Dibenz(A,H)Anthracene	8270C	ug/kg	39 U	39 U	37 U	39 U	39 U	59 U	57 U	59 U	39 U	40 U	8700 U	39 U	39 U	47 U	42 U	43 U	38 U	39 U	8800 U
Dibenzofuran	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Diethyl Phthalate	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Dimethyl Phthalate	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Di-N-Butyl Phthalate	8270C	ug/kg	550 U	540 U	520 U	113000	27800	530 U	69 J	307000	30300	200 J	120000 U	550 U	71 J	15300	590 U	590 U	530 U	540 U	120000 U
Di-N-Octyl Phthalate	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Fluoranthene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	38 J	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Fluorene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Hexachlorobenzene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Hexachlorobutadiene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Hexachlorocyclopentadiene	8270C	ug/kg	2700 U	2700 U	2600 U	2700 U	2700 U	2700 U	2600 U	2700 U	2700 U	2800 U	600000 U	2700 U	2700 U	3300 U	2900 U	3000 U	2600 U	2700 U	610000 U
Hexachloroethane	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Isophorone	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Naphthalene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	128000
Nitrobenzene	8270C	ug/kg	550 R	540 R	520 R	540 R	550 R	530 R	520 R	540 R	540 R	560 R	120000 R	550 R	550 R	650 R	590 R	590 R	530 R	540 R	120000 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	49 U	49 U	46 U	48 U	49 U	87 U	85 U	88 U	48 U	50 U	11000 U	49 U	49 U	59 U	53 U	53 U	48 U	49 U	11000 U
N-Nitrosodiphenylamine	8270C	ug/kg	550 U	540 U	520 U	12300	3500	530 U	520 U	66700	4000	560 U	120000 U	550 U	550 U	1300	590 U	590 U	530 U	540 U	120000 U
Pentachlorophenol	8270C	ug/kg	1900 U	1800 U	1800 U	1800 U	1900 U	1800 U	1800 U	1800 U	1800 U	1900 U	410000 U	1900 U	1900 U	2200 U	2000 U	2000 U	1800 U	1800 U	420000 U
Phenanthrene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Phenol	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Pyrene	8270C	ug/kg	550 U	540 U	520 U	540 U	550 U	530 U	520 U	540 U	540 U	560 U	120000 U	550 U	550 U	650 U	590 U	590 U	530 U	540 U	120000 U
Explosives																					
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
1,3-Dinitrobenzene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	630	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
2,4-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	1500	220 U	210 U	210 U	3500 R	220 U	650	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
2-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
3-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
4-Nitrotoluene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	220 U	210 U	210 UJ	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
Nitrobenzene	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	220 U	210 U	210 U	220 U	210 U	210 U	210 U	220 U	220 U	240 U	220 U	220 U	260 U	240 U	240 U	210 U	220 U	240 U
Hydrocarbons																					
Motor Oil	8015B DRO	mg/kg	11 U	11 U	5 J	8 J	5 J	6 J	4 J	20	8 J	19		20	9 J	7 J	41	67	11 U	9 J	2400 U
Diesel	8015B DRO	mg/kg	11 U	11 U	10 U	130	23	11 U	10 U	387	110	150		11 U	11 U	15	110	324	11 U	11 U	37000
Gasoline	8015B GRO	mg/kg	14 U	9.2 U	10 U	9.9 U	10 U	11 U	9.2 U	11 U	9.5 U	19 U		15 UJ	12 U	12 U	21 U	22 U	9.5 U	14 U	1600 J
General Chemistry																					
Perchlorate	E314	ug/kg	22 U	22 U	21 U	21 U	22 U	21 U	21 U	21 U	22 U	22 U	24 UJ	22 U	22 U	26 U	24 UJ	94 J	21 UJ	48 J	300 J
Nitrate	300.0	mg/kg	3.6	2.1	3.4	3.9	1	0.9	1.9	1.3	2	1.8		0.74	0.78	1.5	1.8	52.7	0.67	0.87	0.99
PH	9040	pH unit	7.43	6.79	6.26	6.91	7.43	7.31	6.88	7.25	7.46	7.78	5.36	8.33	8.39	7.01	8.02	8.03	8.34	6.77	9.92
Metals																					
Aluminum	6010B	mg/kg	5460	6820	2560	4720	7150	3370	3140	5070	7700	5270	6750	8060	5720	8520	88300	190000	5820	5510	11100
Antimony	6010B	mg/kg	0.24 UJ	0.78 UJ	0.32 UJ	0.23 UJ	0.28 UJ	3.2 U	0.22 UJ	0.26 UJ	0.55 UJ	0.93 UJ	0.81 UJ	0.41 UJ	0.27 UJ	0.68 UJ	18.8	103	0.85 UJ	0.44 UJ	0.27 UJ
Arsenic	6010B	mg/kg	0.75	0.97	0.34	0.52	0.74	0.38	0.33	0.57	0.58	0.19	0.22 J	0.61	0.38	0.61	35 U	12.4	0.65	0.42	0.35 UJ
Barium	6010B	mg/kg	45.9	75.5	52.8	30.5	39.1	27.7	29.9	38.2	40.2	23.8	36.9	57.6	115	45.9	245	537	36.2	35.9	170
Beryllium	6010B	mg/kg	0.32	0.25	0.093	0.26	0.3	0.38	0.13	0.19	0.29	0.14	0.2	0.32	0.24	0.29	24 U	0.17	0.33	0.33	0.19
Cadmium	6010B	mg/kg	0.77 J	31.7 J	0.23 J	0.18 J	0.096 J	2 J	0.32 J	4 J	0.14	0.07	0.043	0.18	0.47	6.8	156	2.7	9.1	0.12	0.33
Calcium	6010B	mg/kg	3330	3090	1540	3870	3660	2850	1660	2470	2970	1600	2960	19800	22700	3170	2930	2680	3130	3400	2650
Chromium	6010B	mg/kg	4	7.3	4.8	2.7	4	1.7	2.2	2.9	4.3	4	9.1	4.8	4.3	4.6	171	18.6	10.5	4.2	3.1

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T54 LE158 2 feet bgs	01-T51 LE160 2 feet bgs	01-T06 LE161 2 feet bgs	01-T15 LE162 1 foot bgs	01-T14 LE163 1.5 feet bgs	01-T27 LE165 1 foot bgs	01-T13 LE166 1.5 feet bgs	01-T23 LE167 1.5 feet bgs	01-T20 LE169 3 feet bgs	01-T29A LE170 5 feet bgs	01-T29A LE171 3 feet bgs	01-T05 LE172 0.5 feet bgs	01-T5S LE173 0.5 feet bgs	01-T17 LE174 2 feet bgs	01-T23 LE176 3 feet bgs	01-T33 LE177 3 feet bgs	01-T32 LE178 5 feet bgs	01-T32 LE179 1.5 feet bgs	01-T34 LE181 2 feet bgs
Cobalt	6010B	mg/kg	1.6	1.7	1	1.1	1.5	0.73	1.1	1.1	1.8	1.5	1.9	1.7	1.5	1.9	59 U	2	1.8	1.9	1.3
Copper	6010B	mg/kg	2.7	11.3	9.8	4.6	21.8	13.3	15.7	20.4	11.3	67.6	4.2	5.7	54.3	375	409	16700	9	7	16.8
Iron	6010B	mg/kg	3780	8890	5100	2730	4190	1900	2430	3100	4400	19900	17200	4890	3730	4940	8450	6410	5330	8490	3580
Lead	6010B	mg/kg	6.4	44	12.7	29.4	6.5	4	13	42.4	32.8	89.8	27.4	4.7	13	22.8	115	1580	392	15.3	18.7
Magnesium	6010B	mg/kg	1680	1410	630	1120	1530	895	762	1130	1620	980	1460	2050	1490	1720	2000	2670	1320	1390	1740
Manganese	6010B	mg/kg	60.4 J	80.6 UJ	62.1	43.8	48.4	28.4 J	49.6 J	35.5 J	79.3	70.4	83.7	75.1	53.7	86.8	123	143	67.4	58.8	70.5
Mercury	7471A	mg/kg	0.031	0.069	1.1	0.031	0.044	0.034	1.5	0.048	0.18	0.054	0.061	0.046	0.065	0.13	0.059	0.1	0.012	0.016	0.88
Nickel	6010B	mg/kg	2	3.3	2	1.2	1.8	0.87	1.6	1.3	1.9	6.1	2.3	5.8	36.2	2.7	112	33	2.2	1.3	1.4
Potassium	6010B	mg/kg	450	485	460	416	486	254	525	416	612	518	626	826	730	721	1300	1150	655	810	7940
Selenium	6010B	mg/kg	0.11 UJ	0.33 U	0.31 U	0.32 U	0.33 U	0.32 U	0.31 U	0.32 U	0.32 U	0.34 U	0.38 U	0.33 U	0.33 U	0.39 U	35 U	4.7	0.32 U	0.33 U	0.37 U
Silver	6010B	mg/kg	0.55 UJ	0.54 U	0.52 UJ	0.54 UJ	0.55 UJ	0.53 UJ	0.52 UJ	0.54 UJ	0.54 U	0.56 U	0.6 U	0.55 U	0.55 U	0.65 U	5.8	1.9	0.53 U	0.54 U	0.61 U
Sodium	6010B	mg/kg	22.9 UJ	147	100 UJ	110 UJ	87.8	52.5	100 UJ	110 UJ	110 U	322	256	18.2 UJ	110 U	130 U	3010	120 U	119 UJ	73.4 UJ	6760
Thallium	6010B	mg/kg	0.44 U	0.43 U	0.41 U	0.43 U	0.44 U	0.43 U	0.42 U	0.43 U	0.43 U	0.45 U	0.48 U	0.44 U	0.44 U	0.52 U	47 U	15.2	0.42 U	0.43 U	0.49 U
Vanadium	6010B	mg/kg	7.5	7.7	3.6	6	9.1	4.7	3.9	6.3	8.2	5.2	6.1	9.8	8	8.7	8.3	11.9	5.7	6.2	4
Zinc	6010B	mg/kg	41.8	326	32.6	69.1	163	211	48.6	548	354	54.5	14	104	354	1530	29100	2060	23.7	34.7	98.2
Dioxins																					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6 J	3.2 J	NA	4.15 J	21.1	NA	NA	2.37 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.4	24	NA	90.5	568	NA	NA	98.3
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.19	2.18 J	NA	5.09	29.1	NA	NA	2.33 J
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.66	2.61 J	NA	19.9	96.2	NA	NA	14.4
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.528 J	0.183 J	NA	0.522 J	2.39 J	NA	NA	0.183 J
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.03 J	0.375 J	NA	1.53 J	9.91	NA	NA	0.481 J
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.434 J	0.269 U	NA	1.01 J	4.87	NA	NA	2.31 J
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.04 J	0.437 J	NA	1.47 J	8.22	NA	NA	0.365 J
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.548 J	0.248 J	NA	1.92 J	9.4	NA	NA	1.63 J
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.481	0.149 J	NA	0.498 J	2.88 J	NA	NA	0.24 J
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.501 J	0.161 J	NA	1.78 J	8.53	NA	NA	1.81 J
1,2,3,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.24 J	0.267 J	NA	0.925 J	7.7	NA	NA	0.261 J
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.449 J	0.269 U	NA	0.904 J	5.69	NA	NA	1.19 J
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.11 J	0.556 J	NA	2.11 J	13.5	NA	NA	0.411 J
2,3,4,7,8-Pentachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.83 J	0.487 J	NA	1.85 J	13.7	NA	NA	0.462 J
2,3,7,8-Tetrachlorodibenzofuran	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.04	0.624	NA	1.34	11.5	NA	NA	0.538 J
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.424 U	0.364 U	NA	0.394 J	2.51	NA	NA	0.277 U
Heptachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.8	3.45	NA	8.8	47.3	NA	NA	7.21
Heptachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13	8.23	NA	39.9	176	NA	NA	61.5
Hexachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.6	4.18	NA	16.8	97.5	NA	NA	7.96
Hexachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.68	1.34	NA	23.3	102	NA	NA	45.6
Pentachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29.2	5.54	NA	21.4	148	NA	NA	4.06
Pentachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.18	0.902	NA	10.9	54.4	NA	NA	20.3
Tetrachlorodibenzofurans	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	39	7.58	NA	28.8	249	NA	NA	3.78
Tetrachlorodibenzo-P-Dioxins	8290	NG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6	0.364097 U	NA	7.25	43.4	NA	NA	11.7
Total 2,3,7,8-TCDD TEQ Human/Mammal														**2.69**	**0.89**		**3.7**	**23.65**			**2.53**
Total 2,3,7,8-TCDD TEQ (Bird)														**4.49**	**1.66**		**5.47**	**39.27**			**2.86**

Note: All soil concentrations are on a dry weight basis.

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T34 LE182 6 feet bgs	01-T34 LE183 10 feet bgs	01-T34 LE184 10 feet bgs	01-T31 LE185 8 feet bgs	01-T48 LE187 2 feet bgs	01-T59 LE188 3 feet bgs	01-T57 LE189 3 feet bgs	01-T52 LE190 4 feet bgs	01-T50 LE191 6.5 feet bgs	01-T50 LE192 6.5 feet bgs	01-T34N LE194 3 feet bgs	01-T34E LE195 6 feet bgs	01-T34S LE196 8 feet bgs	01-T34W LE197 8 feet bgs	01-T66 LE199 4 feet bgs	01-T63 LE200 2.5 feet bgs	01-T65 LE201 2 feet bgs	01-T65 LE202 2 feet bgs
VOCs																				
1,1,1,2-Tetrachloroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,1-Dichloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,1-Dichloroethene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,2-Dichloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,2-Dichloropropane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	8260B	ug/kg	11000 U	13000 U	11000 U	150 U	120 U	150 U	130 U	150 U	110 U	99 U	97 U	110 U	92 U	87 U	160 U	98 U	95 U	95 U
2-Hexanone	8260B	ug/kg	5600 U	6400 U	5600 U	76 U	61 U	76 U	65 U	73 U	54 U	49 U	49 U	54 U	46 U	43 U	82 U	49 U	48 U	48 U
4-Methyl-2-Pentanone	8260B	ug/kg	5600 U	6400 U	5600 U	76 U	61 U	76 U	65 U	73 U	54 U	49 U	49 U	54 U	46 U	43 U	82 U	49 U	48 U	48 U
Acetone	8260B	ug/kg	8700 J	13000 UJ	11000 UJ	150 UJ	120 UJ	150 UJ	130 UJ	150 UJ	110 UJ	99 UJ	97 UJ	110 UJ	92 UJ	87 UJ	160 UJ	98 UJ	95 UJ	95 UJ
Benzene	8260B	ug/kg	36 J	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Bromodichloromethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Bromoform	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Bromomethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Carbon Tetrachloride	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Chlorobenzene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Chlorodibromomethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Chloroethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Chloroform	8260B	ug/kg	560 UJ	640 UJ	560 UJ	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	0.6 U	5.4 U	0.6 U	4.3 U	0.8 J	0.6 J	4.8 U	4.8 U
Chloromethane	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Cis-1,2-Dichloroethene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Cis-1,3-Dichloropropene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Dichlorodifluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diisopropyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	8260B	ug/kg	530 J	470 J	240 J	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Methyl Tert-Butyl Ether	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Tert-Butyl Alcohol	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Toluene	8260B	ug/kg	600 J	140 J	73 J	7.6 U	6.1 U	7.6 U	0.7 J	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	1 J	4.9 U	4.8 U	4.8 U
Trans-1,2-Dichloroethene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Trans-1,3-Dichloropropene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Trichloroethene	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Trichlorofluoromethane	8260B	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	8260B	ug/kg	560 U	640 U	560 U	7.6 U	6.1 U	7.6 U	6.5 U	7.3 U	5.4 U	4.9 U	4.9 U	5.4 U	4.6 U	4.3 U	8.2 U	4.9 U	4.8 U	4.8 U
Total Xylenes	8260B	ug/kg	5400 J	3000 J	1500 J	23 U	18 U	23 U	20 U	22 U	16 U	15 U	15 U	16 U	14 U	13 U	25 U	15 U	14 U	14 U
SVOCs																				
1,2,4-Trichlorobenzene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 UJ	3200 UJ	2700 UJ	2700 UJ	3300 UJ	2800 UJ	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	8270C	ug/kg	2300 R	2500 R	2200 R	550 R	1600	640 R	540 R	530 R	660 R	560 R	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	8270C	ug/kg	2300 R	2500 R	2200 R	550 R	680 R	640 R	540 R	530 R	660 R	560 R	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	8270C	ug/kg	18000	36000	22000	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 U	3200 U	2700 U	2700 U	3300 U	2800 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 U	3200 U	2700 U	2700 U	3300 U	2800 U	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 UJ	3200 UJ	2700 UJ	2700 UJ	3300 UJ	2800 UJ	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	8270C	ug/kg	4500 U	5100 U	4500 U	1100 U	1400 U	1300 U	1100 U	1100 U	1300 U	1100 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T34 LE182 6 feet bgs	01-T34 LE183 10 feet bgs	01-T34 LE184 10 feet bgs	01-T31 LE185 8 feet bgs	01-T48 LE187 2 feet bgs	01-T59 LE188 3 feet bgs	01-T57 LE189 3 feet bgs	01-T52 LE190 4 feet bgs	01-T50 LE191 6.5 feet bgs	01-T50 LE192 6.5 feet bgs	01-T34N LE194 3 feet bgs	01-T34E LE195 6 feet bgs	01-T34S LE196 8 feet bgs	01-T34W LE197 8 feet bgs	01-T66 LE199 4 feet bgs	01-T63 LE200 2.5 feet bgs	01-T65 LE201 2 feet bgs	01-T65 LE202 2 feet bgs
4-Nitroaniline	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 UJ	3200 UJ	2700 UJ	2700 UJ	3300 UJ	2800 UJ	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 UJ	3200 UJ	2700 UJ	2700 UJ	3300 UJ	2800 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Benz(A)Anthracene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	8270C	ug/kg	180 U	130 U	110 U	28 U	34 U	32 U	27 U	27 U	33 U	28 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	8270C	ug/kg	730 U	830 U	730 U	180 U	220 U	210 U	180 U	170 U	220 U	180 U	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	2300 UJ	2500 UJ	2200 UJ	550 UJ	73 J	640 UJ	120 J	530 UJ	660 UJ	560 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(A,H)Anthracene	8270C	ug/kg	160 U	180 U	160 U	40 U	49 U	48 U	39 U	38 U	48 U	40 U	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	41700	110 J	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	8270C	ug/kg	11000 U	13000 U	11000 U	2800 U	3400 U	3200 U	2700 U	2700 U	3300 U	2800 U	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	8270C	ug/kg	9900	16000	10000	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	8270C	ug/kg	2300 R	2500 R	2200 R	550 R	680 R	640 R	540 R	530 R	660 R	560 R	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	200 U	230 U	200 U	50 U	61 U	57 U	49 U	48 U	59 U	51 U	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	5300	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	8270C	ug/kg	7700 U	8700 U	7600 U	1900 U	2300 U	2200 U	1800 U	1800 U	2200 U	1900 U	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	8270C	ug/kg	2300 U	2500 U	2200 U	550 U	680 U	640 U	540 U	530 U	660 U	560 U	NA	NA	NA	NA	NA	NA	NA	NA
Explosives																				
1,3,5-Trinitrobenzene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	230 U	250 U	220 U	220 U	270 U	260 U	220 U	210 U	260 U	220 U	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons																				
Motor Oil	8015B DRO	mg/kg	230 U	250 U	560 U	7 J	39	18	69	15	9 J	11 J	6 J	10 J	6 J	6 J	35	14	8 J	21
Diesel	8015B DRO	mg/kg	3700	4600	4900	10 J	73	13 U	20	11 U	13 U	11 U	11 U	12 U	11 U	11 U	4 J	11 U	11 U	11 U
Gasoline	8015B GRO	mg/kg	250 J	220 J	170 J	11 U	13 U	12 U	10 U	10 U	12 U	12 U	9.3 U	11 U	11 U	9.1 U	10 U	8.9 U	9.1 U	9.5 U
General Chemistry																				
Perchlorate	E314	ug/kg	1600	25 U	130	22	27 UJ	26 UJ	22 UJ	21 UJ	26 UJ	22 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	300.0	mg/kg	0.52	0.68	0.49	0.78	0.66	0.64	2.6	5.5	8.7	6.3	NA	NA	NA	NA	NA	NA	NA	NA
PH	9040	pH unit	9.57	9.57	8.83	8.18	8.07	6.97	7.15	7.88	4.7	4.06	8.88	7.58	8.23	8.45	NA	NA	NA	NA
Metals																				
Aluminum	6010B	mg/kg	3610	5400	4580	19800	4310	2560	4810	4960	4590	3660	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	6010B	mg/kg	0.13 UJ	0.33 UJ	3.4 U	4.2	0.28 UJ	11.1	1	0.26 UJ	0.14 UJ	0.15 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	6010B	mg/kg	0.94	0.71	0.54	2.8	0.4 UJ	1.2	0.66	0.67	0.59	0.83	NA	NA	NA	NA	NA	NA	NA	NA
Barium	6010B	mg/kg	40.6	43.6	39	804	36.7	39.3	60.1	44.8	39.9	29	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	6010B	mg/kg	0.24	0.25	0.28	0.23	0.4	0.67	0.48	0.3	0.13 UJ	0.11 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	6010B	mg/kg	0.076	0.1	0.038 UJ	1.9	0.26	2.7	16.3	0.14	0.052 UJ	0.092	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	6010B	mg/kg	1870	2580	2930	5180	14700	2140	3330	3600	2390	2580	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	6010B	mg/kg	2.9	3.7	3.1	15.7	2.5	4	6.2	3.4	2.4	2.5	NA	NA	NA	NA	NA	NA	NA	NA

Table E-4. Site 1 RI Tier II Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-T34 LE182 6 feet bgs	01-T34 LE183 10 feet bgs	01-T34 LE184 10 feet bgs	01-T31 LE185 8 feet bgs	01-T48 LE187 2 feet bgs	01-T59 LE188 3 feet bgs	01-T57 LE189 3 feet bgs	01-T52 LE190 4 feet bgs	01-T50 LE191 6.5 feet bgs	01-T50 LE192 6.5 feet bgs	01-T34N LE194 3 feet bgs	01-T34E LE195 6 feet bgs	01-T34S LE196 8 feet bgs	01-T34W LE197 8 feet bgs	01-T66 LE199 4 feet bgs	01-T63 LE200 2.5 feet bgs	01-T65 LE201 2 feet bgs	01-T65 LE202 2 feet bgs
Cobalt	6010B	mg/kg	1.5	1.5	1.5	1.5	0.93	1	1.5	1.6	0.81	0.79	NA	NA	NA	NA	NA	NA	NA	NA
Copper	6010B	mg/kg	2.8	5.3	2.6	818	55.2	442	30.5	3.7	3	9	NA	NA	NA	NA	NA	NA	NA	NA
Iron	6010B	mg/kg	2880	3290	3330	14000	2620	9760	8050	4010	2820	2790	NA	NA	NA	NA	NA	NA	NA	NA
Lead	6010B	mg/kg	8.1	23.9	4.7	299	14.6	147	56.1	10.1	8.5	11.1	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	6010B	mg/kg	1180	1350	1420	1220	1080	702	1130	1330	754	710	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	6010B	mg/kg	54.8	50.9	57	127	60	58.1	67	66.6	24.3	27.1	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7471A	mg/kg	0.06	0.39	0.062	0.081	0.026	0.058	0.057	0.02 UJ	0.034	0.021 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	6010B	mg/kg	2.4	1.8	1.7	25.3	1.1	2.7	2.8	2	0.8	0.99	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	6010B	mg/kg	1490	1040	607	742	477	354	423	607	392	455	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	6010B	mg/kg	0.34 U	0.38 U	0.34 U	0.21	0.41 U	0.38 U	0.33 U	0.32 U	0.4 U	0.34 U	NA	NA	NA	NA	NA	NA	NA	NA
Silver	6010B	mg/kg	0.56 U	0.64 U	0.56 U	1.1	0.68 U	0.64 U	0.54 U	0.53 U	0.66 U	0.58 U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	6010B	mg/kg	1840	973	427	110 U	76.7 UJ	130 U	195	27.7 UJ	34.2 UJ	34 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	6010B	mg/kg	0.45 U	0.51 U	0.45 U	0.44 U	0.55 U	0.11 UJ	0.43 U	0.42 U	0.53 U	0.45 U	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	6010B	mg/kg	5.4	6.2	6.8	5.8	5.1	3.1	5.2	7.2	5.4	4.8	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	6010B	mg/kg	12.5	33.7	11.8	1250	417	1300	200	15.6	12.4	12.4	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins																				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	NG/KG	0.525 U	0.5 U	0.471 J	NA	45.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	NG/KG	4.27 UJ	5.37 UJ	3.08 UJ	NA	1740	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	NG/KG	0.262 U	0.154 UJ	0.169 UJ	NA	8.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	NG/KG	0.676 UJ	0.963 UJ	0.604 UJ	NA	244	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	2.11 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	0.636 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	0.398 U	0.25 U	0.274 U	NA	7.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	0.529 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	0.32 U	0.152 J	0.274 U	NA	40.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	0.514 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	NG/KG	0.335 U	0.146 J	0.274 U	NA	26.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	0.231 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	6.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	1.72 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	8290	NG/KG	0.262 U	0.25 U	0.274 U	NA	0.414 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	8290	NG/KG	0.233 J	0.166 J	0.212 J	NA	0.259 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	NG/KG	0.242 U	0.248 U	0.216 U	NA	0.955	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans	8290	NG/KG	0.262417 U	0.250248 U	0.267 UJ	NA	37.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	NG/KG	0.676 UJ	2.53	1.34 UJ	NA	448	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans	8290	NG/KG	0.262417 U	0.250248 U	0.273768 U	NA	12.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	NG/KG	0.34807 U	1.19	0.479641 U	NA	313	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans	8290	NG/KG	0.262417 U	0.250248 U	0.273768 U	NA	4.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	NG/KG	0.344291 U	0.148	0.273768 U	NA	55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans	8290	NG/KG	0.137087 U	0.166	0.156595 U	NA	2.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	NG/KG	0.242053 U	0.247646 U	0.332902 U	NA	11.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total 2,3,7,8-TCDD TEQ Human/Mammal			**0.45**	**0.43**	**0.44**		**18.1**													
Total 2,3,7,8-TCDD TEQ (Bird)			**0.6**	**0.63**	**0.69**		**12.3**													

Note: All soil concentrations are on a dry weight base.

Table E-5. Site 1 RI Tier III-A Investigation Soil Analytical Results

Analyte	Analytical Method	Units	01-BH01 LE207 5 feet bgs	01-BH01 LE208 10 feet bgs	01-BH01 LE209 15 feet bgs	01-BH01 LE210 15 feet bgs (dup)	01-BH01 LE211 20 feet bgs	01-BH01 LE212 25 feet bgs	01-BH01 LE213 30 feet bgs	01-BH01 LE214 35 feet bgs
VOCs										
1,1,1,2-Tetrachloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1,1-Trichloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1,2-Trichloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1-Dichloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,1-Dichloroethene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,2-Dichloroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,2-Dichloropropane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 UJ	5.5 UJ	5.1 UJ
2-Butanone	8260B	ug/kg	22000 U	22000 U	22000 U	22000 U	23000 U	130 U	110 U	100 U
2-Hexanone	8260B	ug/kg	11000 U	11000 U	11000 U	11000 U	12000 U	66 U	55 U	51 U
4-Methyl-2-Pentanone	8260B	ug/kg	11000 U	11000 U	11000 U	11000 U	12000 U	66 U	55 U	51 U
Acetone	8260B	ug/kg	22000 U	22000 U	22000 U	22000 U	23000 U	130 U	110 U	100 U
Benzene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Bromodichloromethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Bromoform	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Bromomethane	8260B	ug/kg	1100 UJ	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Carbon Disulfide	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Carbon Tetrachloride	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Chlorobenzene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Chlorodibromomethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Chloroethane	8260B	ug/kg	1100 UJ	1100 U	1100 U	1100 U	1200 U	6.6 UJ	5.5 UJ	5.1 UJ
Chloroform	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Chloromethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Cis-1,2-Dichloroethene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Cis-1,3-Dichloropropene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Dichlorodifluoromethane	8260B	ug/kg	1100 UJ	1100 UJ	1100 UJ	1100 UJ	1200 UJ	6.6 UJ	5.5 UJ	5.1 UJ
Diisopropyl Ether	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 UJ	5.5 UJ	5.1 UJ
Ethylbenzene	8260B	ug/kg	650 J	1000 J	240 J	330 J	2600 J	6.6 U	5.5 U	5.1 U
Methyl Tert-Butyl Ether	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Methylene Chloride	8260B	ug/kg	1100 U	1100 UJ	1100 U	1100 UJ	1200 UJ	9 UJ	6 UJ	5.1 U
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Styrene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Tert-Butyl Alcohol	8260B	ug/kg	4400 UJ	4400 UJ	4500 UJ	4500 UJ	4600 UJ	26 UJ	22 UJ	20 UJ
Tetrachloroethene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Toluene	8260B	ug/kg	440 J	1100 U	1100 U	1100 U	330 J	6.6 U	5.5 U	5.1 U
Trans-1,2-Dichloroethene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Trans-1,3-Dichloropropene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Trichloroethene	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Trichlorofluoromethane	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Vinyl Chloride	8260B	ug/kg	1100 U	1100 U	1100 U	1100 U	1200 U	6.6 U	5.5 U	5.1 U
Total Xylenes	8260B	ug/kg	5400	2800 J	830 J	1200 J	17000 J	20 U	16 U	15 U
SVOCs										
1,2,4-Trichlorobenzene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
1,2-Dichlorobenzene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
1,3-Dichlorobenzene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
1,4-Dichlorobenzene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U

Table E-5. Site 1 RI Tier III-A Investigation Soil Analytical Results

			01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01
			LE207	LE208	LE209	LE210	LE211	LE212	LE213	LE214
Analyte	Analytical Method	Units	5 feet bgs	10 feet bgs	15 feet bgs	15 feet bgs (dup)	20 feet bgs	25 feet bgs	30 feet bgs	35 feet bgs
2,4,5-Trichlorophenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2,4,6-Trichlorophenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2,4-Dichlorophenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2,4-Dimethylphenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2,4-Dinitrophenol	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
2,4-Dinitrotoluene	8270C	ug/kg	22000 R	5500 R	22000 R	22000 R	23000 R	5400 R	550 R	530 R
2,6-Dinitrotoluene	8270C	ug/kg	22000 R	5500 R	22000 R	22000 R	23000 R	5400 R	550 R	530 R
2-Chloronaphthalene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2-Chlorophenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2-Methylnaphthalene	8270C	ug/kg	55000	24000	29100	30500	75000	5400 U	550 U	32 J
2-Methylphenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
2-Nitroaniline	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
2-Nitrophenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
3,3'-Dichlorobenzidine	8270C	ug/kg	22000 U	5500 UJ	22000 UJ	22000 U	23000 U	5400 UJ	550 UJ	530 UJ
3-Nitroaniline	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
4-Chloro-3-Methylphenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
4-Chloroaniline	8270C	ug/kg	44000 U	11000 U	45000 U	45000 U	46000 U	11000 U	1100 U	1100 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
4-Methylphenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
4-Nitroaniline	8270C	ug/kg	110000 UJ	28000 UJ	110000 UJ	110000 UJ	120000 UJ	27000 UJ	2800 UJ	2700 UJ
4-Nitrophenol	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
Acenaphthene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Acenaphthylene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Anthracene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Benz(A)Anthracene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Benzo(A)Pyrene	8270C	ug/kg	1100 U	280 U	1100 U	1100 U	1200 U	270 U	28 U	27 U
Benzo(B)Fluoranthene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Benzo(G,H,I)Perylene	8270C	ug/kg	22000 UJ	5500 UJ	22000 UJ	22000 UJ	23000 UJ	5400 UJ	550 UJ	530 UJ
Benzo(K)Fluoranthene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	7200 U	1800 U	7300 U	7300 U	7500 U	1800 U	180 U	170 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Butyl Benzyl Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Carbazole	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Chrysene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Dibenz(A,H)Anthracene	8270C	ug/kg	1100 U	280 UJ	1100 UJ	1100 U	1200 U	270 UJ	28 UJ	27 UJ
Dibenzofuran	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Diethyl Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Dimethyl Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Di-N-Butyl Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Di-N-Octyl Phthalate	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Fluoranthene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Fluorene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Hexachlorobenzene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Hexachlorobutadiene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Hexachlorocyclopentadiene	8270C	ug/kg	110000 U	28000 U	110000 U	110000 U	120000 U	27000 U	2800 U	2700 U
Hexachloroethane	8270C	ug/kg	22000 U	5500 UJ	22000 UJ	22000 U	23000 U	5400 UJ	550 UJ	530 UJ

Table E-5. Site 1 RI Tier III-A Investigation Soil Analytical Results

			01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01
			LE207	LE208	LE209	LE210	LE211	LE212	LE213	LE214
Analyte	Analytical Method	Units	5 feet bgs	10 feet bgs	15 feet bgs	15 feet bgs (dup)	20 feet bgs	25 feet bgs	30 feet bgs	35 feet bgs
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	22000 U	5500 UJ	22000 UJ	22000 U	23000 U	5400 UJ	550 UJ	530 UJ
Isophorone	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Naphthalene	8270C	ug/kg	31700	13000	14000 J	15000 J	46000	5400 U	550 U	28 J
Nitrobenzene	8270C	ug/kg	22000 R	5500 R	22000 R	22000 R	23000 R	5400 R	550 R	530 R
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	1100 U	290 U	1200 U	1200 U	1200 U	280 U	29 U	28 U
N-Nitrosodiphenylamine	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Pentachlorophenol	8270C	ug/kg	75000 U	19000 U	76000 U	76000 U	78000 U	18000 U	1900 U	1800 U
Phenanthrene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Phenol	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Pyrene	8270C	ug/kg	22000 U	5500 U	22000 U	22000 U	23000 U	5400 U	550 U	530 U
Explosives										
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
1,3-Dinitrobenzene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
2,4,6-Trinitrotoluene	8330	ug/kg	7860	590	220 U	293	395	560	470	327
2,4-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
2-Amino-4,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
2-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
3-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
4-Amino-2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
4-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	14000	510	220 U	267	394	580	251	210 U
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
Nitrobenzene	8330	ug/kg	220 U	220 U	220 U	220 U	230 U	220 U	220 U	210 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	1400	220 U	220 U	220 U	230 U	220 U	220 U	210 U
Hydrocarbons										
Motor Oil	8015B DRO	mg/kg	1100 U	1100 U	560 U	1100 U	1200 U	11 U	11 U	11 U
Diesel	8015B DRO	mg/kg	12000	8800	4300	11000	19000	6 J	4 J	5 J
Gasoline	8015B GRO	mg/kg	140 J	530 J	240 J	330 J	710 J	11 U	0.03 J	0.03 J
General Chemistry										
Perchlorate	E314	ug/kg	44 U	22 U	22 U	22 U	23 U	140	430	160
Nitrate	300.0	mg/kg	0.45 J	0.36 J	0.35 J	0.45 J	0.46 J	2.8	2	0.87
PH	9040	pH unit	9.72	7.55	7.72	7.9	8.44	8.14	7.93	9.16
Metals										
Aluminum	6010B	mg/kg	5030 J	3960 J	4590 J	5030 J	4490 J	3300 J	2180 J	4230 J
Antimony	6010B	mg/kg	3.3 U	3.3 U	3.3 U	0.17 UJ	3.5 U	3.3 U	3.3 U	3.2 U
Arsenic	6010B	mg/kg	0.82	0.62 UJ	0.78	0.69 UJ	1	0.38 UJ	0.4 UJ	0.51 UJ
Barium	6010B	mg/kg	29.1	28.3	28.2	25.2	37.9	28.8	21.3	29.3
Beryllium	6010B	mg/kg	0.17	0.19	0.17	0.18	0.75	0.24	0.19	0.22
Cadmium	6010B	mg/kg	0.089	0.048 UJ	0.037 UJ	0.037 UJ	0.034 UJ	0.028 UJ	0.079	0.15
Calcium	6010B	mg/kg	1690 J	2030 J	1980 J	1970 J	3670 J	3100 J	2930 J	36800 J
Chromium	6010B	mg/kg	3	3	3.3	3.2	2.7	2.2	1.5	2.5
Cobalt	6010B	mg/kg	1.2	1.2	1.5	1.4	1.9	0.58	0.6	1.1
Copper	6010B	mg/kg	37.6	1.2	1.1 UJ	1.1 UJ	0.53 UJ	0.38 UJ	0.35 UJ	0.42 UJ
Iron	6010B	mg/kg	2660 J	2600 J	3140 J	3220 J	2090 J	2020 J	1590 J	3250 J
Lead	6010B	mg/kg	4.2	1.8	1.6	1.6	1.5	0.83	0.97	1.4
Magnesium	6010B	mg/kg	1100	1070	1030	1060	968	842	626	1180
Manganese	6010B	mg/kg	39	37.2	39.2	39.4	15.8	17.6	17.3	104
Mercury	7471A	mg/kg	0.53	0.062	0.039	0.045	0.084	0.039	0.038	0.043
Nickel	6010B	mg/kg	1.3	1.4	1.6	1.6	1.2	0.47	0.43	0.77

Table E-5. Site 1 RI Tier III-A Investigation Soil Analytical Results

			01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01	01-BH01
			LE207	LE208	LE209	LE210	LE211	LE212	LE213	LE214
Analyte	Analytical Method	Units	5 feet bgs	10 feet bgs	15 feet bgs	15 feet bgs (dup)	20 feet bgs	25 feet bgs	30 feet bgs	35 feet bgs
Potassium	6010B	mg/kg	1440	268	292	309	129	365	374	1000
Selenium	6010B	mg/kg	0.2 J	0.22 J	0.21 J	0.33 UJ	0.35 UJ	0.33 UJ	0.33 UJ	0.26 J
Silver	6010B	mg/kg	0.55 UJ	0.55 UJ	0.56 UJ	0.56 UJ	0.58 UJ	0.54 UJ	0.55 UJ	0.53 UJ
Sodium	6010B	mg/kg	1810 J	30.9 UJ	37.4 UJ	35.8 UJ	85.8 J	56.1 UJ	33.6 UJ	43.1 UJ
Thallium	6010B	mg/kg	0.44 U	0.44 U	0.45 U	0.45 U	0.46 U	0.072 UJ	0.44 U	0.43 U
Vanadium	6010B	mg/kg	4.3	5.1	5.9	6	3.9	3.9	3.5	6.5
Zinc	6010B	mg/kg	8.9 J	6.6 J	6.4 J	6.4 J	5.6 J	5.2 J	5.7 J	9.8 J

Note: All soil concentrations are on a dry weight basis.

Table E-6. Site 1 Groundwater Sampling Results (Not Including Perchlorate)

Analyte	Units	Lab Method	01-MW101 LE053 1/14/2002	01-MW102 LE054 1/14/2002	01-MW102 (dup) LE056 1/14/2002	01-MW201 LE086 1/16/2002	01-MW202 LE057 1/15/2002	01-MW202 (VOC Resample) LE206 2/15/2002	01-MW203 LE058 1/15/2002	01-MW204 LE045 1/9/2002	01-MW205 LE087 1/16/2002	01-MW206 LE047 1/10/2002	01-MW207 LE052 1/11/2002	01-MW207 (VOC Resample) LE205 2/15/2002	01-MW208 LE218 6/14/2002	01-MW209 LE217 6/14/2002	01-MW209 (dup) LE219 6/14/2002	01-MW210 LE216 6/12/2002
VOCs																		
1,1,1,2-Tetrachloroethane	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	8260B	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
2-Butanone	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	ug/L	8260B	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	ug/L	8260B	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	ug/L	8260B	1 U	1 U	1 U	1 U	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	ug/L	8260B	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	ug/L	8260B	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 U
Butane, 2-Methoxy-2-Methyl-	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
Carbon Disulfide	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	ug/L	8260B	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.25 U	0.25 U	0.25 U	0.25 U
Chlorobenzene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	ug/L	8260B	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	ug/L	8260B	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloromethane	ug/L	8260B	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
Diisopropyl Ether	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
Ethylbenzene	ug/L	8260B	1 U	1 U	1 U	1 U	3.1	1 U	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U	1 U	1 U
Methyl Tert-Butyl Ether	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 U	3 U	3 U	3 U
Methylene Chloride	ug/L	8260B	3 UJ	4 UJ	228	1 J	3 U	4 UJ	3 U	3 U	3 U	0.4 J	0.3 J	4 UJ	3 U	3 U	3 U	3 U
Propane, 2-Ethoxy-2-Methyl-	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
Styrene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tert-Butyl Alcohol	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U	2 U
Tetrachloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	ug/L	8260B	1 U	1 U	1 U	1 U	0.8 J	1 U	1 U	1 U	1 U	1 U	0.3 J	1 U	1 U	1 U	1 U	1 U
Total Xylenes	ug/L	8260B	1 U	1 U	1 U	1 U	4.9	1 U	1 U	1 U	1 U	1 U	2.1	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	19	1 U	1 U	1 U	1 U	1 U	10	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	8260B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
Vinyl Chloride	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SVOCs																		
1,2,4-Trichlorobenzene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
1,2,4-Trichlorobenzene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
1,2-Dichlorobenzene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
1,3-Dichlorobenzene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
1,4-Dichlorobenzene	ug/L	8270C	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	4.8 U	4.8 U	4.8 U	4.8 U
2,4,5-Trichlorophenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2,4,6-Trichlorophenol	ug/L	8270C	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	4.8 U	4.8 U	4.8 U	4.8 U
2,4-Dichlorophenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.8 U	9.6 U	9.6 U	9.6 U
2,4-Dimethylphenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2,4-Dinitrophenol	ug/L	8270C	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	NA	50 UJ	50 UJ	50 UJ	50 UJ	50 U	NA	9.6 UJ	9.6 UJ	9.6 UJ	9.6 UJ
2,4-Dinitrotoluene	ug/L	8270C	10 R	10 R	10 R	10 R	10 R	NA	10 R	10 R	10 R	10 R	10 R	NA	9.6 R	9.6 R	9.6 R	9.6 R
2,6-Dinitrotoluene	ug/L	8270C	10 R	10 R	10 R	10 R	10 R	NA	10 R	10 R	10 R	10 R	10 R	NA	9.6 R	9.6 R	9.6 R	9.6 R
2-Chloronaphthalene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 UJ	10 U	10 UJ	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2-Chlorophenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2-Methylnaphthalene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2-Methylphenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
2-Nitroaniline	ug/L	8270C	50 U	50 U	50 U	50 U	50 U	NA	50 U	50 U	50 U	50 U	50 U	NA	48 U	48 U	48 UJ	48 U
2-Nitrophenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
3,3'-Dichlorobenzidine	ug/L	8270C	14 U	14 U	14 U	14 U	14 U	NA	14 U	12 U	14 U	12 U	14 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
3-Nitroaniline	ug/L	8270C	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	NA	50 UJ	50 U	50 UJ	50 U	50 U	NA	48 U	48 U	48 U	48 U
4,6-Dinitro-2-Methylphenol	ug/L	8270C	50 UJ	50 UJ	50 UJ	50 U	50 U	NA	50 U	50 UJ	50 U	50 UJ	50 U	NA	48 U	48 U	48 U	48 U
4-Bromophenyl Phenyl Ether	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
4-Chloro-3-Methylphenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
4-Chloroaniline	ug/L	8270C	20 U	20 U	20 U	20 U	20 U	NA	20 U	20 U	20 U	20 U	20 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
4-Chlorophenyl Phenyl Ether	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
4-Methylphenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
4-Nitroaniline	ug/L	8270C	50 U	50 U	50 U	50 U	50 U	NA	50 U	50 U	50 U	50 U	50 U	NA	48 UJ	48 UJ	48 U	48 UJ
4-Nitrophenol	ug/L	8270C	50 U	50 U	50 U	50 U	50 U	NA	50 U	50 U	50 U	50 U	50 U	NA	48 U	48 U	48 U	48 U

Table E-6. Site 1 Groundwater Sampling Results (Not Including Perchlorate)

Analyte	Units	Lab Method	01-MW101 LE053 1/14/2002	01-MW102 LE054 1/14/2002	01-MW102 (dup) LE056 1/14/2002	01-MW201 LE086 1/16/2002	01-MW202 LE057 1/15/2002	01-MW202 (VOC Resample) LE206 2/15/2002	01-MW203 LE058 1/15/2002	01-MW204 LE045 1/9/2002	01-MW205 LE087 1/16/2002	01-MW206 LE047 1/10/2002	01-MW207 LE052 1/11/2002	01-MW207 (VOC Resample) LE205 2/15/2002	01-MW208 LE218 6/14/2002	01-MW209 LE217 6/14/2002	01-MW209 (dup) LE219 6/14/2002	01-MW210 LE216 6/12/2002
Acenaphthene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Acenaphthylene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Anthracene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Benz(A)Anthracene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Benzo(A)Pyrene	ug/L	PAH-SIM	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	1.3 U	1.3 U	1.3 U	1.3 U
Benzo(B)Fluoranthene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Benzo(G,H,I)Perylene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Benzo(K)Fluoranthene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Chloroethoxy)Methane	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Chloroethyl)Ether	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	10 U	10 U	49	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	10 U	10 U	49	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Butyl Benzyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Carbazole	ug/L	8270C	50 U	50 U	50 U	50 UJ	50 UJ	NA	50 UJ	50 U	50 UJ	50 U	50 U	NA	48 U	48 U	48 U	48 U
Chrysene	ug/L	8270C	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	4.8 U	4.8 U	4.8 U	4.8 U
Dibenz(A,H)Anthracene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Dibenzofuran	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Diethyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Dimethyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Di-N-Butyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Di-N-Octyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Di-N-Octyl Phthalate	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Fluoranthene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Fluorene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Hexachlorobenzene	ug/L	8270C	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	NA	3.2 U	1.3 U	3.2 U	1.3 U	3.2 U	NA	1.1 U	1.1 U	1.1 U	1.1 U
Hexachlorobutadiene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Hexachlorocyclopentadiene	ug/L	8270C	50 U	50 U	50 U	50 U	50 U	NA	50 U	50 UJ	50 U	50 UJ	50 U	NA	48 U	48 U	48 U	48 U
Hexachlorocyclopentadiene	ug/L	8270C	50 U	50 U	50 U	50 U	50 U	NA	50 U	50 UJ	50 U	50 UJ	50 U	NA	48 U	48 U	48 U	48 U
Hexachloroethane	ug/L	8270C	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	4.8 U	4.8 U	4.8 U	4.8 U
Indeno(1,2,3-Cd)Pyrene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Isophorone	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Naphthalene	ug/L	8270C	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	4.8 U	4.8 U	4.8 U	4.8 U
Nitrobenzene	ug/L	8270C	5 R	5 R	5 R	5 R	5 R	NA	5 R	5 R	5 R	5 R	5 R	NA	4.8 R	4.8 R	4.8 R	4.8 R
N-Nitroso-Di-N-Propylamine	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
N-Nitrosodiphenylamine	ug/L	8270C	11 U	11 U	11 U	11 U	11 U	NA	11 U	10 U	11 U	10 U	11 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Pentachlorophenol	ug/L	8270C	12 U	12 U	12 U	12 U	12 U	NA	12 U	12 U	12 U	12 U	12 U	NA	4 U	4 U	4 U	4 U
Phenanthrene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Phenol	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Pyrene	ug/L	8270C	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	9.6 U	9.6 U	9.6 U	9.6 U
Explosives																		
1,3,5-Trinitrobenzene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
1,3-Dinitrobenzene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
2,4,6-Trinitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
2,4-Dinitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
2,6-Dinitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
2-AMINO-4,6-DINITROTOLUENE	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
2-Nitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA				
3-Nitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
4-AMINO-2,6-DINITROTOLUENE	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
4-Nitrotoluene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA				
2/4-NITROTOLUENE	ug/L	8330	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U	2 U
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
Methyl-2,4,6-Trinitrophenylnitramine	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
Nitrobenzene	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	ug/L	8330	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	1 U	1 U	1 U	1 U
Hydrocarbons																		
Motor Oil	mg/L	8015B DRO	1 U	1 U	1 U	1 U	0.05 J	NA	1 U	0.06 J	1 U	0.07 J	1 U	NA	0.1	0.09 J	0.1	0.08 J
Diesel	mg/L	8015B DRO	1 U	1 U	1 U	1 U	1 U	NA	0.2 J	1 U	1 U	1 U	1 U	NA	0.05 J	0.06 J	0.07 J	0.07 J
Gasoline	mg/L	8015B GRO	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	0.03 J	0.02 J	0.1 U	0.04 J
General Chemistry																		
NITRATE AS N	mg/L	300.0	2	1.7	1.9	15.4	9.6 J	NA	20.1	6.1	7.8	7.5	9.2	NA	3.8	8.9	3.8	2.8
PH	pH	9040	7.61	7.49	7.54	7.8	7.16	NA	7.28	7.76	7.59	7.74	7.02	NA				
Metals								NA						NA				
Aluminum	ug/L	6010B	13.6 UJ	12.8 UJ	22.3 UJ	44.3 UJ	41.9 UJ	NA	21.9 UJ	7.6 UJ	44.9 UJ	11.9 UJ	100 U	NA	48 UJ	41 UJ	35 UJ	43 UJ
Antimony	ug/L	6010B	5.1 UJ	1.8 UJ	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	60 U	60 U	60 U	60 U
Arsenic	ug/L	6010B	2 U	2 U	1.5	2.9	4.1	NA	4.4	1.3	3.5	3.3	2 U	NA	10 U	10 U	2.3 UJ	1.5 UJ
Barium	ug/L	6010B	13.6	7.6	6	12.3	71	NA	6.7	43.2	87.8	18	7.7 J	NA	45	110	46	23
Barium	ug/L	6010B	13.6	7.6	6	12.3	71	NA	6.7	43.2	87.8	18	7.7 J	NA	45	110	46	23
Beryllium	ug/L	6010B	0.21 UJ	2 U	2 U	2 U	2 U	NA	2 U	2 U	2 U	2 U	2 U	NA	0.061 UJ	0.057 UJ	5 U	0.11 UJ
Cadmium	ug/L	6010B	2 U	2 U	2 U	0.28 UJ	0.11 UJ	NA	0.11 UJ	0.39 UJ	0.23 UJ	0.63 UJ	0.62 UJ	NA	0.99 UJ	1.5 UJ	0.71 UJ	2.1 UJ
Calcium	ug/L	6010B	42600	104000	104000	85900	166000	NA	93400	60100 J	86300	77000 J	92300 J	NA	110000	93800	114000	48200
Chromium	ug/L	6010B	157	25.4	19.7	2.1	1.4 J	NA	0.92 J	2.5 J	0.43 UJ	1.2 UJ	3.8 J	NA	1.9 UJ	1.1 UJ	11 UJ	2 UJ
Cobalt	ug/L	6010B	1.7 UJ	6.3	5.8	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	50 U	0.49 UJ	50 U	0.27 UJ
Copper	ug/L	6010B	7.6 UJ	8.5 UJ	6.9 UJ	2.9 UJ	5.4 UJ	NA	5.2 UJ	2.7 UJ	2.8 UJ	4.3 UJ	3.7 UJ	NA	5.9 UJ	4.9 UJ	2.8 UJ	8.1 UJ

Table E-6. Site 1 Groundwater Sampling Results (Not Including Perchlorate)

Analyte	Units	Lab Method	01-MW101 LE053 1/14/2002	01-MW102 LE054 1/14/2002	01-MW102 (dup) LE056 1/14/2002	01-MW201 LE086 1/16/2002	01-MW202 LE057 1/15/2002	01-MW202 (VOC Resample) LE206 2/15/2002	01-MW203 LE058 1/15/2002	01-MW204 LE045 1/9/2002	01-MW205 LE087 1/16/2002	01-MW206 LE047 1/10/2002	01-MW207 LE052 1/11/2002	01-MW207 (VOC Resample) LE205 2/15/2002	01-MW208 LE218 6/14/2002	01-MW209 LE217 6/14/2002	01-MW209 (dup) LE219 6/14/2002	01-MW210 LE216 6/12/2002
Iron	ug/L	6010B	1610	1010	884	19.7 UJ	34.4 UJ	NA	18.1 UJ	39 UJ	11.4 UJ	7 UJ	36.4 J	NA	29 UJ	130	19 UJ	28 UJ
Lead	ug/L	6010B	2.6 UJ	2.5 UJ	5 U	1.2 UJ	1.5 UJ	NA	1.4 UJ	5 U	1.5 UJ	5 U	0.94 J	NA	4.5 UJ	4.7 UJ	3.4 UJ	9.2
Magnesium	ug/L	6010B	9830	3690	3710	2410	5310	NA	3600	2820	2400	6460	17600	NA	14100	9200	14400	3800
Manganese	ug/L	6010B	13.8	37.9	33	5 U	2.6	NA	5 U	2.7 J	5 U	1.2 UJ	97.1	NA	39	260	39	4.3 UJ
Mercury	ug/L	7470A	0.43	0.5	0.5	0.15 J	0.17 J	NA	0.26 J	0.34	0.19 J	0.24	0.14 J	NA	0.19	0.19	0.18	0.19
Nickel	ug/L	6010B	286	1300	1250	6.5	4.7	NA	0.41 UJ	3.1 UJ	1 UJ	1 UJ	3.2 J	NA	2.7 UJ	2.2 UJ	2.6 UJ	1.3 UJ
Nickel	ug/L	6010B	286	1300	1250	6.5	4.7	NA	0.41 UJ	3.1 UJ	1 UJ	1 UJ	3.2 J	NA	2.7 UJ	2.2 UJ	2.6 UJ	1.3 UJ
Potassium	ug/L	6010B	3020 J	1550 J	1560 J	1350 J	1860 J	NA	1630 J	756 J	993 J	2120 J	990 J	NA	4700 J	2100 J	5100 J	4300 J
Potassium	ug/L	6010B	3020 J	1550 J	1560 J	1350 J	1860 J	NA	1630 J	756 J	993 J	2120 J	990 J	NA	4700 J	2100 J	5100 J	4300 J
Selenium	ug/L	6010B	10 U	10 U	10 U	3.2	10 U	NA	2.5	10 U	10 U	5.2 UJ	4.8 UJ	NA	5.6	5 U	2.9	3.6
Silver	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	10 U	0.47 UJ	10 U	0.69 UJ
Sodium	ug/L	6010B	48000	66900	67300	40100	42500	NA	64000	38600 J	42600	37000 J	32000 J	NA	76500	50700	79700	57500
Thallium	ug/L	6010B	2.5 UJ	2.4 U	2.4 U	2.4 U	2.4 U	NA	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	NA	1.9 UJ	1.2 UJ	3.1 UJ	1.7 UJ
Vanadium	ug/L	6010B	2.8 UJ	4.1 UJ	3.7 UJ	6.7 UJ	7.2 UJ	NA	7.9 UJ	11.1	14.5	10.7	8.1 J	NA	5.7	2.3 UJ	5.9	3 UJ
Zinc	ug/L	6010B	3.2	12.4	9.6	5.9 J	22.6 J	NA	12.9 J	36.8	17.2 J	18.3	7.1 J	NA	13	83	9.7	6.1

Table E-6. Site 1 Groundwater Sampling Results (Not Including Per

Analyte	Units	Lab Method	01-DGMW57 LE048 1/11/2002	01-DGMW57 (VOC Resample) LE204 2/14/2002	01-DGMW58 LE050 1/11/2002	01-DGMW58 (dup) LE051 1/11/2002	18-BGMW24 LE089 1/21/2002
VOCs							
1,1,1,2-Tetrachloroethane	ug/L	8260B	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	8260B	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	8260B	NA	NA	NA	NA	NA
1,1-Dichloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	8260B	NA	NA	NA	NA	NA
2-Butanone	ug/L	8260B	100 U	100 U	100 UJ	100 UJ	100 U
2-Hexanone	ug/L	8260B	50 U	50 U	50 UJ	50 UJ	50 U
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	50 U	50 U	50 U
Acetone	ug/L	8260B	100 U	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	ug/L	8260B	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
Bromoform	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Bromomethane	ug/L	8260B	1 UJ	1 U	1 UJ	1 UJ	1 U
Butane, 2-Methoxy-2-Methyl-	ug/L	8260B	NA	NA	NA	NA	NA
Carbon Disulfide	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	ug/L	8260B	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Chloroethane	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Chloroform	ug/L	8260B	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
Chloromethane	ug/L	8260B	1 UJ	1 UJ	1 UJ	1 UJ	1 U
Cis-1,2-Dichloroethene	ug/L	8260B	1	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	ug/L	8260B	NA	NA	NA	NA	NA
Diisopropyl Ether	ug/L	8260B	NA	NA	NA	NA	NA
Ethylbenzene	ug/L	8260B	3.6	1 U	1 U	1 U	1 U
Methyl Tert-Butyl Ether	ug/L	8260B	NA	NA	NA	NA	NA
Methylene Chloride	ug/L	8260B	3 U	3 UJ	3 U	3 U	3 U
Propene, 2-Ethoxy-2-Methyl-	ug/L	8260B	NA	NA	NA	NA	NA
Styrene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Tert-Butyl Alcohol	ug/L	8260B	NA	NA	NA	NA	NA
Tetrachloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	8260B	0.8 J	1 U	1 U	1 U	0.4 J
Total Xylenes	ug/L	8260B	4.6	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	ug/L	8260B	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	8260B	27	1 U	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	8260B	NA	NA	NA	NA	NA
Vinyl Chloride	ug/L	8260B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SVOCs							
1,2,4-Trichlorobenzene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
1,2,4-Trichlorobenzene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
1,2-Dichlorobenzene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
1,3-Dichlorobenzene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
1,4-Dichlorobenzene	ug/L	8270C	5 U	NA	5 U	5 U	5 U
2,4,5-Trichlorophenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2,4,6-Trichlorophenol	ug/L	8270C	5 U	NA	5 U	5 U	5 U
2,4-Dichlorophenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2,4-Dimethylphenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2,4-Dinitrophenol	ug/L	8270C	50 U	NA	50 U	50 U	50 U
2,4-Dinitrotoluene	ug/L	8270C	10 R	NA	10 R	10 R	10 R
2,6-Dinitrotoluene	ug/L	8270C	10 R	NA	10 R	10 R	10 R
2-Chloronaphthalene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2-Chlorophenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2-Methylnaphthalene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2-Methylphenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
2-Nitroaniline	ug/L	8270C	50 U	NA	50 U	50 U	50 U
2-Nitrophenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
3,3'-Dichlorobenzidine	ug/L	8270C	14 U	NA	14 U	14 U	14 UJ
3-Nitroaniline	ug/L	8270C	50 U	NA	50 U	50 U	50 UJ
4,6-Dinitro-2-Methylphenol	ug/L	8270C	50 U	NA	50 U	50 U	50 U
4-Bromophenyl Phenyl Ether	ug/L	8270C	10 U	NA	10 U	10 U	10 U
4-Chloro-3-Methylphenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
4-Chloroaniline	ug/L	8270C	20 U	NA	20 U	20 U	20 U
4-Chlorophenyl Phenyl Ether	ug/L	8270C	10 U	NA	10 U	10 U	10 U
4-Methylphenol	ug/L	8270C	10 U	NA	10 U	10 U	10 U
4-Nitroaniline	ug/L	8270C	50 U	NA	50 U	50 U	50 U
4-Nitrophenol	ug/L	8270C	50 U	NA	50 UJ	50 U	50 U

Table E-8. Site 1 Groundwater Sampling Results (Not Including Per

Analyte	Units	Lab Method	01-DGMW57 LE048 1/11/2002	01-DGMW57 (VOC Resample) LE204 2/14/2002	01-DGMW58 LE050 1/11/2002	01-DGMW58 (dup) LE051 1/11/2002	18-BGMW24 LE089 1/21/2002
Acenaphthene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Acenaphthylene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Anthracene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Benz(A)Anthracene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Benzo(A)Pyrene	ug/L	PAH-SIM	0.2 U	NA	0.2 U	0.2 U	0.2 U
Benzo(B)Fluoranthene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Benzo(G,H,I)Perylene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Benzo(K)Fluoranthene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Bis(2-Chloroethyl)Ether	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Butyl Benzyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Carbazole	ug/L	8270C	50 U	NA	50 U	50 U	50 UJ
Chrysene	ug/L	8270C	5 U	NA	5 U	5 U	5 U
Dibenz(A,H)Anthracene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Dibenzofuran	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Diethyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Dimethyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Di-N-Butyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Di-N-Octyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Di-N-Octyl Phthalate	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Fluoranthene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Fluorene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Hexachlorobenzene	ug/L	8270C	3.2 U	NA	3.2 U	3.2 U	3.2 U
Hexachlorobutadiene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Hexachlorocyclopentadiene	ug/L	8270C	50 U	NA	50 U	50 U	50 UJ
Hexachlorocyclopentadiene	ug/L	8270C	50 U	NA	50 U	50 U	50 UJ
Hexachloroethane	ug/L	8270C	5 U	NA	5 U	5 U	5 U
Indeno(1,2,3-Cd)Pyrene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Isophorone	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Naphthalene	ug/L	8270C	5 U	NA	5 U	5 U	5 U
Nitrobenzene	ug/L	8270C	5 R	NA	5 R	5 R	5 R
N-Nitroso-Di-N-Propylamine	ug/L	8270C	10 U	NA	10 U	10 U	10 U
N-Nitrosodiphenylamine	ug/L	8270C	11 U	NA	11 U	11 U	11 U
Pentachlorophenol	ug/L	8270C	12 U	NA	12 U	12 U	12 U
Phenanthrene	ug/L	8270C	10 U	NA	10 U	10 U	10 U
Phenol	ug/L	8270C	10 U	NA	10 UJ	10 U	10 U
Pyrene	ug/L	8270C	10 U	NA	10 U	10 U	10 UJ
Explosives							
1,3,5-Trinitrobenzene	ug/L	8330	5 U	NA	5 U	5 U	5 U
1,3-Dinitrobenzene	ug/L	8330	5 U	NA	5 U	5 U	5 U
2,4,6-Trinitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
2,4-Dinitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
2,6-Dinitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
2-AMINO-4,6-DINITROTOLUENE	ug/L	8330	5 U	NA	5 U	5 U	5 U
2-Nitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
3-Nitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
4-AMINO-2,6-DINITROTOLUENE	ug/L	8330	5 U	NA	5 U	5 U	5 U
4-Nitrotoluene	ug/L	8330	5 U	NA	5 U	5 U	5 U
2/4-NITROTOLUENE	ug/L	8330	NA	NA	NA	NA	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	ug/L	8330	5 U	NA	5 U	5 U	5 U
Methyl-2,4,6-Trinitrophenylnitramine	ug/L	8330	5 U	NA	5 U	5 U	5 U
Nitrobenzene	ug/L	8330	5 U	NA	5 U	5 U	5 U
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	ug/L	8330	5 U	NA	5 U	5 U	5 U
Hydrocarbons							
Motor Oil	mg/L	8015B DRO	1 U	NA	1 U	1 U	1 U
Diesel	mg/L	8015B DRO	1 U	NA	1 U	1 U	0.03 J
Gasoline	mg/L	8015B GRO	1 U	NA	1 U	1 U	1 U
General Chemistry							
NITRATE AS N	mg/L	300.0	3.6	NA	9.2	9.6	8.2
PH	pH	9040	7.01	NA	7.05	7.03	7.54
Metals				NA			
Aluminum	ug/L	6010B	13.2 J	NA	100 U	100 U	102
Antimony	ug/L	6010B	2.1 J	NA	10 U	10 U	10 U
Arsenic	ug/L	6010B	2	NA	2 U	2 U	5.7 UJ
Barium	ug/L	6010B	16	NA	36.7	31.5	36.9
Barium	ug/L	6010B	16	NA	36.7	31.5	36.9
Beryllium	ug/L	6010B	2 U	NA	0.14 J	2 U	2 U
Cadmium	ug/L	6010B	0.77 J	NA	0.68 UJ	0.16 UJ	0.17
Calcium	ug/L	6010B	67900 J	NA	98300 J	129000 J	87300
Chromium	ug/L	6010B	7	NA	49.8	47.7	1.8 J
Cobalt	ug/L	6010B	1.6 UJ	NA	3.8 J	4.4 J	5 U
Copper	ug/L	6010B	17	NA	5.4 J	1.7 UJ	4.9 UJ

Table E-6. Site 1 Groundwater Sampling Results (Not Including Per

Analyte	Units	Lab Method	01-DGMW57 LE048 1/11/2002	01-DGMW57 (VOC Resample) LE204 2/14/2002	01-DGMW58 LE050 1/11/2002	01-DGMW58 (dup) LE051 1/11/2002	18-BGMW24 LE089 1/21/2002
Iron	ug/L	6010B	128 J	NA	1220 J	1190 J	95.8
Lead	ug/L	6010B	4.9 J	NA	1.2 J	5 U	5 U
Magnesium	ug/L	6010B	27300	NA	16200	17800	38800
Manganese	ug/L	6010B	25.7	NA	24.7	28.6	1.6 UJ
Mercury	ug/L	7470A	0.16 J	NA	0.12 J	0.13 J	0.24
Nickel	ug/L	6010B	39.1 J	NA	598 J	892 J	1.3 UJ
Nickel	ug/L	6010B	39.1 J	NA	598 J	892 J	1.3 UJ
Potassium	ug/L	6010B	3230 J	NA	1520 J	1250 J	2710
Potassium	ug/L	6010B	3230 J	NA	1520 J	1250 J	2710
Selenium	ug/L	6010B	11.1 U	NA	6.4 UJ	9 UJ	29.9
Silver	ug/L	6010B	0.31 J	NA	0.39 J	10 U	10 U
Sodium	ug/L	6010B	62900 J	NA	31800 J	42200 J	72500
Thallium	ug/L	6010B	4.1	NA	3.8	2.8	3.7 UJ
Vanadium	ug/L	6010B	5.1 J	NA	7.7 J	8.9 J	15.5
Zinc	ug/L	6010B	14.5	NA	14	9.6 J	6.6 UJ

Table E-7. Site 1 Groundwater Perchlorate Concentrations

Monitoring Well ID	Sample Date	Sample ID	Duplicate?	Perchlorate Concentration (ug/L)	
01-MW101	1/14/2002	LE053	N	4	U
01-MW102	1/14/2002	LE054	N	4	
01-MW102	1/14/2002	LE056	Y	4	U
01-MW102	6/20/2002	LE225	N	8.6	J
01-MW102	3/12/2003	LE256	N	2.3	J
01-MW102	3/12/2003	LE257	Y	2.4	J
01-MW102	6/19/2003	LE298	N	3.3	
01-MW102	6/19/2003	LE299	Y	2.8	J
01-MW102	11/4/2003	LE347	N	3	
01-MW102	3/25/2004	LE383	N	2.8	J
01-MW102	8/4/2004	LE422	N	3.7	
01-MW201	1/16/2002	LE086	N	280	
01-MW201	6/19/2002	LE224	N	218	J
01-MW201	3/14/2003	LE261	N	273	
01-MW201	3/14/2003	LE262	Y	267	
01-MW201	6/20/2003	LE304	N	193	
01-MW201	6/20/2003	LE305	Y	193	
01-MW201	11/5/2003	LE350	N	135	
01-MW201	3/26/2004	LE386	N	94.6	
01-MW201	8/5/2004	LE425	N	96.3	
01-MW201	8/5/2004	LE426	Y	95.3	
01-MW202	1/15/2002	LE057	N	7.2	J
01-MW202	6/18/2002	LE223	N	7.8	
01-MW202	3/13/2003	LE258	N	16.3	
01-MW202	6/19/2003	LE301	N	23.1	
01-MW202	11/5/2003	LE348	N	30.3	
01-MW202	11/5/2003	LE349	Y	31.1	
01-MW202	3/25/2004	LE384	N	21	
01-MW202	8/4/2004	LE423	N	17.8	
01-MW203	1/15/2002	LE058	N	4	UJ
01-MW204	1/9/2002	LE045	N	4	U
01-MW204	3/24/2004	LE379	N	1.2	J
01-MW204	8/2/2004	LE418	N	1.8	J
01-MW205	1/16/2002	LE087	N	4	U
01-MW205	3/24/2004	LE380	N	2.9	J
01-MW205	3/24/2004	LE381	Y	3.1	
01-MW205	8/3/2004	LE420	N	3.3	
01-MW206	1/10/2002	LE047	N	4	U
01-MW206	11/11/2004	LE472	N	1.97	J
01-MW206	11/11/2004	LE473	Y	1.97	J
01-MW207	1/11/2002	LE052	N	4.2	
01-MW207	6/17/2002	LE221	N	6	
01-MW207	3/12/2003	LE254	N	5.3	
01-MW207	6/18/2003	LE296	N	5.4	
01-MW207	11/3/2003	LE345	N	6.1	
01-MW207	3/26/2004	LE385	N	5.2	
01-MW207	8/5/2004	LE424	N	6.1	
01-MW207	11/11/2004	LE474	N	5.8	
01-MW208	6/14/2002	LE218	N	4	U
01-MW208	3/12/2003	LE255	N	3	U
01-MW208	6/18/2003	LE297	N	1.4	J
01-MW208	11/4/2003	LE346	N	1.4	J
01-MW208	3/25/2004	LE382	N	3	U
01-MW208	8/3/2004	LE421	N	2.3	J
01-MW209	6/14/2002	LE217	N	338	J
01-MW209	6/14/2002	LE219	Y	4	U
01-MW209	3/13/2003	LE260	N	343	
01-MW209	6/20/2003	LE303	N	351	
01-MW209	11/6/2003	LE352	N	325	
01-MW209	3/29/2004	LE388	N	281	
01-MW209	8/6/2004	LE428	N	294	
01-MW210	6/12/2002	LE216	N	99.6	
01-MW210	7/13/2002	LE226	N	148	
01-MW210	3/13/2003	LE259	N	238	
01-MW210	6/19/2003	LE302	N	290	

Table E-7. Site 1 Groundwater Perchlorate Concentrations

Monitoring Well ID	Sample Date	Sample ID	Duplicate?	Perchlorate Concentration (ug/L)	
01-MW210	11/6/2003	LE351	N	306	
01-MW210	3/29/2004	LE387	N	264	
01-MW210	8/5/2004	LE427	N	297	
01-MW211	9/13/2004	LE438	N	34.8	
01-MW211	11/10/2004	LE465	N	32.6	
01-MW212	9/14/2004	LE446	N	3	U
01-MW212	11/8/2004	LE458	N	1.1	J
01-MW213	9/13/2004	LE441	N	94.9	
01-MW213	11/10/2004	LE468	N	105	
01-MW214	9/14/2004	LE443	N	145	
01-MW214	9/14/2004	LE444	Y	146	
01-MW214	11/11/2004	LE471	N	124	
01-MW215	9/14/2004	LE445	N	121	
01-MW215	11/11/2004	LE470	N	114	
01-MW216	9/14/2004	LE447	N	3	U
01-MW216	11/8/2004	LE459	N	1.6	J
01-MW217	9/10/2004	LE433	N	1.9	J
01-MW218	9/13/2004	LE436	N	14.1	
01-MW218	9/13/2004	LE437	Y	13.9	
01-MW219	9/13/2004	LE439	N	3	U
01-MW220	9/9/2004	LE429	N	1.6	J
01-MW221	9/10/2004	LE432	N	2.8	J
01-MW222	9/9/2004	LE430	N	3	U
01-DGMW57	1/11/2002	LE048	N	4	U
01-DGMW57	6/17/2002	LE222	N	4	U
01-DGMW57	11/12/2004	LE476	N	1.6	J
01-DGMW58	1/11/2002	LE051	N	4	U
01-DGMW58	1/11/2002	LE050	Y	4	U
01-DGMW58	11/12/2004	LE477	N	2.1	J
18-BGMW24	1/21/2002	LE089	N	4	U
18-BGMW24	3/14/2003	LE263	N	3	U
18-BGMW24	11/12/2004	LE478	N	1.2	J
01-PZ01	3/5/2003	LE242	N	8.4	
01-PZ01	6/12/2003	LE285	N	10	
01-PZ01	10/29/2003	LE331	N	7.9	
01-PZ01	3/18/2004	LE363	N	8.8	J
01-PZ01	7/28/2004	LE407	N	12.3	J
01-PZ02	2/28/2003	LE234	N	3	U
01-PZ02	6/9/2003	LE274	N	1.6	J
01-PZ02	10/27/2003	LE321	N	1.6	J
01-PZ02	3/17/2004	LE360	N	1.8	J
01-PZ02	7/22/2004	LE401	N	2.6	J
01-PZ03	3/6/2003	LE244	N	11.1	
01-PZ03	6/12/2003	LE286	N	9.7	
01-PZ03	10/29/2003	LE333	N	7.2	
01-PZ03	3/18/2004	LE364	N	6.3	J
01-PZ03	7/28/2004	LE406	N	5.4	
01-PZ04	2/28/2003	LE235	N	13.5	
01-PZ04	6/11/2003	LE283	N	7.4	
01-PZ04	10/28/2003	LE329	N	2.9	J
01-PZ04	3/17/2004	LE361	N	2.2	J
01-PZ04	7/26/2004	LE403	N	3.3	
01-PZ05	3/4/2003	LE238	N	3	U
01-PZ05	6/10/2003	LE278	N	1.6	J
01-PZ05	10/28/2003	LE325	N	2	J
01-PZ05	3/18/2004	LE365	N	2.1	J
01-PZ05	7/26/2004	LE404	N	2.6	J
01-PZ06	3/5/2003	LE241	N	2.2	J
01-PZ06	6/11/2003	LE280	N	1.2	J
01-PZ06	6/11/2003	LE281	Y	3	U
01-PZ06	10/28/2003	LE327	N	0.8	J
01-PZ06	3/19/2004	LE367	N	3	UJ
01-PZ06	7/21/2004	LE397	N	1.6	J
01-PZ07	3/7/2003	LE247	N	250	
01-PZ07	6/13/2003	LE289	N	398	

Table E-7. Site 1 Groundwater Perchlorate Concentrations

Monitoring Well ID	Sample Date	Sample ID	Duplicate?	Perchlorate Concentration (ug/L)	
01-PZ07	10/31/2003	LE343	N	460	
01-PZ07	10/31/2003	LE344	Y	459	
01-PZ07	3/24/2004	LE378	N	442	
01-PZ07	8/2/2004	LE417	N	459	
01-PZ08	3/6/2003	LE245	N	49	
01-PZ08	6/13/2003	LE288	N	21.2	
01-PZ08	10/29/2003	LE335	N	24.3	
01-PZ08	3/22/2004	LE370	N	33.3	
01-PZ08	7/30/2004	LE412	N	57.6	
01-PZ08	7/30/2004	LE413	Y	56.3	
01-PZ09	3/11/2003	LE250	N	74.2	
01-PZ09	6/17/2003	LE293	N	94.7	
01-PZ09	10/31/2003	LE341	N	88.9	
01-PZ09	3/23/2004	LE375	N	94.8	
01-PZ09	3/23/2004	LE376	Y	97.2	
01-PZ09	7/30/2004	LE414	N	93.6	
01-PZ10	3/11/2003	LE251	N	4.7	
01-PZ10	3/11/2003	LE252	Y	4.7	
01-PZ10	6/17/2003	LE294	N	6.8	
01-PZ10	10/30/2003	LE339	N	10.3	
01-PZ10	3/22/2004	LE371	N	13.7	
01-PZ10	7/29/2004	LE409	N	17.6	
01-PZ11	3/7/2003	LE248	N	14.8	
01-PZ11	6/16/2003	LE291	N	16.4	
01-PZ11	10/30/2003	LE337	N	17.9	
01-PZ11	3/23/2004	LE374	N	18.6	
01-PZ11	7/29/2004	LE410	N	15.4	
01-PZ12	3/4/2003	LE237	N	3	U
01-PZ12	6/10/2003	LE276	N	1.1	J
01-PZ12	10/27/2003	LE323	N	1.4	J
01-PZ12	3/19/2004	LE368	N	3	UJ
01-PZ12	7/22/2004	LE400	N	2.1	J
01-PZ13	2/27/2003	LE232	N	3	U
01-PZ13	6/6/2003	LE267	N	1.2	J
01-PZ13	10/23/2003	LE312	N	1.8	J
01-PZ13	3/15/2004	LE353	N	2.4	J
01-PZ13	7/19/2004	LE391	N	4.3	
01-PZ13	11/9/2004	LE461	N	4.1	
01-PZ14	2/27/2003	LE230	N	5.8	
01-PZ14	2/27/2003	LE231	Y	5.9	
01-PZ14	6/6/2003	LE269	N	7	
01-PZ14	10/24/2003	LE317	N	7.2	
01-PZ14	3/16/2004	LE356	N	5.9	J
01-PZ14	7/20/2004	LE394	N	6.1	
01-PZ14	11/9/2004	LE462	N	5.3	
01-PZ15	2/26/2003	LE228	N	34.6	
01-PZ15	6/9/2003	LE272	N	40.1	
01-PZ15	6/9/2003	LE273	Y	40.2	
01-PZ15	10/24/2003	LE319	N	36.8	
01-PZ15	3/16/2004	LE357	N	34.5	J
01-PZ15	3/16/2004	LE358	Y	34.7	J
01-PZ15	7/21/2004	LE396	N	37.4	
01-PZ15	11/10/2004	LE466	N	40.7	
01-PZ15	11/10/2004	LE467	Y	40.8	
01-PZ16	2/26/2003	LE227	N	4.3	
01-PZ16	6/6/2003	LE268	N	5.5	
01-PZ16	10/23/2003	LE314	N	4.5	
01-PZ16	10/23/2003	LE315	Y	5.1	
01-PZ16	3/15/2004	LE354	N	5.3	J
01-PZ16	7/20/2004	LE392	N	6	J
01-PZ16	7/20/2004	LE393	Y	6.3	J
01-PZ16	11/9/2004	LE463	N	5.6	

Table E-8. Ephemeral Pond Soil/Sediment Sampling Results

Analyte	Lab Method	Units	01-PSS01 0 feet bgs LE479/LE480	01-PSS05 0 feet bgs LE481/LE482	01-PSS09 0 feet bgs LE483/LE484	01-PSS13 0 feet bgs LE485/LE486	01-PSS14 0 feet bgs LE487/LE489	01-PSS14 (Dup) 0 feet bgs LE488/LE490	01-PSS10 0 feet bgs LE491/LE492	01-PSS06 0 feet bgs LE493/LE495	01-PSS06 (dup) 0 feet bgs LE494/LE496	01-PSS02 0 feet bgs LE498/LE499	01-PSS04 0 feet bgs LE500/LE501	01-PSS08 0 feet bgs LE502/LE503	01-PSS15 0 feet bgs LE505/LE506	01-PSS11 0 feet bgs LE507/LE508	01-PSS07 0 feet bgs LE509/LE510	01-PSS03 0 feet bgs LE511/LE512	01-PSS16 0 feet bgs LE513/LE514	01-PSS12 0 feet bgs LE515/LE516	01-HA15 0.5 feet bgs LE517	01-HA16 0.5 feet bgs LE518	01-HA17 0.5 feet bgs LE519
VOCs																							
1,1,1-Trichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1,2-Trichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1-Dichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,2-Dichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,2-Dichloropropane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
2-Butanone	8260B	ug/kg	47 U	47 U	55 U	52 U	51 U	49 U	55 U	51 U	50 U	49 U	55 U	51 U	56 U	51 U	49 U	65 U	52 U	55 U	49 U	49 U	56 U
2-Hexanone	8260B	ug/kg	9.4 U	9.3 U	11 U	10 U	10 U	9.7 U	11 U	10 U	10 U	9.7 U	11 U	10 U	11 U	10 U	9.8 U	13 U	10 U	11 U	9.8 U	9.9 U	11 U
4-Methyl-2-Pentanone	8260B	ug/kg	9.4 U	9.3 U	11 U	10 U	10 U	9.7 U	11 U	10 U	10 U	9.7 U	11 U	10 U	11 U	10 U	9.8 U	13 U	10 U	11 U	9.8 U	9.9 U	11 U
Acetone	8260B	ug/kg	19 UJ	19 UJ	22 UJ	21 UJ	20 UJ	19 UJ	22 UJ	20 UJ	20 UJ	19 UJ	22 UJ	20 UJ	23 UJ	20 UJ	20 UJ	26 UJ	21 UJ	22 UJ	20 UJ	20 UJ	22 UJ
Benzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromodichloromethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromoform	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromomethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Carbon Disulfide	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Carbon Tetrachloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chlorobenzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chlorodibromomethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloroform	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloromethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Cis-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Cis-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Ethylbenzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Methylene Chloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	5 UJ	5.6 U
Styrene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Tetrachloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Toluene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	0.7 J	0.8 J	4.9 U	5.6 U
Trans-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Trans-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Trichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Vinyl Chloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Total Xylenes	8260B	ug/kg	14 U	14 U	16 U	16 U	15 U	15 U	17 U	15 U	15 U	15 U	17 U	15 U	17 U	15 U	15 U	20 U	16 U	16 U	15 U	15 U	17 U
SVOCs																							
1,2,4-Trichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,2-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,3-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,4-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4,5-Trichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4,6-Trichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dimethylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dinitrophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
2-Chloronaphthalene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Chlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
2-Nitrophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
3,3'-Dichlorobenzidine	8270C	ug/kg	620 U	600 U	620 UJ	580 U	600 U	610 U	620 U	610 UJ	620 UJ	630 U	580 U	570 U	610 U	590 U	650 U	760 U	630 U	680 U	580 U	620 U	630 U
3-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Chloro-3-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Chloroaniline	8270C	ug/kg	620 U	600 U	620 U	580 U	600 U	610 U	620 U	610 U	620 U	630 U	580 U	570 U	610 U	590 U	650 U	760 U	630 U	680 U	580 U	620 U	630 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4-Nitrophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1500 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Butyl Benzyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Carbazole	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Dibenzofuran	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Diethyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Dimethyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Di-N-Butyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Di-N-Octyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorobutadiene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorocyclopentadiene	8270C	ug/kg	1600 UJ	1600 UJ	1600 UJ	1500 UJ	1500 UJ	1600 UJ	1600 UJ	1600 UJ	1600 UJ	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Hexachloroethane	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U

Analyte	Lab Method	Units	LE479/LE480	LE481/LE482	LE483/LE484	LE485/LE486	LE487/LE489	LE488/LE490	LE491/LE492	LE493/LE495	LE494/LE496	LE498/LE499	LE500/LE501	LE502/LE503	LE505/LE506	LE507/LE508	LE509/LE510	LE511/LE512	LE513/LE514	LE515/LE516	LE517	LE518	LE519
Isophorone	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Nitrobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
N-Nitrosodiphenylamine	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Pentachlorophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Phenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
PAHs																							
2-Methylnaphthalene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Acenaphthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Acenaphthylene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benz(a)anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(A)Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(b)fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(g,h,i)perylene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(k)fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Chrysene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Dibenz(a,h)anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Fluorene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Indeno(1,2,3-Cd)Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Naphthalene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Phenanthrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	2 J	22 U	24 U	25 U
Explosives																							
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
1,3-Dinitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4-Diamino-4-nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,6-Diamino-4-nitrotoluene	8330	ug/kg	150 U	150 U	160 U	170 U	170 U	150 U	150 U	170 U	160 U	150 U	160 U	160 U	170 U	160 U	160 U	160 U	150 U	160 U	NA	NA	NA
2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
3-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	8330	ug/kg	220 UJ	220 UJ	220 UJ	230 UJ	230 UJ	220 UJ	210 UJ	240 UJ	220 UJ	220 UJ	230 UJ	220 UJ	230 UJ	220 UJ	230 UJ	230 UJ	210 UJ	220 UJ	NA	NA	NA
4-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Nitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Hydrocarbons																							
Motor Oil	8015B DRO	mg/kg	21	43	19	20	48	76	39	110	16	27	12	43	35	22	21	19	36	150	28	48	59
Diesel	8015B DRO	mg/kg	2 J	2 J	9.4 U	8.8 U	3 J	4 J	2 J	6 J	9.1 U	9.5 U	8.8 U	2 J	4 J	8.8 U	9.4 U	12 U	3 J	6 J	2 J	2 J	3 J
Gasoline	8015B GRO	mg/kg	9.5 U	11 U	10 U	10 U	10 U	11 U	12 U	10 U	10 U	12 U	10 U	11 U	9.9 U	9.7 U	11 U	13 U	1 J	10 U	10 U	11 U	11 U
General Chemistry																							
Perchlorate	E314	ug/kg	19 U	18 U	19 U	18 U	19 U	19 U	19 U	19 U	19 U	19 U	18 U	18 U	19 U	19 U	20 U	24 U	19 U	21 U	18 U	19 U	20 U
Total Organic Carbon (TOC)	Walkly-Black	mg/kg	1400	3390	4120	4280	9190	8930	6150	1680	920	2960	2210	4110	7480	3510	1830	5620	5590	9190	7310	5710	8320
pH	9045	pH	8.98	8.73	9.09	7.92	7.2	7.07	7.56	8.9	8.82	8.46	8.84	8.55	7.62	7.38	7.91	8.72	7.41	7.09	6.98	7.34	8.88
Metals																							
Aluminum	6010B	mg/kg	8580	5880	8700	6800	5090	6360	9670	11900	13700	8350	5950	7210	7400	6850	7980	16900	8200	10200	4220	7970	12800
Antimony	6010B	mg/kg	1.9 U	1.8 U	1.9 U	1.8 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U	1.9 U	1.9 U	2 U	2.4 U	1.9 U	2 U	1.8 U	2 U	2 U
Arsenic	6010B	mg/kg	0.69	0.47 J	0.82	0.76	0.46 J	0.6 J	0.94	1.2	1.4	0.73	0.77	0.73	0.95	0.59	0.65	1.5	0.65	0.93	0.68	0.72	1.1
Barium	6010B	mg/kg	34.2	24.6	46.4	33.3	30	30.5	47.3	54.2	61.3	32.1	33.4	31.4	30.7	29.9	35	81.7	31.2	41.7	33.2	34.8	72.5
Beryllium	6010B	mg/kg	0.38	0.17	0.33	0.17	0.12	0.17	0.34	0.41	0.52	0.25	0.31	0.27	0.12	0.21	0.28	0.98	0.22	0.29	0.11	0.22	0.57
Cadmium	6010B	mg/kg	0.042	0.13	0.047	0.069	0.08	0.062	0.15	0.016	0.014	0.033	0.046	0.079	0.044	0.043	0.088	0.059	0.036	0.19	0.21	0.094	0.34
Calcium	6010B	mg/kg	9110	2720	12100	2460	2220	2310	3820	11700	11500	5080	9920	4780	2120	2520	3440	16400	2770	3570	2160	3040	16500
Chromium	6010B	mg/kg	3.7	3	4.1	3.3	2.7	3.5	4.7	5.5	6.3	3.4	2.5	3.2	3.5	3.5	3.8	6.9	3.7	4.7	2.6	3.7	7.1
Cobalt	6010B	mg/kg	1.2 J	1 J	1.4 J	1.4 J	1.3 J	1.3 J	1.8 J	1.9 J	2.3	1.2 J	1 J	1.2 J	1.4 J	1.3 J	1.4 J	2.7 J	1.4 J	1.8 J	1.3 J	1.5 J	2.3 J
Copper	6010B	mg/kg	1.1	1.7	1.4	2.2	1.9	2.7	3.4	1.4	1.6	1.2	0.8	2.5	2	1.7	1.7	2.8	1.8	3.4	2.7	2.5	6.4
Iron	6010B	mg/kg	3650	2860	4370	3610	2920	3540	5110	5990	6910	3740	2930	3540	3640	3650	4000	7720	4410	5060	2870	4160	6480
Lead	6010B	mg/kg	2.1	3.4	2.1	4.5	5.5	5.9	6.7	2.8	2.9	2.8	1.8	3.8	6.8	3.3	2.9	5.7	3	7	6.1	5.4	12.1
Magnesium	6010B	mg/kg	1760	1140	1710	1330	1080	1300	1960	2650	3110	1430	1300	1500	1240	1270	1530	3710	1490	1970	990	1470	2830
Manganese	6010B	mg/kg	57.8	47.8	61.1	56.5	56.5	53.2	73.2	82.3	101	47	48.4	59.1	59.9	39.8	47.7	109	52.2	81.2	60.3	60.9	121
Mercury	7471A	mg/kg	0.02	0.05	0.041	0.073	0.096	0.12	0.092	0.042	0.023	0.16	0.013	0.0098	0.035	0.058	0.041	0.32	0.085	0.1	0.033	0.071	0.13
Nickel	6010B	mg/kg	1.5 J	1.4 J	2.3 J	1.6 J	1.5 J	1.6 J	2.5 J	2.8 J	3	1.5 J	1.3 J	1.5 J	1.7 J	1.7 J	1.8 J	3.8 J	1.8 J	2.4 J	1.6 J	2 J	4 J
Potassium	6010B	mg/kg	548	588	579	614	648	777	735	549	564	439	452	628	581	409	598	856	614	1170	721	777	1100
Selenium	6010B	mg/kg	0.28 UJ	0.27 UJ	0.28 UJ	0.27 UJ	0.28 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 U	0.28 UJ	0.27 UJ	0.29 UJ	0.28 UJ	0.29 UJ	0.36 UJ	0.28 UJ	0.31 UJ	0.27 UJ	0.19 J	0.3 UJ
Silver	6010B	mg/kg	0.47 U	0.46 U	0.47 U	0.46 U	0.47 U	0.48 U	0.49 U	0.48 U	0.49 U	0.48 U	0.46 UJ	0.45 UJ	0.48 UJ	0.47 UJ	0.49 UJ	0.6 UJ	0.47 UJ	0.51 UJ	0.45 UJ	0.49 UJ	0.5 U
Sodium	6010B	mg/kg	23.3 J	91 UJ	9.7 J	92 UJ	95 UJ	96 UJ	12.7 J	96 UJ	18.9 J	95 UJ	92 UJ	90 UJ	97 UJ	94 UJ	98 UJ	19.5 J	95 UJ	22.4 J	91 UJ	98 UJ	53.2
Thallium	6010B	mg/kg	0.38 U	0.37 U	0.38 U	0.37 U	0.38 U	0.39 U	0.39 U	0.38 U	0.39 U	0.38 U	0.37 U	0.36 U	0.39 U	0.38 U	0.39 U	0.48 U	0.38 U	0.41 U	0.36 U	0.39 U	0.4 U
Vanadium	6010B	mg/kg	6.3	5.3	8.6	6.6	5.4	6.3	8.8	12.8	15.3	6.7	5.4	6.1	7.3	6.5	7.1	14.4	6.7	9.2	6.1	6.9	10.6
Zinc	6010B	mg/kg	8.1 J	8.2 J	8.2 J	9.5 J	10.5 J	12 J	14.9 J	12.8 J	15.3	7.9 J	6.4 J	11.1 J	9.8 J	8.3 J	9.6 J	16.7 J	9.8 J	16.3 J	10.7 J	13.1 J	19.6 J

Table E-9. Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	Risk-based Screening Values	01-POND LE524	01-POND-OUTFALL LE619	01-POND-OUTFALL LE620	01-STREAM LE622	01-STREAM LE623
VOCs (ug/L)						
1,1,1-Trichloroethane	11 [1]	5 U	5 U	NA	5 U	NA
1,1,2,2-Tetrachloroethane	610 [1]	5 U	5 U	NA	5 U	NA
1,1,2-Trichloroethane	1200 [1]	5 U	5 U	NA	5 U	NA
1,1-Dichloroethane	47 [1]	5 U	5 U	NA	5 U	NA
1,1-Dichloroethene	25 [1]	5 U	5 U	NA	5 U	NA
1,2-Dichloroethane	910 [1]	5 U	5 U	NA	5 U	NA
1,2-Dichloropropane	--	5 U	5 U	NA	5 U	NA
2-Butanone	14000 [1]	100 U	100 U	NA	100 U	NA
2-Hexanone	99 [1]	50 U	50 U	NA	50 U	NA
4-Methyl-2-Pentanone	170 [1]	50 U	50 U	NA	50 U	NA
Acetone	1500 [1]	50 U	6 J	NA	6 J	NA
Benzene	130 [1]	5 U	5 U	NA	5 U	NA
Bromodichloromethane	--	5 U	5 U	NA	5 U	NA
Bromoform	--	5 U	5 U	NA	5 U	NA
Bromomethane	--	5 U	5 U	NA	5 U	NA
Carbon Disulfide	0.92 [1]	5 U	0.5 U	NA	0.5 U	NA
Carbon Tetrachloride	9.8 [1]	5 U	5 U	NA	5 U	NA
Chlorobenzene	64 [1]	5 U	5 U	NA	5 U	NA
Chloroethane	--	5 U	5 U	NA	5 U	NA
Chloroform	28 [1]	5 U	5 U	NA	5 U	NA
Chloromethane	--	5 U	5 U	NA	5 U	NA
Cis-1,2-Dichloroethene	590 [1]	5 U	5 U	NA	5 U	NA
Cis-1,3-Dichloropropene	0.055 [1]	5 U	0.072 U	NA	0.072 U	NA
Dibromochloromethane	--	5 U	5 U	NA	5 U	NA
Ethylbenzene	7.3 [1]	5 U	5 U	NA	5 U	NA
Methylene Chloride	2200 [1]	5 U	5 U	NA	5 U	NA
Styrene	--	5 U	5 U	NA	5 U	NA
Tetrachloroethene	98 [1]	5 U	5 U	NA	5 U	NA
Toluene	9.8 [1]	5 U	5 U	NA	5 U	NA
Trans-1,2-Dichloroethene	590 [1]	5 U	5 U	NA	5 U	NA
Trans-1,3-Dichloropropene	0.055 [1]	5 U	0.054 U	NA	0.054 U	NA
Trichloroethene	47 [1]	5 U	5 U	NA	5 U	NA
Vinyl Chloride	--	5 U	5 U	NA	5 U	NA
Total Xylenes	13 [1]	15 U	15 U	NA	15 U	NA
SVOCs (ug/L)						
1,2,4-Trichlorobenzene	110 [1]	10 U	NA	NA	NA	NA
1,2-Dichlorobenzene	14 [1]	10 U	9.6 U	NA	9.6 U	NA
1,3-Dichlorobenzene	71 [1]	10 U	9.6 U	NA	9.6 U	NA
1,4-Dichlorobenzene	15 [1]	10 U	9.6 U	NA	9.6 U	NA
2,2'-Oxybis(1-chloropropane)	--	10 U	9.6 U	NA	9.6 U	NA
2,4,5-Trichlorophenol	--	10 U	9.6 U	NA	9.6 U	NA
2,4,6-Trichlorophenol	--	10 U	9.6 U	NA	9.6 U	NA
2,4-Dichlorophenol	--	10 U	9.6 U	NA	9.6 U	NA
2,4-Dimethylphenol	--	10 U	9.6 U	NA	9.6 U	NA
2,4-Dinitrophenol	--	50 U	48 U	NA	48 U	NA
2-Chloronaphthalene	--	10 U	9.6 U	NA	9.6 U	NA
2-Chlorophenol	--	10 U	9.6 U	NA	9.6 U	NA
2-Methylphenol	13 [1]	10 U	9.6 U	NA	9.6 U	NA
2-Nitroaniline	--	50 U	48 U	NA	48 U	NA
2-Nitrophenol	--	10 U	9.6 U	NA	9.6 U	NA
3,3'-Dichlorobenzidine	--	20 U	9.6 U	NA	9.6 U	NA
3-Nitroaniline	--	50 U	48 U	NA	48 U	NA
4,6-Dinitro-2-Methylphenol	--	50 U	48 U	NA	48 U	NA
4-Bromophenyl Phenyl Ether	1.5 [1]	10 U	1.3 U	NA	1.3 U	NA
4-Chloro-3-Methylphenol	--	20 U	9.6 U	NA	9.6 U	NA
4-Chloroaniline	--	50 U	48 U	NA	48 U	NA
4-Chlorophenyl Phenyl Ether	--	10 U	9.6 U	NA	9.6 U	NA
3/4-Methylphenol	--	10 U	9.6 U	NA	9.6 U	NA
4-Nitroaniline	--	50 U	48 U	NA	48 U	NA
4-Nitrophenol	300 [1]	50 U	48 U	NA	48 U	NA
Bis(2-Chloroethoxy)Methane	--	10 U	9.6 U	NA	9.6 U	NA
Bis(2-Chloroethyl)Ether	--	10 U	9.6 U	NA	9.6 U	NA
Bis(2-Ethylhexyl)Phthalate	3 [1]	10 U	1.9 U	NA	1.9 U	NA
Butyl Benzyl Phthalate	19 [1]	10 U	9.6 U	NA	9.6 U	NA
Carbazole	--	10 U	19 U	NA	19 U	NA
Chrysene	--	10 U	9.6 U	NA	9.6 U	NA

Table E-9. Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	Risk-based Screening Values	01-POND LE524	01-POND-OUTFALL LE619	01-POND-OUTFALL LE620	01-STREAM LE622	01-STREAM LE623
Dibenzofuran	3.7 [1]	10 U	1.1 U	NA	1.1 U	NA
Diethyl Phthalate	210 [1]	10 U	9.6 U	NA	9.6 U	NA
Dimethyl Phthalate	--	10 U	9.6 U	NA	9.6 U	NA
Di-N-Butyl Phthalate	35 [1]	10 U	9.6 U	NA	9.6 U	NA
Di-N-Octyl Phthalate	--	10 U	9.6 U	NA	9.6 U	NA
Hexachlorobenzene	--	10 U	9.6 U	NA	9.6 U	NA
Hexachlorobutadiene	--	10 U	9.6 U	NA	9.6 U	NA
Hexachlorocyclopentadiene	--	50 U	48 U	NA	48 U	NA
Hexachloroethane	12 [1]	10 U	9.6 U	NA	9.6 U	NA
Indeno(1,2,3-cd)-pyrene	--	10 U	9.6 U	NA	9.6 U	NA
Isophorone	--	10 U	9.6 U	NA	9.6 U	NA
Nitrobenzene	--	10 U	9.6 U	NA	9.6 U	NA
N-Nitroso-Di-N-Propylamine	--	50 U	9.6 U	NA	9.6 U	NA
N-Nitrosodiphenylamine	210 [1]	10 U	48 U	NA	48 U	NA
Pentachlorophenol	15 [2]	50 U	12 U	NA	12 U	NA
Phenol	--	10 U	9.6 U	NA	9.6 U	NA
2-Methylnaphthalene	--	10 U	9.6 U	NA	9.6 U	NA
PAHs (ug/L)						
Acenaphthene	--	10 U	0.096 U	NA	0.096 U	NA
Acenaphthylene	--	10 U	0.096 U	NA	0.096 U	NA
Anthracene	0.73 [1]	10 U	0.096 U	NA	0.096 U	NA
Benzo(a)anthracene	0.027 [1]	10 U	0.096 U	NA	0.096 U	NA
Benzo(a)pyrene	0.014 [1]	10 U	0.096 U	NA	0.096 U	NA
Benzo(b)fluoranthene	--	10 U	0.096 U	NA	0.096 U	NA
Benzo(g,h,i)perylene	--	10 U	0.096 U	NA	0.096 U	NA
Benzo(k)fluoranthene	--	10 U	0.096 U	NA	0.096 U	NA
Dibenz(a,h)anthracene	--	10 U	0.096 U	NA	0.096 U	NA
Fluoranthene	--	10 U	0.096 U	NA	0.096 U	NA
Fluorene	3.9 [1]	10 U	0.096 U	NA	0.096 U	NA
Naphthalene	12 [1]	10 U	0.096 U	NA	0.096 U	NA
Phenanthrene	--	10 U	0.096 U	NA	0.096 U	NA
Pyrene	--	10 U	0.096 U	NA	0.096 U	NA
Explosives (ug/L)						
1,3,5-Trinitrobenzene	11 [3]	1 U	1 U	NA	1 U	NA
1,3-Dinitrobenzene	17 [3]	1 U	1 U	NA	1 U	NA
2,4,6-Trinitrotoluene	93 [3]	1 U	1 U	NA	1 U	NA
2,4-Dinitrotoluene	--	1 U	1 U	NA	1 U	NA
2,6-Dinitrotoluene	--	1 U	1 U	NA	1 U	NA
2-Amino-4,6-Dinitrotoluene	--	1 U	1 U	NA	1 U	NA
2-Nitrotoluene	--	2 U	1 U	NA	1 U	NA
3-Nitrotoluene	--	1 U	1 U	NA	1 U	NA
4-Amino-2,6-Dinitrotoluene	--	1 U	1 U	NA	1 U	NA
4-Nitrotoluene	--	2 U	1 U	NA	1 U	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	186 [3]	1 U	1 U	NA	1	NA
Methyl-2,4,6-Trinitrophenylnitramine (Tetryl)	--	1 U	1 U	NA	1 U	NA
Nitrobenzene	--	1 U	1 U	NA	1 U	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	330 [3]	1 U	1 U	NA	1 U	NA
2,4-diamino-6-nitrotoluene		2 U	1 U	NA	1 U	NA
2,6-diamino-4-nitrotoluene		2 U	1 U	NA	1 U	NA
Hydrocarbons (mg/L)						
Motor Oil		0.09 J	0.07 J	NA	0.04 J	NA
Diesel		0.08 J	0.02 J	NA	0.01 J	NA
Gasoline		0.05	0.03 J	NA	0.05 U	NA
General Chemistry						
Perchlorate		4 U	4 U	NA	4 U	NA
Alkalinity		57.6	62.9	NA	79	NA
Hardness		NA	53	NA	66	NA
Ammonia		0.79	0.36	NA	0.28	NA
pH		7.02	7.02	NA	7.29	NA
Chloride		0.68	2.6	NA	2.2	NA
Fluoride		0.07 J	0.058 J	NA	0.075 J	NA
Nitrate as N		0.088	0.36	NA	0.029 J	NA
Nitrite as N		0.05 U	0.05 U	NA	0.05 U	NA
Sulfate		0.73	1.8	NA	1.8	NA
Metals (mg/L)						
Aluminum	87 [5]	2840	3740	131	1390	61.7 J
Antimony	30 [1]	10 U	10 U	10 U	4.7 J	3.4 J

Table E-9. Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	Risk-based Screening Values	01-POND LE524	01-POND-OUTFALL LE619	01-POND-OUTFALL LE620	01-STREAM LE622	01-STREAM LE623
Arsenic	150 [2]	5 U	1.2	1.1	0.8	0.69
Barium	4 [1]	50.2	39.3	33.5	45.9	43.3
Beryllium	0.66 [1]	2 U	0.1	0.043 J	0.048 J	0.1 U
Cadmium	1.47 [2,6]	0.24 J	2 U	2 U	2 U	2 U
Calcium	--	17200	17900	17000	22900	23400
Chromium	11 [2,7]	7.9	3.3 J	1.6 J	2.4 J	2.5 J
Cobalt	23 [1]	1.1 J	1.1 J	0.44 J	0.55 J	0.32 J
Copper	5.5 [2,6]	4.1 J	5.3	2.5 J	9.6	8.1
Iron	1000 [5]	1890	1140	81.3	725	32.3 J
Lead	1.4 [2,6]	3.1 J	0.93	0.35	0.95	0.59
Magnesium	--	3360	3830	3280	3790	3660
Manganese	120 [1]	26.4	24.2	15.1	13.8	3.5 J
Mercury	0.77 [4]	0.21 J	0.89	0.082 J	0.3 J	0.56
Nickel	32.2 [2,6]	4.1 J	3.5	2.8	2.6	3
Potassium	--	3440	2650	2470	5140	5230
Selenium	5 [2]	10 U	0.4 J	0.2 J	0.37 J	1 U
Silver	0.36 [1]	10 U	0.3 U	0.3 U	0.3 U	0.3 U
Sodium	--	4060	6150	6350	4140	4360
Thallium	12 [1]	10 U	10 U	10 U	10 U	10 U
Vanadium	20 [1]	6.1 J	3.8 J	2.5 J	3.9 J	1.3 J
Zinc	73 [2,6]	20.8	15.3	12.1	19.3	17

[1]US GL – Tier II Secondary Chronic Values
[2]California Toxics Rule
[3]Talmage
[4]NRWQC
[5]NRWQC – non-priority pollutants
[6]hardness adjusted value
[7]hexavalent chromium
-- No aquatic threshold established.

Appendix F
Validation Reports

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LD110	997388 / 997400	4550H / 4550J
LD111	997388	4550H
LD112	997388	4550H
LD113	997388	4550H
LD114	997388	4550H
LD115	997388	4550H
LD116	997388	4550H
LD117	997388	4550H
LD120	997388	4550H
LD121	997388	4550H
LD122	997388	4550H
LD123	997388	4550H
LD124	997388	4550H
LD125	997388	4550I
LD126	997398	4550I
LD127	997398	4550I
LD128	997398	4550I
LD129	997398 / 997400	4550I / 4550J
LD130	997398 / 997400	4550I / 4550J
LD131	997398	4550I
LD132	997398	4550I
LD133	997398	4550I
LD134	997398	4550I
LD135	997398	4550I
LD136	997398	4550I
LD137	997398	4550I
LD138	997398	4550I
LD139	997398	4550I
LD141	997398 / 997400	4550I / 4550J
LD142	997398	4550I
LD143	997398	4550I
LD144	997398	4550I
LD145	997398	4550I
LE001	12254	6196A
LE002	12254	6196A
LE003	12254	6196A
LE004	12254	6196A
LE005	12254	6196A
LE006	12254	6196A
LE007	12254	6196A
LE008	12254	6196A
LE009	12254 / 12632	6196A / 6249
LE010	12254 / 12632	6196A / 6249
LE011	12254	6196A
LE013	12288	6196B
LE014	12288	6196B
LE015	12288	6196B
LE016	12288	6196B
LE017	12288	6196B
LE018	12288	6196B
LE019	12288	6196B
LE020	12288	6196B
LE021	12288	6196B
LE022	12288	6196B
LE023	12288	6196B
LE024	12288	6196B
LE025	12288	6196B
LE026	12288	6196B
LE027	12288	6196B
LE028	12289	6196C
LE029	12289	6196C
LE030	12289	6196C
LE031	12289	6196C
LE032	12289	6196C
LE033	12289	6196C
LE034	12289	6196C
LE035	12289	6196C

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE036	12289	6196C
LE037	12289	6196C
LE038	12289	6196C
LE039	12289	6196C
LE045	21114	7940A
LE047	21114	7940A
LE048	21114	7940B
LE050	21114	7940B
LE051	21114	7940B
LE052	21114	7940B
LE053	21165	7940C
LE054	21165	7940C
LE056	21165	7940C
LE057	21198	7940E
LE058	21198	7940E
LE060	21207	7940
LE061	21207	7940
LE062	21207	7940
LE063	21207	7940
LE064	21207	7940
LE065	21207	7940
LE066	21207	7940
LE067	21207	7940
LE068	21207	7940
LE069	21207	7940
LE070	21207	7940
LE071	21207	7940
LE072	21207	7940
LE073	21207	7940
LE074	21207	7940
LE075	21207	7940
LE076	21207	7940
LE077	21207	7940
LE078	21207	7940
LE079	21216	7961
LE080	21216	7961
LE081	21216	7961
LE082	21216	7961
LE083	21216	7961
LE084	21216	7961
LE085	21216	7961
LE086	21214	7940H
LE087	21214	7940H
LE089	21221	8017
LE090	21287	7971
LE091	21216	7961
LE092	21216	7961
LE093	21216	7961
LE094	21216	7961
LE095	21216	7961
LE096	21219	7961
LE097	21219	7961
LE098	21219	7961
LE099	21219	7961
LE100	21219	7961
LE101	21219	7961
LE102	21219	7961
LE103	21219	7961
LE104	21219	7961
LE105	21219	7961
LE106	21219	7961
LE107	21219	7961
LE108	21219	7961
LE109	21219	7961
LE110	21219	7961
LE111	21219	7961
LE112	21219	7961

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE113	21243	7948
LE114	21243	7948
LE115	21243	7948
LE116	21243	7948
LE117	21243	7948
LE118	21243	7948
LE119	21243	7948
LE120	21243	7948
LE121	21243	7948
LE122	21243	7948
LE123	21243	7948
LE124	21243	7948
LE125	21245	7991
LE126	21245	7991
LE127	21245	7991
LE128	21245	7991
LE129	21245	7991
LE130	21245	7991
LE131	21245	7991
LE132	21245	7991
LE133	21245	7991
LE134	21245	7991
LE135	21245	7991
LE136	21245	7991
LE137	21245	7991
LE138	21245	7991
LE139	21245	7991
LE140	21245	7991
LE141	21245	7991
LE142	21268	7991
LE143	21268	7991
LE144	21268	7991
LE145	21268	7991
LE146	21268	7991
LE147	21268	7991
LE148	21268	7991
LE149	21268	7991
LE150	21268	7991
LE151	21268	7991
LE152	21268	7991
LE153	21268	7991
LE154	21268	7991
LE155	21268	7991
LE156	21268	7991
LE157	21268	7991
LE158	21369	8010
LE159	21369	8010
LE160	21383	8002
LE161	21383	8002
LE162	21383	8002
LE163	21383	8002
LE165	21383	8002
LE166	21401	8002
LE167	21401	8002
LE168	21401	8002
LE169	21437	8015
LE170	21437	8015
LE171	21439	8049
LE172	21437	8015
LE173	21437	8015
LE174	21437	8015
LE175	21437	8015
LE176	21446	8015
LE177	21446	8015
LE178	21446	8015
LE179	21446	8015
LE180	21446	8015

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE181	21474	8061
LE182	21474	8061
LE183	21474	8061
LE184	21474	8061
LE185	21474	8061
LE186	21474	8061
LE187	21517	8061
LE188	21517	8061
LE189	21517	8061
LE190	21517	8061
LE191	21517	8061
LE192	21517	8061
LE193	21517	8061
LE194	21534	8043
LE195	21534	8043
LE196	21534	8043
LE197	21534	8043
LE198	21534	8043
LE199	21552	8024
LE200	21552	8024
LE201	21552	8024
LE202	21552	8024
LE203	21552	8024
LE204	21641	8049
LE205	21641	8049
LE206	21641	8049
LE207	23017	8669
LE208	23017	8669
LE209	23017	8669
LE210	23017	8669
LE211	23017 / G204285	8669 / 8707
LE212	23017	8669
LE213	23017	8669
LE214	23017	8669
LE216	23426	8759
LE217	23426	8759
LE218	23426	8759
LE219	23426	8759
LE221	23502	8789
LE222	23502	8789
LE223	23502	8789
LE224	23502	8789
LE225	23502	8789
LE226	23711	8840
LE227	40865	9982
LE228	40865	9982
LE230	40865	9982
LE231	40865	9982
LE232	40865	9982
LE234	40865	9982
LE235	40865	9982
LE237	40931	10150
LE238	40931	10150
LE241	40931	10150
LE242	40931	10150
LE244	40931	10150
LE245	40931	10150
LE247	40931	10150
LE248	40931	10150
LE249	40931	10150
LE250	40981	10258
LE251	40981	10258
LE252	40981	10258
LE254	40981	10258
LE255	40981	10258
LE256	40981	10258
LE257	40981	10258

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE258	40981	10258
LE259	40981	10258
LE260	40981	10258
LE261	40981	10258
LE262	40981	10258
LE263	40981	10258
LE264	41630	10309, 10408
LE267	41789	10519
LE268	41789	10519
LE269	41789	10519
LE270	41789	10519
LE271	41789	10519
LE272	41852	10631
LE273	41852	10631
LE274	41852	10631
LE276	41852	10631
LE278	41852	10631
LE280	41852	10631
LE281	41852	10631
LE283	41852	10631
LE285	41852	10631
LE286	41852	10631
LE288	41852	10631
LE289	41852	10631
LE290	41852	10631
LE291	41923	10716
LE293	41923	10716
LE294	41923	10716
LE296	41923	10716
LE297	41923	10716
LE298	41923	10716
LE299	41923	10716
LE301	41923	10716
LE302	41923	10716
LE303	41923	10716
LE304	41923	10716
LE305	41923	10716
LE306	41923	10716
LE307	41923	10716
LE308	41923	10716
LE310	42987	11178
LE311	42987	11178
LE312	42987	11178
LE314	42987	11178
LE315	42987	11178
LE317	42987	11178
LE319	42987	11178
LE320	43043	11188
LE321	43043	11188
LE323	43043	11188
LE325	43043	11188
LE327	43043	11188
LE329	43043	11188
LE331	43043	11188
LE333	43043	11188
LE335	43043	11188
LE337	43043	11188
LE339	43043	11188
LE341	43043	11188
LE343	43043	11188
LE344	43043	11188
LE345	43086	11244
LE346	43086	11244
LE347	43086	11244
LE348	43086	11244
LE349	43086	11244
LE350	43086	11244

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE351	43086	11244
LE352	43086	11244
LE353	43992	11929
LE354	43992	11929
LE356	43992	11929
LE357	43992	11929
LE358	43992	11929
LE360	43992	11929
LE361	43992	11929
LE363	43992	11929
LE364	43992	11929
LE365	43992	11929
LE367	43992	11929
LE368	43992	11929
LE369	43992	11929
LE370	44063	11929
LE371	44063	11929
LE374	44063	11929
LE375	44063	11929
LE376	44063	11929
LE378	44063	11929
LE379	44063	11929
LE380	44064	11929
LE381	44064	11929
LE382	44064	11929
LE383	44064	11929
LE384	44064	11929
LE385	44064	11929
LE386	44064	11929
LE387	44118	11897
LE388	44118	11897
LE389	44962	12364
LE390	44962	12364
LE391	44962	12364
LE392	44962	12364
LE393	44962	12364
LE394	44962	12364
LE396	44962	12364
LE397	44962	12364
LE400	44962	12364
LE401	44962	12364
LE402	44962	12364
LE403	45038	12395
LE404	45038	12395
LE406	45038	12395
LE407	45038	12395
LE409	45038	12395
LE410	45038	12395
LE412	45038	12395
LE413	45038	12395
LE414	45038	12395
LE415	45038	12395
LE417	45078	12395
LE418	45078	12395
LE420	45078	12395
LE421	45078	12395
LE422	45078	12395
LE423	45078	12395
LE424	45078	12395
LE425	45078	12395
LE426	45078	12395
LE427	45078	12395
LE428	45078	12395
LE429	45342	12595
LE430	45342	12595
LE432	45342	12595
LE433	45342	12595

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE434	45342	12595
LE435	45269	12595
LE436	45269	12595
LE437	45269	12595
LE438	45269	12595
LE439	45269	12595
LE441	45269	12595
LE443	45269	12595
LE444	45269	12595
LE445	45269	12595
LE446	45269	12595
LE447	45269	12595
LE448	45269	12595
LE449	45269	12595
LE453	44869	12743
LE455	44869	12743
LE456	45897	12838
LE457	45897	12838
LE458	45897	12838
LE459	45897	12838
LE460	45897	12838
LE461	45912	12838
LE462	45912	12838
LE463	45912	12838
LE464	45912	12838
LE465	45912	12838
LE466	45912	12838
LE467	45912	12838
LE468	45912	12838
LE469	45912	12838
LE470	45937	12838
LE471	45937	12838
LE472	45937	12838
LE473	45937	12838
LE474	45937	12838
LE475	45937	12838
LE476	45943	12838
LE477	45943	12838
LE478	45943	12838
LE479	45864	13090
LE480	45864	13090
LE481	45864	13090
LE482	45864	13090
LE483	45864	13090
LE484	45864	13090
LE485	45864	13090
LE486	45864	13090
LE487	45864	13090
LE488	45864	13090
LE489	45864	13090
LE490	45864	13090
LE491	45864	13090
LE492	45864	13090
LE493	45864	13090
LE494	45864	13090
LE495	45864	13090
LE496	45864	13090
LE497	45864	13090
LE498	45879	13090
LE499	45879	13090
LE500	45879	13090
LE501	45879	13090
LE502	45879	13090
LE503	45879	13090
LE505	45879	13090
LE506	45879	13090
LE507	45879	13090

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE508	45879	13090
LE509	45879	13090
LE510	45879	13090
LE511	45879	13090
LE512	45879	13090
LE513	45879	13090
LE514	45879	13090
LE515	45879	13090
LE516	45879	13090
LE517	45879	13090
LE518	45879	13090
LE519	45879	13090
LE520	45879	13090
LE524	51022	13060
LE524	51692	13258
LE525	51022	13060
LE526	46401	13169
LE527	46401	13169
LE528	46410	13169
LE529	46410	13169
LE530	46410	13169
LE532	46410	13169
LE534	46410	13169
LE535	46410	13169
LE536	46428	13169
LE537	46428	13169
LE538	46428	13169
LE539	46428	13169
LE540	46428	13169
LE541	46428	13169
LE542	46428	13169
LE544	46432	13169
LE545	46432	13169
LE547	46432	13169
LE548	46432	13169
LE549	46432	13169
LE550	46432	13169
LE551	46432	13169
LE552	46432	13169
LE557	46452	13169
LE558	46452	13169
LE559	46452	13169
LE562	46452	13169
LE563	46452	13169
LE566	46471	13201
LE567	46471	13201
LE569	46471	13201
LE571	46471	13201
LE572	46471	13201
LE573	46471	13201
LE575	46471	13201
LE576	46471	13201
LE578	46481	13201
LE580	46481	13201
LE581	46481	13201
LE582	46481	13201
LE583	46481	13201
LE585	46481	13201
LE586	46481	13201
LE587	46481	13201
LE588	46481	13201
LE590	46490	13201
LE591	46490	13201
LE593	46490	13201
LE594	46490	13201
LE597	46490	13201
LE598	46501	13201

Table F-1. Site 1 RI Analytical Data EPA ID's, SDGs, and Validation

EPA ID	Sample Delivery Group	Validation Package Number
LE599	46501	13201
LE602	46501	13201
LE604	46501	13201
LE606	46501	13201
LE609	46501	13201
LE611	46501	13201
LE613	46524	13201
LE614	46524	13201
LE615	46524	13201
LE616	46524	13201
LE619	51691	13288
LE620	51691	13288
LE621	51691	13288
LE622	51691	13288
LE623	51691	13288
LE624	46935	13380
LE625	46936	13380
LE626	46935	13380
LE627	46939	13380
LE628	52261	13481
LE629	52261	13481
LE630	52261	13481

Note: Items not included with the Draft RI Report will be included in the D

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Earth Tech
9675 Business Park Ave
San Diego, CA 92131
ATTN: Mr. Chris Barr

March 20, 2003

SUBJECT: MCAS El Toro, CTO 78, Data Validation

Dear Mr. Barr,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on March 13, 2003. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 9982:

SDG #	Fraction
03-1540, 40707, 40728, 40762, 40812, 40813, 40865, 40866	Volatiles, 1,4-Dioxane, Metals, Wet Chemistry, TPH as Gasoline, TPH as Extractables

The data validation was performed under Level III and Level IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA, Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996

The data validators did utilize their professional judgement when evaluating the data to achieve the most complete and accurate assessment of the data. The data packages were reviewed according to the above stated validation procedures.

For volatile, 1,4-dioxane, metal, wet chemistry, TPH as gasoline, and TPH as extractable analyses, no data was qualified as unusable.

n general, the data for all analyses appear usable with the limitations noted in the Data Validation Reports. Data validation flags were noted on the Laboratory Form 1s and included with each validation report.

Sincerely,

Stacey A. Mavrakos
Operations Manager/Senior Chemist

Attachment 1

LDC #9982 (Earth Tech-San Diego / MCAS El Toro, CTO#78)

LDC	SDG#	DATE REC'D	DATE DUE	VOA (8260B)		1,4-Dioxane (8270C -SIM)		Metals (SW846)		TPH-G (8015)		TPH-E (8015)		CLO_4 (314.0)		pH (9040B)		TSS (160.2)															
Matrix	Air/Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	03-1540	3/13/03	3/27/03	2	0	1	0	1	0	1	0	1	0	-	-	1	0	1	0														
B	40707	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	1	0	-	-	-	-														
C	40728	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	5	0	-	-	-	-														
D	40762	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	3	0	-	-	-	-														
E	40812	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	2	0	-	-	-	-														
F	40813	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	4	0	-	-	-	-														
G	40865	3/13/03	3/27/03v	-	-	-	-	-	-	-	-	-	-	10	0	-	-	-	-														
H	40866	3/13/03	3/27/03	-	-	-	-	-	-	-	-	-	-	6	0	-	-	-	-														
Total	B			2	0	1	0	1	0	1	0	1	0	31	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS/MSD, and DUPs

9982ST.wpd

LDC Report# 9982G6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: MCAS El Toro, CTO 078

Collection Date: February 26 through February 28, 2003

LDC Report Date: March 19, 2003

Matrix: Water

Parameters: Perchlorate

Validation Level: Level III

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 40865

Sample Identification

LF227
LF228
LF229
LF230
LF231
LF232
LF233
LF234
LF235
LF236

Introduction

This data review covers 10 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 314.0 for Perchlorate.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (February 1994) and the Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP), October 1998.

A table summarizing all data qualification is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration of each method were met.

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No perchlorate contaminants were found in the method blanks.

No field blanks were identified in this SDG.

IV. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the water samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

V. Duplicates

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the water samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for the water samples. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

VII. Sample Result Verification

Raw data were not reviewed for this SDG.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report.

IX. Field Duplicates

No field duplicates were identified in this SDG.

MCAS El Toro, CTO 078
Perchlorate - Data Qualification Summary - SDG 40865

No Sample Data Qualified in this SDG

MCAS El Toro, CTO 078
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 40865

No Sample Data Qualified in this SDG

MCAS El Toro, CTO 078
Perchlorate - Field Blank Data Qualification Summary - SDG 40865

No Sample Data Qualified in this SDG

998269

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE227
Sample Collection Date: 2/26/03

APPL ID: AP46616
ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	4.3	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:00:24 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE228
Sample Collection Date: 2/26/03

APPL ID: AP46617
ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	34.6	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:09:24 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE229

Sample Collection Date: 2/26/03

APPL ID: AP46618

ARF: 40865

Method	Analyte	Result		PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	Not detected	U	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:09:24 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE230

Sample Collection Date: 2/27/03

APPL ID: AP46619

ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	5.8	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:08:24 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE231
Sample Collection Date: 2/27/03

APPL ID: AP46620
ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	5.9	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:08:24 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE232

Sample Collection Date: 2/27/03

APPL ID: AP46621

ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	Not detected	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:08:25 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE233

Sample Collection Date: 2/27/03

APPL ID: AP46622

ARF: 40865

Method	Analyte	Result		PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	Not detected	U	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:08:25 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE234
Sample Collection Date: 2/28/03

APPL ID: AP46623
ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	Not detected U	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:09:25 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE235
Sample Collection Date: 2/28/03

APPL ID: AP46624
ARF: 40865

Method	Analyte	Result	PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	13.5	3.0	ug/L	3/5/03	3/5/03

3/19/03

Printed: 3/7/03 12:08:25 PM

Wet Lab Analysis

Earth Tech
9675 Business Park
San Diego, CA 92131

APPL Inc.
4203 West Swift Avenue
Fresno, CA 93722

Attn: Chris Barr

Project: 36097.003002 MCAS El Toro #1

Sample ID: LE236

Sample Collection Date: 2/28/03

APPL ID: AP46625

ARF: 40865

Method	Analyte	Result		PQL	Units	Prep Date	Analysis Date
EPA 314.0	Perchlorate	Not detected	U	3.0	ug/L	3/5/03	3/5/03

3/12/03

Printed: 3/7/03 12:08:25 PM

LDC #: 9982G6
SDG #: 40865
Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
Level III

Date: 3-17-03
Page: 1 of 1
Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Perchlorate (EPA Method 314.0)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 2-26-03 through 2-28-03
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	N	Client specified
V	Duplicates	N	" "
VI.	Laboratory control samples	A	LCS/LCSD
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X	Field blanks	N	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

1	LF227 W	11	PBW	21		31	
2	LF228	12		22		32	
3	LF229	13		23		33	
4	LF230	14		24		34	
5	LF231	15		25		35	
6	LF232	16		26		36	
7	LF233	17		27		37	
8	LF234	18		28		38	
9	LF235	19		29		39	
10	LF236	20		30		40	

Notes:

Revision #1

LDC Report# 8840B6

Laboratory Data Consultants, Inc.
Data Validation Report

***Project/Site Name:**	MCAS El Toro, CTO 072
Collection Date:	July 3, 2002
LDC Report Date:	August 13, 2002
Matrix:	Water
Parameters:	Perchlorate
Validation Level:	Level III
Laboratory:	Applied P & Ch Laboratory
Sample Delivery Group (SDG):	02-3711

Sample Identification

*LE-226

An asterisk (*) will be placed in the margin to the left of any revised section in the text.

Introduction

This data review covers one water sample listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 314.0 for Perchlorate.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (February 1994) and the Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP), October 1998.

A table summarizing all data qualification is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration of each method were met.

Instrument detection limits, interelement corrections and linear range analysis were performed at the required frequency with the following exceptions:

Analyte	Calibration	Date of Last Report	Report Frequency Requirement	Date of Analysis	Associated Samples	Flag	A or P
Perchlorate	ICAL	11/14/02	Every 6 months	7/8/02	All samples in SDG 02-3711.	None	P

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No perchlorate contaminants were found in the method blanks.

No field blanks were identified in this SDG.

IV. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the water samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

V. Duplicates

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the water samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for the water samples. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

Raw data were not reviewed for this SDG.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report.

IX. Field Duplicates

No field duplicates were identified in this SDG.

***MCAS El Toro, CTO 072**
Perchlorate - Data Qualification Summary - SDG 02-3711

SDG	Sample	Analyte	Flag	A or P	Reason
02-3711	*LE-226	Perchlorate	None	P	Calibration (%R)

***MCAS El Toro, CTO 072**
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 02-3711

No Sample Data Qualified in this SDG

***MCAS El Toro, CTO 072**
Perchlorate - Field Blank Data Qualification Summary - SDG 02-3711

No Sample Data Qualified in this SDG

8840B

Applied P & Ch Laboratory

Wet Analysis Results for Method E314.0

Client Name:	Earth Tech (SD)	Project No:	36097	Anal. Method	E314.0
Project ID:	MCAS El Toro	Service ID:	023711	Collected by:	

Component Name: PERCHLORATE
CAS No:

Lab ID	Sample ID	Matrix	Coll. Date	Rcv Date	Anal. Date	Batch	Unit	RL	Result	Q
02-3711-1	LE-226	Water	07/03/02	07/03/02	07/08/02	02W3401	µg/L	8	148	
02W3401-MB-01	02W3401-MB-01	Water	07/08/02	07/08/02	07/08/02	02W3401	µg/L	4	<4	U

Not Detected is shown as PQL, with dilution and moisture corrected if applicable.

Note: Q - Qualifier.
Qualifier: U - Not Detected or less than MDL
B - Less than RL (PQL, EQL or CRDL), but greater than MDL.

TC 80602

LDC #: 8840B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/2/02
SDG #: 02-3711 Level III Page: 1 of 1
Laboratory: Applied P & Ch Laboratory Reviewer: MH
2nd Reviewer:

METHOD: Perchlorate (EPA Method 314.0)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 7/3/02
IIa.	Initial calibration	SW	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	N	client specifics
V	Duplicates	N	
VI.	Laboratory control samples	A	LCS
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X.	Field blanks	N	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

1	LE-226	11		21		31	
2	MB	12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Notes:

LDC #: 8840B6
SDG #: 02-3711

VALIDATION FINDINGS WORKSHEET
Calibration

Page: 1 of 1
Reviewer: MH
2nd Reviewer: [illegible]

METHOD: Inorganics, EPA Method 310.4

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were all instruments calibrated daily, each set-up time, and were the proper number of standards used?
(Y) N N/A Were all initial and continuing calibration verification percent recoveries (%R) within the control limits of 90-110% ?
(Y) N N/A Are all correlation coefficients ≥0.995 ?

LEVEL IV/D ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Initial and Continuing Calibration Recaluculation Worksheet for recalulations.
Y N (N/A) Was a balance check conducted prior to the TDS analysis.?
Y N (N/A) Was the titrant normality checked?

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
1	09/08/02	ICBL	cl04	ICBL > 6 months (11/14/01)	1-11	none/p

Comments:

CAL 6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: MCAS El Toro, CTO 072

Collection Date: June 17 through June 20, 2002

LDC Report Date: July 26, 2002

Matrix: Water

Parameters: Perchlorate

Validation Level: Level V

Laboratory: Applied P & Ch Laboratory

Sample Delivery Group (SDG): 02-3502

Sample Identification

LE221
LE222
LE223
LE224
LE225

Introduction

This data review covers 5 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 314.0 for Perchlorate.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (February 1994) and the Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP), October 1998.

A table summarizing all data qualification is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met with the following exceptions:

Sample	Analyte	Finding	Criteria	Flag	A or P
All samples in SDG 02-3502	Perchlorate	Initial calibration was not performed at the required frequency.	Initial calibration must be performed every 6 months.	None	P

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
7/1/02	CCV2	Perchlorate	85 (90-110)	LE224 LE225	J (all detects) UJ (all non-detects)	P

III. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the method blanks.

No field blanks were identified in this SDG.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for the water matrix. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

V. Duplicates

Duplicate (DUP) sample analyses were reviewed for the water samples as applicable.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for the water samples. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

All sample result verifications met validation criteria.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report.

IX. Field Duplicates

No field duplicates were identified in this SDG.

MCAS El Toro, CTO 072
Perchlorate - Data Qualification Summary - SDG 02-3502

SDG	Sample	Analyte	Flag	A or P	Reason
02-3502	LE221 LE222 LE223 LE224 LE225	Perchlorate	None	P	Initial calibration
02-3502	LE224 LE225	Perchlorate	J (all detects) UJ (all non-detects)	P	Calibration (%R)

MCAS El Toro, CTO 072
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 02-3502

No Sample Data Qualified in this SDG

MCAS El Toro, CTO 072
Perchlorate - Field Blank Data Qualification Summary - SDG 02-3502

No Sample Data Qualified in this SDG

8789B

Applied P & Ch Laboratory

Wet Analysis Results for Method E314.0

Client Name: Earth Tech (SD) Project No: 36097 Anal. Method E314.0
Project ID: MCAS El Toro Service ID: 023502 Collected by:

Component Name: PERCHLORATE
CAS No:

Lab ID	Sample ID	Matrix	Coll. Date	Rcv Date	Anal. Date	Batch	Unit	RL	Result	Q
02-3502-1	LE221	Water	06/17/02	06/20/02	07/01/02	02W3332	µg/L	4	6.0	
02-3502-2	LE222	Water	06/17/02	06/20/02	07/01/02	02W3332	µg/L	4	<4	U U
02-3502-3	LE223	Water	06/18/02	06/20/02	07/01/02	02W3332	µg/L	4	7.8	
02-3502-4	LE224	Water	06/19/02	06/20/02	07/01/02	02W3332	µg/L	20	218	J (C)
02-3502-5	LE225	Water	06/20/02	06/20/02	07/01/02	02W3332	µg/L	4	8.6	↓ ↓
02W3332-MB-01	02W3332-MB-01	Water	07/01/02	07/01/02	07/01/02	02W3332	µg/L	4	<4	U

Not Detected is shown as PQL, with dilution and moisture corrected if applicable.

Note: Q - Qualifier.
Qualifier: U - Not Detected or less than MDL
B - Less than RL (PQL, EQL or CRDL), but greater than MDL.

R 72902

LDC #: 8789B6

SDG #: 02-3502

Laboratory: Applied P & Ch Laboratory

VALIDATION COMPLETENESS WORKSHEET

X Level IV

Date: 7-24-02

Page: 1 of 1

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Perchlorate (EPA Method 314.0)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 6-17-02 through 6-20-02
IIa.	Initial calibration	SW	
IIb.	Calibration verification	SW	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	LF514 (sdg 02-3594)
IVb.	Laboratory control samples	A	LCS
V.	Sample result verification	A	
VI.	Overall assessment of data	A	
VII.	Field duplicates	N	
VIII.	Field blanks	N	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

1	LE221 W	11		21		31	
2	LE222	12		22		32	
3	LE223	13		23		33	
4	LE224	14		24		34	
5	LE225	15		25		35	
6	PBW	16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Notes:

LDC #: 8789B6
SDG #: 02-3502

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: MW

Method: Inorganics (EPA Method 314.0)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?		✓		
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?		✓		
Were titrant checks performed as required?			✓	
Were balance checks performed as required?			✓	
~~Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?~~				
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 878986
SDG #: 02-3502

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: MM

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

DC #: 8789B6
DG #: 02-3502

VALIDATION FINDINGS WORKSHEET
Calibration

Page 1 of 1
Reviewer: MG
2nd Reviewer: MW

IETHOD: Inorganics, EPA Method 314.0

lease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all instruments calibrated daily, each set-up time, and were the proper number of standards used?
Y (N) N/A Were all initial and continuing calibration verification percent recoveries (%R) within the control limits of 90-110% ?
(Y) N N/A Are all correlation coefficients ≥0.995 ?

EVEL IV/D ONLY:

(Y) N N/A Were recalculated results acceptable? See Level IV Initial and Continuing Calibration Recaluculation Worksheet for recalulations.
Y N (N/A) Was a balance check conducted prior to the TDS analysis.?
Y N (N/A) Was the titrant normality checked?

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
1	11-14-01	ICAL	ClO_4	(ICAL > 6 mo. old samples analyzed 7-1-02)	All	None / P
2	7-1-02	CCV2	ClO_4	85	4, 5	J/UJ/P

Comments:

CAL.6

LDC #: 8789B6
SDG #: 02-3502

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: MB

METHOD: Inorganics, Method 314.0

The correlation coefficient (r) for the calibration of ClO_4 was recalculated. Calibration date: 11-14-01

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Conc (µg/L) ~~Found~~ (units)	response ~~True~~ (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	ClO_4	~~Blank~~ Std 1	4	19371	$r^2=0.997906$	$r^2=0.997193$	Y
		Standard ~~1~~ 2	10	70547			
		Standard ~~2~~ 3	25	181269			
		Standard ~~3~~ 4	50	373818			
		Standard ~~4~~ 5	75	577926			
		Standard ~~5~~ 6	100	818433			
Calibration verification	ClO_4	CCV1	50.5 (µg/L)	50 (µg/L)	101	101	↓
Calibration verification	ClO_4	CCV2	42.4 (µg/L)	50 (µg/L)	85	85	
Calibration verification							

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 8789B6
SDG #: 02-3502

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: MG
2nd Reviewer: MW

METHOD: Inorganics, Method 314.0

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	ClO_4	25.7 (µg/L)	25 (µg/L)	103	103	Y
LF514 MS	Matrix spike sample	ClO_4	(SSR-SR) 44.1 (µg/L)	50.0 (µg/L)	88	88	↓
LF514 MSD	Duplicate sample	ClO_4	44.1 (µg/L)	45.6 (µg/L)	3	3	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

TOTCLC.6

LDC #: 8789B6
SDG #: 02-3502

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: MW

METHOD: Inorganics, Method 314.0

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for ClO4 #1 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $y = mx + b$

where y = conc (µg/L)
$m = 0.0001248$
$b = 0$

Recalculation:

$6.022\ \mu g/L = (0.0001248)(48256) + 0$

#	Sample ID	Analyte	Reported Concentration (µg/L)	Calculated Concentration (µg/L)	Acceptable (Y/N)
1	1	ClO4	6.0	6.0	Y

Note:

MCAS El Toro, CTO 72
Data Validation Reports
LDC# 8707

Dioxins/Dibenzofurans

LDC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: MCAS El Toro, CTO 072

Collection Date: May 16, 2002

LDC Report Date: July 10, 2002

Matrix: Soil

Parameters: Dioxins/Dibenzofurans

Validation Level: Level III

Laboratory: Paradigm Analytical Laboratories, Inc.

Sample Delivery Group (SDG): G204-285

Sample Identification

LE211

Introduction

This data review covers one soil sample listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8290 for Polychlorinated Dioxins/Dibenzofurans.

This review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (October 1999) and the Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP), October 1998.

A table summarizing all data qualification is provided at the end of this report. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section V.

Field duplicates are summarized in Section XIV.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at the required daily frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

III. Initial Calibration

A five point initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 30.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

IV. Routine Calibration (Continuing)

Routine calibration was performed at the required frequencies.

All of the routine calibration percent differences (%D) between the initial calibration RRF and the routine calibration RRF were less than or equal to 20.0% for unlabeled compounds and less than or equal to 30.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated dioxin/dibenzofuran contaminants were found in the method blanks with the following exceptions:

Method Blank ID	Extraction Date	Compound	Concentration	Associated Samples
LMB	6/10/02	1,2,3,4,6,7,8-HpCDD OCDD 2,3,7,8-TCDF 2,3,4,7,8-PeCDF 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF Total HpCDD Total TCDF Total PeCDF Total HxCDF	0.288 pg/g 0.558 pg/g 0.222 pg/g 0.108 pg/g 0.0920 pg/g 0.0880 pg/g 0.288 pg/g 1.01 pg/g 0.522 pg/g 0.366 pg/g	All samples in SDG G204-285

Sample concentrations were compared to concentrations detected in the method blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated method blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LE211	2,3,7,8-TCDF 2,3,4,7,8-PeCDF Total TCDF Total PeCDF	0.327 pg/g 0.327 pg/g 0.755 pg/g 1.33 pg/g	0.327UJ pg/g 0.327UJ pg/g 0.755UJ pg/g 1.33UJ pg/g

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the soil samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for the soil samples. The percent recoveries (%R) were within the QC limits with the following exceptions:

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
OPR	2,3,4,7,8-PeCDF	131 (70-130)	All samples in SDG G204-285	J (all detects)	P

VIII. Regional Quality Assurance and Quality Control

Not applicable.

IX. Internal Standards

All internal standard recoveries were within QC limits.

X. Target Compound Identifications

Raw data were not reviewed for this SDG.

XI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG G204-285	2,3,7,8-TCDF	2nd column confirmation was not performed for this compound.	All compounds must be confirmed on the 2nd column per the QAPP.	None	P

Raw data were not reviewed for this SDG.

XII. System Performance

Raw data were not reviewed for this SDG.

XIII. Overall Assessment of Data

Data flags have been summarized at the end of the report.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

MCAS El Toro, CTO 072
Dioxins/Dibenzofurans - Data Qualification Summary - SDG G204-285

SDG	Sample	Compound	Flag	A or P	Reason
G204-285	LE211	2,3,4,7,8-PeCDF	J (all detects)	P	Laboratory control samples (%R)
G204-285	LE211	2,3,7,8-TCDF	None	P	Compound quantitation and CRQLs

MCAS El Toro, CTO 072
Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG G204-285

SDG	Sample	Compound	Modified Final Concentration	A or P
G204-285	LE211	2,3,7,8-TCDF 2,3,4,7,8-PeCDF Total TCDF Total PeCDF	0.327UJ pg/g 0.327UJ pg/g 0.755UJ pg/g 1.33UJ pg/g	A

MCAS El Toro, CTO 072
Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG G204-285

No Sample Data Qualified in this SDG

8707D

Paradigm Analytical Labs

Method 8290

LE 211

Earth Tech

Analytical Data Summary Sheet

Analyte	Amount (pg/g)	EDL (pg/g)	EMPC (pg/g)	RT (min.)	Ratio	Qualifier
2,3,7,8-TCDD	ND	U 0.149				
1,2,3,7,8-PeCDD	ND	U 0.238				
1,2,3,4,7,8-HxCDD	0.112			35:50	1.35	A
1,2,3,6,7,8-HxCDD	0.141			35:55	1.14	A
1,2,3,7,8,9-HxCDD	0.247			36:08	1.36	A
1,2,3,4,6,7,8-HpCDD	3.65			38:55	1.06	
OCDD	32.5			42:45	0.98	
2,3,7,8-TCDF	0.327	UJ (B)		28:58	0.72	A
1,2,3,7,8-PeCDF	0.171			32:37	1.59	A
2,3,4,7,8-PeCDF	0.327	UJ (L)	(B)	33:13	1.4	A
1,2,3,4,7,8-HxCDF	EMPC	0.683	0.696	35:09	0.96	
1,2,3,6,7,8-HxCDF	EMPC	0.616	0.464	35:15	0.93	
2,3,4,6,7,8-HxCDF	0.476			35:42	1.41	A
1,2,3,7,8,9-HxCDF	ND	U 0.774				
1,2,3,4,6,7,8-HpCDF	1.41			37:47	0.93	A
1,2,3,4,7,8,9-HpCDF	EMPC	0.376	0.272	39:31	0.58	
OCDF	2.32			43:00	0.91	A
Total TCDDs	ND	U 0.323				
Total PeCDDs	ND	U 0.238				
Total HxCDDs	1.85		3.09			
Total HpCDDs	7.27					
Total TCDFs	0.755	UJ(B)				
Total PeCDFs	1.33	UJ(B)	2.04			DPE
Total HxCDFs	4.68		5.84			
Total HpCDFs	2.84		3.12			
ITEF TEQ (ND=0)	0.388		0.506			
ITEF TEQ (ND=½)	0.627		0.679			

Client Information			**Sample Information**		
Project Name:	CTO 72		Report Basis:	Dry Weight	
			Matrix:	Soil	
Sample ID:	LE 211		Weight / Volume:	12.22	Grams
			Solids / Lipids:	86.0	%
			Original pH :	NA	
Laboratory Information			Batch ID:	WG7320	
Project ID:	G204-285				
Sample ID:	44821		Filename:	a11jun02a_2-3	
Collection Date/Time:	16-May-02	10:35	Retchk:	a11jun02a-15	
Receipt Date:	31-May-02		Begin ConCal:	a11jun02a-15	
Extraction Date:	10-Jun-02		End ConCal:	a11jun02a_2-4	
Analysis Date:	12-Jun-02		Initial Cal:	m8290-101201a	

A715

LDC #: 8707D21

VALIDATION COMPLETENESS WORKSHEET

Date: 7-9-02

SDG #: G204-285

X Level III

Page: 1 of 1

Laboratory: Paradigm Analytical Laboratories, Inc.

Reviewer: SC

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5-16-02
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration	A	
IV.	Routine calibration	A	
V.	Blanks	SW	
VI.	Matrix spike/Matrix spike duplicates	N	client spec
VII.	Laboratory control samples	SW	LCS
VIII.	Regional quality assurance and quality control	N	
IX.	Internal standards	A	
X.	Target compound identifications	N	
XI.	Compound quantitation and CRQLs	SW	*no confirmation performed for tl. hxne/p
XII.	System performance	N	
XIII.	Overall assessment of data	A	
XIV.	Field duplicates	N	
XV.	Field blanks	N	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

1 A	LE211 S	11		21		31	
2	LMB	12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 107D21
SDG #: G204-285

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 01
Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was method blank contamination less < CRQL for all target compounds?

Blank extraction date: 6-10-02 **Blank analysis date:** 6-11-02 **Associated samples:** All

Conc. units: pg/g

Compound	Blank ID	Sample Identification								
	LMB	1								
F	0.288	3.65								
G	0.558	32.5								
H	0.222*	0.327	/UJ							
J	0.108*	0.327	↓							
K	0.0920*	0.696*								
L	0.0880*	0.464*								
U	0.288	7.27								
V	1.01	0.755	/UJ							
W	0.588	1.33	↓							
X	0.366	4.68								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 8707D21
SDG #: 6204-285

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?
Y N N/A Was a LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?
Y N N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

#	Date	Lab ID/Reference	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		OPR	J	131 (70-130)	( )	( )	All. blk	J det/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		

Appendix G
Human Health Risk Assessment Tables

Table G-1: Rejected Analytical Results from Soil Data Set, Site 1

Chemical	Sample ID	Lab ID	Ending Depth (feet)	Value (ug/kg)	Flag
1,2-Dichloroethane	HA12	LD136	1.5	5.8	R
	HA13	LD138	1.5	6	R
	HA11	LD134	1.5	6.2	R
	HA11	LD135	3.0	5.7	R
	HA12	LD137	3.5	5.5	R
	HA13	LD139	4.0	6.1	R
	HA10	LD133	4.5	5.4	R
2-Butanone	DP13	LE030	1.5	60	R
Acetone	DP16	LE036	1.5	97	R
	DP14	LE032	1.5	92	R
	DP02	LE003	1.5	93	R
	DP10	LE023	1.5	95	R
	DP15	LE034	1.5	96	R
	DP17	LE038	1.5	96	R
	DP11	LE025	1.5	97	R
	DP03	LE005	1.5	98	R
	DP12	LE027	1.5	98	R
	DP07	LE016	1.5	100	R
	DP07	LE017	1.5	100	R
	HA06	LD122	1.5	110	R
	DP04	LE007	1.5	110	R
	DP08	LE019	1.5	110	R
	DP09	LE021	1.5	110	R
	DP05	LE009	1.5	140	R
	DP05	LE010	1.5	120	R
	DP13	LE030	1.5	120	R
	DP01	LE001	1.5	130	R
	DP06	LE013	1.5	130	R
	DP06	LE014	1.5	140	R
	HA05	LD121	4.5	110	R
	HA06	LD123	4.5	110	R
	DP15	LE035	5.0	92	R
	DP02	LE004	5.0	95	R
	DP08	LE020	5.0	96	R
	DP12	LE029	5.0	110	R
	DP12	LE028	5.0	97	R
	DP13	LE031	5.0	97	R
	DP03	LE006	5.0	98	R
	DP14	LE033	5.0	98	R
	DP01	LE002	5.0	100	R
	DP09	LE022	5.0	100	R
	DP11	LE026	5.0	100	R
	DP16	LE037	5.0	100	R
	DP17	LE039	5.0	100	R
	DP06	LE015	5.0	110	R
	DP07	LE018	5.0	110	R
	DP10	LE024	5.0	110	R
	DP04	LE008	5.0	120	R
	DP05	LE011	5.0	120	R

Notes:

ug/kg = micrograms per kilogram

R = result is unusable (rejected)

Table G-2: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Surface Soil[d]				
VOCs by EPA SW-846 Method 8260B (µg/kg)[e]				
1,1,2,2-Tetrachloroethane	408	4.4 - 6,100	5	1%
1,1,2-Trichloroethane	729	4.4 - 6,100	5	1%
1,2-Dichloroethane	278	4.4 - 6,100	5	1%
1,2-Dichloropropane	342	4.4 - 6,100	5	1%
Bromodichloromethane	824	4.4 - 6,100	5	1%
Bromomethane	3,897	4.4 - 6,100	5	1%
Carbon Tetrachloride	251	4.4 - 6,100	5	1%
Chloroethane	3,026	4.4 - 6,100	5	1%
Chloroform	221	4.4 - 6,100	5	1%
cis-1,3-Dichloropropene	777	4.4 - 6,100	5	1%
Dibromochloromethane	1,109	4.4 - 6,100	5	1%
Tetrachloroethene (PCE)	484	4.4 - 6,100	5	1%
trans-1,3-Dichloropropene	777	4.4 - 6,100	5	1%
Trichloroethene (TCE)	53	4.4 - 6,100	5	1%
Vinyl Chloride	79	4.4 - 6,100	5	1%
SVOCS by EPA SW-846 Method 8270C (µg/kg)[f]				
1,4-Dichlorobenzene	3,447	350 - 120,000	10	1%
2,4,6-Trichlorophenol	6,110	350 - 120,000	10	1%
2,4-Dinitrophenol	122,206	1,700 - 610,000	50	1%
2-Chlorophenol	63,398	350 - 120,000	10	1%
2-Nitroaniline	182,772	1,700 - 610,000	50	1%
3,3'-Dichlorobenzidine	1,081	350 - 120,000	10	1%
3-Nitroaniline	18,331	1,700 - 610,000	50	1%
4-Nitroaniline	23,161	1,700 - 610,000	50	1%
Benzo(a)anthracene	621	350 - 120,000	10	3%
Benzo(b)fluoranthene	621	350 - 120,000	10	3%
Benzo(k)fluoranthene	6,215	350 - 120,000	10	1%
Bis(2-Chloroethyl) Ether	218	170 - 40,000	10	36%
Bis(2-Chloroisopropyl) Ether	2,884	510 - 120,000	10	1%
Bis(2-ethylhexyl) Phthalate	34,741	510 - 120,000	10	1%
Carbazole	24,319	350 - 120,000	10	1%
Chrysene	62,146	350 - 120,000	10	1%
Dibenz(a,h)anthracene	62	37 - 8,800	10	23%
Hexachlorobenzene	304	350 - 120,000	10	100%
Hexachlorobutadiene	6,236	350 - 120,000	10	1%
Hexachlorocyclopentadiene	365,487	1,700 - 610,000	50	1%
Hexachloroethane	34,741	350 - 120,000	10	1%
Indeno(1,2,3-c,d)pyrene	621	350 - 120,000	10	3%
n-nitrosodi-n-propylamine	69	46 - 11,000	10	53%
n-nitrosodiphenylamine	99,261	350 - 120,000	10	1%
Pentachlorophenol	2,979	1,700 - 420,000	50	1%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	62	26 - 6,100	10	7%
Perchlorate by EPA E314 (mg/kg)				
Perchlorate	7.8	0.02 - 24	20	37%
Metals by EPA 6010B (mg/kg)[g]				
Arsenic	0.39	0.29 - 4.5	0.3	91%
Subsurface Soil[d]				
VOCs by EPA SW-846 Method 8260B (µg/kg)[e]				
1,1,2,2-Tetrachloroethane	408	4.3 - 6,100	5	4%
1,1,2-Trichloroethane	729	4.3 - 6,100	5	2%
1,2-Dichloroethane	278	4.3 - 6,100	5	4%
1,2-Dichloropropane	342	4.3 - 6,100	5	4%
Benzene	643	4.3 - 1,100	5	1%

Table G-2: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Bromodichloromethane	824	4.3 - 6,100	5	2%
Bromomethane	3,897	4.3 - 6,100	5	1%
Carbon Tetrachloride	251	4.3 - 6,100	5	4%
Chloroethane	3,026	4.3 - 6,100	5	1%
Chloroform	221	0.6 - 6,100	5	4%
cis-1,3-Dichloropropene	777	4.3 - 6,100	5	2%
Dibromochloromethane	1,109	4.3 - 6,100	5	1%
Tetrachloroethene (PCE)	484	4.3 - 6,100	5	4%
trans-1,3-Dichloropropene	777	4.3 - 6,100	5	2%
Trichloroethene (TCE)	53	4.3 - 6,100	5	4%
Vinyl Chloride	79	4.3 - 6,100	5	4%
SVOCS by EPA SW-846 Method 8270C (μg/kg)[f]				
1,4-Dichlorobenzene	3,447	350 - 120,000	10	3%
2,4,6-Trichlorophenol	6,110	350 - 120,000	10	3%
2,4-Dinitrophenol	122,206	540 - 610,000	50	1%
2-Chlorophenol	63,398	350 - 120,000	10	1%
2-Nitroaniline	182,772	540 - 610,000	50	1%
3,3'-Dichlorobenzidine	1,081	350 - 120,000	10	3%
3-Nitroaniline	18,331	540 - 610,000	50	3%
4-Nitroaniline	23,161	540 - 610,000	50	3%
Benzo(a)anthracene	621	350 - 120,000	10	6%
Benzo(b)fluoranthene	621	27 - 120,000	10	6%
Benzo(k)fluornthene	6,215	350 - 120,000	10	1%
Bis(2-Chloroethyl) Ether	218	170 - 40,000	10	37%
Bis(2-Chloroisopropyl) Ether	2,884	180 - 120,000	10	3%
Bis(2-ethylhexyl) Phthalate	34,741	510 - 120,000	10	1%
Carbazole	24,319	350 - 120,000	10	1%
Chrysene	62,146	350 - 120,000	10	1%
Dibenz(a,h)anthracene	62	37 - 8,800	10	28%
Hexachlorobenzene	304	350 - 120,000	10	100%
Hexachlorobutadiene	6,236	350 - 120,000	10	2%
Hexachlorocyclopentadiene	365,487	540 - 610,000	50	1%
Hexachloroethane	34,741	350 - 120,000	10	1%
Indeno(1,2,3-c,d)pyrene	621	350 - 120,000	10	6%
Naphthalene	55,916	350 - 120,000	10	1%
n-nitrosodi-n-propylamine	69	46 - 11,000	10	58%
n-nitrosodiphenylamine	99,261	49 - 120,000	10	1%
Pentachlorophenol	2,979	540 - 420,000	50	4%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	62	26 - 6,100	10	9%
Perchlorate by EPA E314 (mg/kg)				
Perchlorate	7.8	0.02 - 24	20	38%
Metals by EPA 6010B (mg/kg)[g]				
Arsenic	0.39	0.17 - 35	0.3	87%
Thallium	5.2	0.077 - 47	0.4	1%
Groundwater[h]				
VOCs by EPA SW-846 Method 8260B (μg/L)[e]				
1,1,2,2-Tetrachloroethane	0.055	1 - 5	1	100%
cis-1,3-Dichloropropene	0.395	0.5 - 1	0.5	100%
trans-1,3-Dichloropropene	0.395	0.5	0.5	100%
SVOCS by EPA SW-846 Method 8270C (μg/L)				
2,4,6-Trichlorophenol	3.650	4.8 - 5	5	100%
3,3'-Dichlorobenzidine	0.149	9.6 - 14	10	100%
3-Nitroaniline	3.202	48 - 50	50	100%
4-Nitroaniline	3.202	48 - 50	50	100%
Benzo(a)anthracene	0.092	9.6 - 10	10	100%
Benzo(b)fluoranthene	0.092	9.6 - 10	10	100%

Table G-2: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Benzo(k)fluornthene	0.921	9.6 - 10	10	100%
Bis(2-Chloroethyl) Ether	0.010	9.6 - 10	10	100%
Bis(2-Chloroisopropyl) Ether	0.274	10	--	100%
Bis(2-ethylhexyl) Phthalate	6[i]	9.6 - 10	10	100%
Carbazole	3.362	48 - 50	50	100%
Dibenz(a,h)anthracene	0.009	9.6 - 10	10	100%
Hexachlorobenzene	1[i]	1.1 - 3.2	1	100%
Hexachlorobutadiene	0.862	9.6 - 10	10	100%
Hexachloroethane	4.802	4.8 - 5	5	79%
Indeno(1,2,3-c,d)pyrene	0.092	9.6 - 10	10	100%
Nitrobenzene	3.395	4.8 - 5	5	100%
n-nitrosodi-n-propylamine	0.010	9.6 - 10	10	100%
n-nitrosodimethylamine	0.0013	0.002	NP	100%
Pentachlorophenol	1[i]	4 - 12	1	100%
Explosives by EPA SW-846 Method 8330 (μg/L)[d]				
1,3-Dinitrobenzene	3.650	1 - 5	5	74%
2,4,6-Trinitrotoluene	2.241	1 - 5	5	74%
RDX	0.611	1 - 5	5	100%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	0.2[i]	0.2 - 1.3	0.2	21%
Perchlorate by EPA E314 (ug/L)				
Perchlorate	3.65	4	5	100%
Metals by EPA 6010B (ug/L)				
Antimony	14.6	1.8 - 60	5	21%
Arsenic	0.045	1.5 - 10	0.3	100%
Lead	0.015[i]	1.2 - 5	0.3	100%
Thallium	2.409	1.2 - 3.7	0.5	20%

Notes:

mg/kg = micrograms per kilogram
mg/L = micrograms per liter
EQL = estimated quantitation limit
FOE = frequency of exceedence; percentage of times SQL of nondetect exceeds PRG
SQL = sample quantitation limit of nondetect value
VOC = volatile organic compound
SVOC = semivolatile organic compound

[a] Unless otherwise noted, the screening criteria for soil are equivalent to EPA Region IX (2004) residential preliminary remediation goals. For groundwater, the EPA Region IX (2004) tap water PRGs are only used if nothing more applicable is available.
[b] This value is the laboratory estimated quantitation limit from the *Work Plan*, (Earth Tech 2001).
[c] Total number of samples includes the field duplicate sample.
[d] Because PRGs are currently unavailable for 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene (Method 8330), no comparison was conducted.
[e] Because a PRG is currently unavailable for 2-hexanone, no comparison was conducted.
[f] Because PRGs are currently unavailable for 2-methylnaphthalene, 2-nitrophenol, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, 4-nitrophenol, acenaphthylene, benzo(g,h,i)perylene, bis(2-chloroethoxy)methane, and phenanthrene, no comparison was conducted.
[g] Because a PRG is currently unavailable for sodium, no comparison was conducted.
[h] No groundwater standard is currently available for TPHs.
[i] Federal maximum contaminant level (EPA 2004)
-- = not presented
na = not applicable
NP = Not provided.

Table G-3 : Summary Statistics for Analytical Data from Surface Soil (0 feet –2 feet bgs) Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	FI
Surface Soil	8260B	2-Butanone	ug/kg	83	2	2%	DP29	9.00E+00	–	–	–	9.00E+00	X
Surface Soil	8260B	2-Hexanone	ug/kg	84	3	4%	DP38	4.40E+01	–	–	–	4.40E+01	X
Surface Soil	8260B	4-Methyl-2-Pentanone	ug/kg	84	1	1%	DP24	2.00E+00	–	–	–	2.00E+00	X
Surface Soil	8260B	Acetone	ug/kg	66	2	3%	HA02	1.70E+01	–	–	–	1.70E+01	X
Surface Soil	8260B	Benzene	ug/kg	84	1	1%	Trench 34	4.30E+02	–	–	–	4.30E+02	X
Surface Soil	8260B	Chloroform	ug/kg	84	5	6%	Trench 5	2.20E+00	–	–	–	2.20E+00	X
Surface Soil	8260B	Ethylbenzene	ug/kg	84	1	1%	Trench 34	1.40E+04	–	–	–	1.40E+04	X
Surface Soil	8260B	Toluene	ug/kg	84	10	12%	Trench 34	4.10E+04	–	–	–	4.10E+04	X
Surface Soil	8260B	Xylenes, Total	ug/kg	84	1	1%	Trench 34	9.80E+04	–	–	–	9.80E+04	
Surface Soil	8270C	2-Methylnaphthalene	ug/kg	72	1	1%	Trench 34	2.70E+05	–	–	–	2.70E+05	X
Surface Soil	8270C	Bis(2-ethylhexyl) Phthalate	ug/kg	71	3	4%	Trench 15/Trench 23	4.20E+02	–	–	–	4.20E+02	X
Surface Soil	8270C	Diethyl Phthalate	ug/kg	72	2	3%	DP11	1.10E+02	–	–	–	1.10E+02	X
Surface Soil	8270C	Di-n-butyl Phthalate	ug/kg	72	8	11%	Trench 23	3.07E+05	–	–	–	3.07E+05	X
Surface Soil	8270C	Fluoranthene	ug/kg	72	1	1%	Trench 23	3.80E+01	–	–	–	3.80E+01	X
Surface Soil	8270C	Naphthalene	ug/kg	72	1	1%	Trench 34	1.28E+05	–	–	–	1.28E+05	X
Surface Soil	8270C	n-Nitrosodiphenylamine	ug/kg	72	5	7%	Trench 23	6.67E+04	–	–	–	6.67E+04	X
Surface Soil	8270C	Phenol	ug/kg	72	7	10%	DP18	8.68E+02	–	–	–	8.68E+02	X
Surface Soil	8330	2,4-Dinitrotoluene	ug/kg	76	5	7%	Trench 23	7.00E+03	–	–	–	7.00E+03	X
Surface Soil	8330	2,6-Dinitrotoluene	ug/kg	74	1	1%	Trench 15	4.40E+01	–	–	–	4.40E+01	X
Surface Soil	8330	2,4,6-Trinitrotoluene	ug/kg	73	1	1%	DP05	2.78E+02	–	–	–	2.78E+02	X
Surface Soil	8330	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	ug/kg	73	3	4%	DP12	2.20E+03	–	–	–	2.20E+03	X
Surface Soil	8015B DRO	Motor Oils	mg/kg	53	24	45%	Trench 48	3.90E+01	2.53E+02	Non-parametric	95% Chebyshev (Mean, Sd) UCL	3.90E+01	X
Surface Soil	8015B DRO	PHC as Diesel Fuel	mg/kg	53	10	19%	Trench 34	3.70E+04	–	–	–	3.70E+04	X
Surface Soil	8015B GRO	PHC as Gasoline	mg/kg	70	5	7%	Trench 34	1.60E+03	–	–	–	1.60E+03	X
Surface Soil	M8015E	Motor Oils	mg/kg	17	17	100%	01SS01-SS01--D0.0	5.90E+01	2.72E+01	Lognormal	H-UCL	2.72E+01	
Surface Soil	M8015E	Diesel	mg/kg	17	9	53%	01SS03-SS01-D0.0	2.70E+01	–	–	–	2.70E+01	X
Surface Soil	E314	Perchlorate	ug/kg	86	7	8%	Trench 5	6.60E+02	–	–	–	6.60E+02	X
Surface Soil	300.0	Nitrate as N	mg/kg	52	52	100%	DP33	1.09E+01	2.38E+00	Lognormal	H-UCL	2.38E+00	
	8290	2,3,7,8-TCDD	ng/kg	10	3	30%	01-SS-T48-S01-D2.0	9.55E-01	–	–	–	9.55E-01	X
Surface Soil	8290	Total 2,3,7,8-TCDD[c]	ng/kg	10	10	100%	Trench 48	2.70E+00	–			2.70E+00	X
Surface Soil	6010B	Aluminum	mg/kg	72	72	100%	DP34	1.28E+04	6.22E+03	Gamma	Approximate Gamma	6.22E+03	
Surface Soil	6010B	Arsenic	mg/kg	72	52	72%	DP09	8.60E+00	2.12E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	2.12E+00	
Surface Soil	6010B	Barium	mg/kg	72	72	100%	Trench 34	1.70E+02	6.02E+01	Non-parametric	Modified-t UCL	6.02E+01	

Table G-3 : Summary Statistics for Analytical Data from Surface Soil (0 feet –2 feet bgs) Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	FI
Surface Soil	6010B	Beryllium	mg/kg	72	54	75%	DP28	9.90E-01	5.55E-01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	5.55E-01	
Surface Soil	6010B	Cadmium	mg/kg	72	49	68%	Trench 51	3.17E+01	3.98E+00	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	3.98E+00	
Surface Soil	6010B	Calcium	mg/kg	72	72	100%	DP35	3.46E+04	9.69E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	9.69E+03	
Surface Soil	6010B	Chromium	mg/kg	72	72	100%	DP09	2.22E+01	5.78E+00	Lognormal	H-UCL	5.78E+00	
Surface Soil	6010B	Cobalt	mg/kg	72	72	100%	DP09	6.60E+00	2.22E+00	Lognormal	H-UCL	2.22E+00	
Surface Soil	6010B	Copper	mg/kg	72	70	97%	Trench 17	3.75E+02	4.54E+01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	4.54E+01	
Surface Soil	6010B	Iron	mg/kg	72	72	100%	DP09	1.45E+04	5.56E+03	Non-parametric	Modified-t UCL	5.56E+03	
Surface Soil	6010B	Lead	mg/kg	72	72	100%	HA09	8.85E+01	1.65E+01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.65E+01	
Surface Soil	6010B	Magnesium	mg/kg	72	72	100%	DP08	6.55E+03	2.83E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	2.83E+03	
Surface Soil	6010B	Manganese	mg/kg	72	71	99%	DP09	2.28E+02	9.62E+01	Gamma	Approximate Gamma	9.62E+01	
Surface Soil	7471A	Mercury	mg/kg	72	63	88%	HA09	7.10E+00	8.64E-01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	8.64E-01	
Surface Soil	6010B	Nickel	mg/kg	72	72	100%	DP09	2.63E+01	6.76E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	6.76E+00	
Surface Soil	6010B	Potassium	mg/kg	72	72	100%	Trench 34	7.94E+03	1.05E+03	Lognormal	H-UCL	1.05E+03	
Surface Soil	6010B	Selenium	mg/kg	72	5	7%	HA07	1.40E+00	–	–	–	1.40E+00	X
Surface Soil	6010B	Sodium	mg/kg	72	18	25%	Trench 34	8.76E+03	1.02E+03	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.02E+03	
Surface Soil	6010B	Vanadium	mg/kg	72	72	100%	DP09	6.09E+01	1.60E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.60E+01	
Surface Soil	6010B	Zinc	mg/kg	72	72	100%	Trench 17	1.53E+03	2.13E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	2.13E+02	

NOTES:
RME = reasonable maximum exposure
EPC = exposure point concentration
UCL = upper confidence limit
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
ng/g = nanogram per kilogram
% = percent
– = Not applicable. Mean, standard deviaion , distribution and UCL were not calculated for data sets with fewer than 11 detections.
Cross mark in the Flag column indicates that the RME EPC for that analyte is the maximum concentration.
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.
[c] Total 2,3,7,8-TCDD contribution was calculated using the toxicity equivalency procedure (EPA 2001) as illustrated in Tables G-8 and G-9.

Table G-4: Summary Statistics for Analytical Data from Subsurface Soil (0 feet –10 feet bgs) Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	FI
Subsurface Soil	8260B	2-Butanone	ug/kg	174	2	1%	01-SS-DP29-S01-D1.5	9.00E+00	–	–	–	9.00E+00	X
Subsurface Soil	8260B	2-Hexanone	ug/kg	175	7	4%	01-SS-DP36-S02-D5.0	5.00E+01	–	–	–	5.00E+01	X
Subsurface Soil	8260B	4-Methyl-2-Pentanone	ug/kg	175	1	1%	01-SS-DP24-S01-D1.5	2.00E+00	–	–	–	2.00E+00	X
Subsurface Soil	8260B	Acetone	ug/kg	138	5	4%	01-SS-T34-S02-D6.0	8.70E+03	–	–	–	8.70E+03	X
Subsurface Soil	8260B	Benzene	ug/kg	175	3	2%	01-SS-T29A-S02-D3.0	6.10E+02	–	–	–	6.10E+02	X
Subsurface Soil	8260B	Chloroform	ug/kg	175	11	6%	01-SS-T5-S01-D0.5	2.20E+00	4.06E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	2.20E+00	X
Subsurface Soil	8260B	Ethylbenzene	ug/kg	174	5	3%	01-SS-T34-S01-D2.0	1.40E+04	–	–	–	1.40E+04	X
Subsurface Soil	8260B	Tetrachloroethene	ug/kg	175	1	1%	01-SS-T33-S01-D3.0	2.00E+00	–	–	–	2.00E+00	X
Subsurface Soil	8260B	Toluene	ug/kg	175	26	15%	01-SS-T34-S01-D2.0	4.10E+04	1.77E+03	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.77E+03	
Subsurface Soil	8260B	Total Xylenes	ug/kg	175	6	3%	01-SS-T34-S01-D2.0	9.80E+04	–	–	–	9.80E+04	X
Subsurface Soil	8270C	2-Methylnaphthalene	ug/kg	147	5	4%	01-SS-T34-S01-D2.0	2.70E+05	–	–	–	2.70E+05	X
Subsurface Soil	8270C	Bis(2-Ethylhexyl)Phthalate	ug/kg	148	6	4%	01-SS-T15-S01-D1.0	4.20E+02	–	–	–	4.20E+02	X
Subsurface Soil	8270C	Diethyl Phthalate	ug/kg	148	4	3%	01HA09-SS02-D4.0	2.50E+02	–	–	–	2.50E+02	X
Subsurface Soil	8270C	Di-N-Butyl Phthalate	ug/kg	148	12	8%	01-SS-T23-S01-D1.5	3.07E+05	2.15E+04	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	2.15E+04	
Subsurface Soil	8270C	Fluoranthene	ug/kg	148	1	1%	01-SS-T23-S01-D1.5	3.80E+01	–	–	–	3.80E+01	X
Subsurface Soil	8270C	Hexachlorobenzene	ug/kg	148	1	1%	01HA09-SS02-D4.0	2.20E+02	–	–	–	2.20E+02	X
Subsurface Soil	8270C	Naphthalene	ug/kg	148	6	4%	01-SS-T34-S01-D2.0	1.28E+05	–	–	–	1.28E+05	X
Subsurface Soil	8270C	N-Nitrosodiphenylamine	ug/kg	148	6	4%	01-SS-T23-S01-D1.5	6.67E+04	–	–	–	6.67E+04	X
Subsurface Soil	8270C	Phenol	ug/kg	148	15	10%	01-SS-DP51-S02-D5.0	1.20E+03	7.31E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.20E+03	X
Subsurface Soil	8330	1,3-Dinitrobenzene	ug/kg	149	1	1%	01-SS-T29A-S02-D3.0	6.30E+02	–	–	–	6.30E+02	X
Subsurface Soil	8330	2,4,6-Trinitrotoluene	ug/kg	149	3	2%	01-SS-BH01-S01-D5.0	7.86E+03	–	–	–	7.86E+03	X
Subsurface Soil	8330	2,4-Dinitrotoluene	ug/kg	152	6	4%	01-SS-T23-S01-D1.5	7.00E+03	–	–	–	7.00E+03	X
Subsurface Soil	8330	2,6-Dinitrotoluene	ug/kg	150	1	1%	01-SS-T15-S01-D1.0	4.40E+01	–	–	–	4.40E+01	X
Subsurface Soil	8330	2-Amino-4,6-dinitrotoluene	ug/kg	149	1	1%	01-SS-DP05-S01-D1.5	3.10E+02	–	–	–	3.10E+02	X
Subsurface Soil	8330	4-Amino-2,6-dinitrotoluene	ug/kg	149	1	1%	01-SS-DP05-S01-D1.5	2.28E+02	–	–	–	2.28E+02	X
Subsurface Soil	8330	(RDX)	ug/kg	148	6	4%	01-SS-BH01-S01-D5.0	1.40E+04	–	–	–	1.40E+04	X
Subsurface Soil	8330	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	ug/kg	149	1	1%	01-SS-BH01-S01-D5.0	1.40E+03	–	–	–	1.40E+03	X
Subsurface Soil	8290	2,3,7,8-TCDD	ng/kg	14	5	1%	01-SS-T33-S01-D3.0	2.51E+00	–	–	–	2.51E+00	X
Subsurface Soil	8290	Total 2,3,7,8-TCDD[c]	ng/kg	14	14	1%	01-T33	2.37E+01	6.08E+00	Gamma	Approximate Gamma	6.08E+00	
Subsurface Soil	8015B DRO	Motor oil	mg/kg	111	40	36%	01-SS-T57-S01-D3.0	6.90E+01	2.19E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	6.90E+01	X
Subsurface Soil	M8015E	Motor oil	mg/kg	31	29	94%	01SS01-SS01-D0.0	5.90E+01	1.67E+01	Gamma	Approximate Gamma	1.67E+01	
Subsurface Soil	8015B DRO	PHC as Diesel Fuel	mg/kg	112	23	21%	01-SS-T34-S01-D2.0	3.70E+04	2.90E+03	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	2.90E+03	
Subsurface Soil	SW8015E	Diesel	mg/kg	31	12	39%	01SS03-SS01-D0.0	2.70E+01	1.33E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.33E+01	
Subsurface Soil	8015B GRO	Gasoline	mg/kg	143	11	8%	01-SS-T34-S01-D2.0	1.60E+03	–	–	–	1.60E+03	X
Subsurface Soil	E314	Perchlorate	ug/kg	170	14	16%	01-SS-DP35-S02-D5.0	1.60E+03	8.62E+01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	8.62E+01	
Subsurface Soil	300.0	Nitrate as N	mg/kg	105	105	100%	01-SS-T33-S01-D3.0	5.27E+01	4.37E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	4.37E+00	
Subsurface Soil	CLO4METH	Nitrate	ug/kg	8	6	75%	01HA04-SS02-D3.5	2.70E+03	–	–	–	2.70E+03	X
Subsurface Soil	6010B	Aluminum	mg/kg	148	148	100%	01-SS-T33-S01-D3.0	1.90E+05	1.36E+04	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.36E+04	
Subsurface Soil	6010B	Antimony	mg/kg	148	6	4%	01-SS-T33-S01-D3.0	1.03E+02	–	–	–	1.03E+02	X
Subsurface Soil	6010B	Arsenic	mg/kg	148	103	70%	01-SS-T33-S01-D3.0	1.24E+01	2.79E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	2.79E+00	
Subsurface Soil	6010B	Barium	mg/kg	148	148	100%	01-SS-T31-S01-D8.0	8.04E+02	9.14E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	9.14E+01	
Subsurface Soil	6010B	Beryllium	mg/kg	148	108	73%	01-SS-DP23-S02-D5.0	1.10E+00	1.27E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.10E+00	X
Subsurface Soil	6010B	Cadmium	mg/kg	148	90	61%	01-SS-T28-S01-D3.0	1.56E+02	8.86E+00	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	8.86E+00	
Subsurface Soil	6010B	Calcium	mg/kg	148	148	100%	01-SS-DP37-S02-D5.0	7.10E+04	8.72E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	8.72E+03	
Subsurface Soil	6010B	Chromium	mg/kg	148	148	100%	01-SS-T28-S01-D3.0	1.71E+02	1.16E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.16E+01	
Subsurface Soil	6010B	Cobalt	mg/kg	148	147	99%	01-SS-DP09-S01-D1.5	6.60E+00	4.06E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	4.06E+00	

Table G-4: Summary Statistics for Analytical Data from Subsurface Soil (0 feet –10 feet bgs) Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	FI
Subsurface Soil	6010B	Copper	mg/kg	148	133	90%	01-SS-T33-S01-D3.0	1.67E+04	8.39E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	8.39E+02	
Subsurface Soil	6010B	Iron	mg/kg	148	148	100%	01-SS-T29A-S01-D5.0	1.99E+04	5.94E+03	Lognormal	H-UCL	5.94E+03	
Subsurface Soil	6010B	Lead	mg/kg	148	147	99%	01-SS-T33-S01-D3.0	1.58E+03	9.34E+01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	9.34E+01	
Subsurface Soil	6010B	Magnesium	mg/kg	148	148	100%	01-SS-DP03-S02-D5.0	8.34E+03	2.72E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	2.72E+03	
Subsurface Soil	6010B	Manganese	mg/kg	148	147	99%	01-SS-DP26-S02-D5.0	7.11E+02	1.03E+02	Lognormal	H-UCL	1.03E+02	
Subsurface Soil	7471A	Mercury	mg/kg	148	122	82%	01HA09-SS01-D1.5	7.10E+00	4.95E-01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	4.95E-01	
Subsurface Soil	6010B	Nickel	mg/kg	148	146	99%	01-SS-T28-S01-D3.0	1.12E+02	1.24E+01	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.24E+01	
Subsurface Soil	6010B	Potassium	mg/kg	148	148	100%	01-SS-T34-S01-D2.0	7.94E+03	1.22E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.22E+03	
Subsurface Soil	6010B	Selenium	mg/kg	148	14	9%	01-SS-T33-S01-D3.0	4.70E+00	2.06E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	2.06E+00	
Subsurface Soil	6010B	Silver	mg/kg	148	3	2%	01-SS-T28-S01-D3.0	5.80E+00	–	–	–	5.80E+00	X
Subsurface Soil	6010B	Sodium	mg/kg	148	49	33%	01-SS-T34-S01-D2.0	8.76E+03	6.61E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	6.61E+02	
Subsurface Soil	6010B	Thallium	mg/kg	148	2	1%	01-SS-T33-S01-D3.0	1.52E+01	–	–	–	1.52E+01	X
Subsurface Soil	6010B	Vanadium	mg/kg	148	148	100%	01-SS-DP09-S01-D1.5	6.09E+01	1.44E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.44E+01	
Subsurface Soil	6010B	Zinc	mg/kg	148	148	100%	01-SS-T28-S01-D3.0	2.91E+04	1.51E+03	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.51E+03	

NOTES:
RME = reasonable maximum exposure
EPC = exposure point concentration
UCL = upper confidence limit
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
ng/g = nanogram per kilogram
% = percent
– = Not applicable. Mean, standard deviaion , distribution and UCL were not calculated for data sets with fewer than 11 detections.
Cross mark in the Flag column indicates that the RME EPC for that analyte is the maximum concentration.
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.
[c] Total 2,3,7,8-TCDD contribution was calculated using the toxicity equivalency procedure (EPA 2001) as illustrated in Table 7-4.

Table G-5 : Summary Statistics for Analytical Data from Groundwater Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	FI
Groundwater	8260B	Benzene	ug/L	19	1	5%	01-MW-202	4.00E-01	–	–	–	4.00E-01	X
Groundwater	8260B	cis-1,2-Dichloroethene	ug/L	19	2	11%	01-MW-202	1.00E+00	–	–	–	1.00E+00	X
Groundwater	8260B	Ethylbenzene	ug/L	19	3	16%	01-DGMW57	3.60E+00	–	–	–	3.60E+00	X
Groundwater	8260B	Methylene Chloride	ug/L	19	4	21%	01-MW-102	1.15E+02	–	–	–	1.15E+02	X
Groundwater	8260B	Toluene	ug/L	19	4	21%	01-MW-202	8.00E-01	–	–	–	8.00E-01	X
Groundwater	8260B	Trichloroethene (TCE)	ug/L	19	3	16%	01-DGMW57	2.70E+01	–	–	–	2.70E+01	X
Groundwater	8260B	Xylenes, Total	ug/L	19	3	16%	01-MW-202	4.90E+00	–	–	–	4.90E+00	X
Groundwater	8270C	Bis(2-ethylhexyl)phthalate	ug/L	16	1	6%	01-MW-102	2.70E+01	–	–	–	2.70E+01	X
Groundwater	8015B DRO	Motor Oils	mg/L	16	7	44%	01-MW-209	1.00E-01	–	–	–	1.00E-01	X
Groundwater	8015B DRO	PHC as Diesel Fuel	mg/L	16	6	38%	01-MW-203	2.00E-01	–	–	–	2.00E-01	X
Groundwater	8015B DRO	PHC as Gasoline	mg/L	16	3	19%	01-MW-210	4.00E-02	–	–	–	4.00E-02	X
Groundwater	6010B	Aluminum	ug/L	16	2	13%	18_BGMW24	1.02E+02	–	–	–	1.02E+02	X
Groundwater	6010B	Antimony	ug/L	16	1	6%	01-DGMW57	2.10E+00	–	–	–	2.10E+00	X
Groundwater	6010B	Arsenic	ug/L	16	8	50%	01-MW-203	4.40E+00	–	–	–	4.40E+00	X
Groundwater	6010B	Barium	ug/L	16	16	100%	01-MW-205	1.10E+02	5.39E+01	Gamma	Approximate Gamma	5.39E+01	
Groundwater	6010B	Beryllium	ug/L	16	1	6%	01-DGMW58	5.70E-01	–	–	–	5.70E-01	X
Groundwater	6010B	Cadmium	ug/L	16	2	13%	01-DGMW57	7.70E-01	–	–	–	7.70E-01	X
Groundwater	6010B	Calcium	ug/L	16	16	100%	01-MW-202	1.66E+05	1.03E+05	Normal	Student-t UCL	1.03E+05	
Groundwater	6010B	Chromium	ug/L	16	10	63%	01-MW-101	1.57E+02	–	–	–	1.57E+02	X
Groundwater	6010B	Cobalt	ug/L	16	2	13%	01-MW-102	5.95E+00	–	–	–	5.95E+00	X
Groundwater	6010B	Copper	ug/L	16	2	13%	01-DGMW57	1.70E+01	–	–	–	1.70E+01	X
Groundwater	6010B	Iron	ug/L	16	7	44%	01-MW-101	1.61E+03	–	–	–	1.61E+03	X
Groundwater	6010B	Lead	ug/L	16	4	25%	01-MW-210	9.20E+00	–	–	–	9.20E+00	X
Groundwater	6010B	Magnesium	ug/L	16	16	100%	18_BGMW24	3.88E+04	1.68E+04	Gamma	Approximate Gamma	1.68E+04	
Groundwater	6010B	Manganese	ug/L	16	10	63%	01-MW-209	2.60E+02	–	–	–	2.60E+02	X
Groundwater	6010B	Mercury	ug/L	16	16	100%	01-MW-102	5.00E-01	2.77E-01	Lognormal	H-UCL	2.77E-01	
Groundwater	6010B	Nickel	ug/L	16	7	44%	01-MW-102	1.28E+03	–	–	–	1.28E+03	X
Groundwater	6010B	Potassium	ug/L	16	16	100%	01-MW-209	5.10E+03	2.96E+03	Normal	Student-t UCL	2.96E+03	
Groundwater	6010B	Selenium	ug/L	16	6	38%	18_BGMW24	2.99E+01	–	–	–	2.99E+01	X
Groundwater	6010B	Silver	ug/L	16	2	13%	01-DGMW58	2.70E+00	–	–	–	2.70E+00	X
Groundwater	6010B	Sodium	ug/L	16	16	100%	01-MW-209	7.97E+01	5.99E+04	Normal	Student-t UCL	7.97E+01	X
Groundwater	6010B	Thallium	ug/L	16	2	13%	01-DGMW57	4.10E+00	–	–	–	4.10E+00	X
Groundwater	6010B	Vanadium	ug/L	16	9	56%	18_BGMW24	1.55E+01	–	–	–	1.55E+01	X
Groundwater	6010B	Zinc	ug/L	16	15	94%	01-MW-209	8.30E+01	2.59E+01	Gamma	Approximate Gamma	2.59E+01	
Groundwater	300.0	Nitrate as N	mg/L	16	16	100%	01-MW-203	2.01E+01	1.02E+01	Gamma	Approximate Gamma	1.02E+01	
Groundwater	E314	Perchlorate	ug/L	169	145	86%	01-PZ-07	4.60E+02	1.04E+02	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	1.04E+02	

NOTES:
RME = reasonable maximum exposure
EPC = exposure point concentration
UCL = upper confidence limit
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
% = percent

– = Not applicable. Mean, standard deviaion , distribution and UCL were not calculated for data sets with fewer than 11 detections.
Cross mark in the Flag column indicates that the RME EPC for that analyte is the maximum concentration.
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.

Table G-6 : Summary Statistics for Analytical Data from Sediment Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	Fl
Sediment	8260B	Toluene	ug/kg	19	2	11%	01-SS-HA15-S01-D0.5	8.00E-01	--	--	--	8.00E-01	X
Sediment	PAH-SIM	Pyrene	ug/kg	19	1	5%	01-SS-PSS12-S01-D0.0	2.00E+00	--	--	--	2.00E+00	X
Sediment	8015B DRO	PHC as Diesel Fuel	mg/kg	19	12	63%	01-SS-PSS12-S01-D0.0	6.00E+00	8.89E+00	Non-parametric	95% Chebyshev (Mean, Sd) UCL	6.00E+00	X
Sediment	8015B DRO	TEPH as Motor Oil	mg/kg	19	19	100%	01-SS-PSS12-S01-D0.0	1.50E+02	5.24E+01	Gamma	Approximate Gamma	5.24E+01	
Sediment	8015B GRO	Gasoline	mg/kg	19	1	5%	01-SS-PSS16-S01-D0.0	1.00E+00	--	--	--	1.00E+00	X
Sediment	6010B	Aluminum	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	1.69E+04	9.77E+03	Gamma	Approximate Gamma	9.77E+03	
Sediment	6010B	Arsenic	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	1.50E+00	9.22E-01	Gamma	Approximate Gamma	9.22E-01	
Sediment	6010B	Barium	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	8.17E+01	4.61E+01	Non-parametric	Student's-t UCL	4.61E+01	
Sediment	6010B	Beryllium	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	9.80E-01	3.87E-01	Gamma	Approximate Gamma	3.87E-01	
Sediment	6010B	Cadmium	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	3.40E-01	1.29E-01	Gamma	Approximate Gamma	1.29E-01	
Sediment	6010B	Calcium	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	1.65E+04	1.10E+04	Non-parametric	95% Chebyshev (Mean, Sd) UCL	1.10E+04	
Sediment	6010B	Chromium	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	7.10E+00	4.54E+00	Lognormal	Student's-t UCL	4.54E+00	
Sediment	6010B	Cobalt	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	2.70E+00	1.69E+00	Lognormal	Student's-t UCL	1.69E+00	
Sediment	6010B	Copper	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	6.40E+00	2.77E+00	Gamma	Approximate Gamma	2.77E+00	
Sediment	6010B	Iron	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	7.72E+03	4.83E+03	Gamma	Approximate Gamma	4.83E+03	
Sediment	6010B	Lead	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	1.21E+01	5.72E+00	Gamma	Approximate Gamma	5.72E+00	
Sediment	6010B	Magnesium	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	3.71E+03	2.00E+03	Lognormal	Student's-t UCL	2.00E+03	
Sediment	6010B	Manganese	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	1.21E+02	7.33E+01	Lognormal	Student's-t UCL	7.33E+01	
Sediment	7471A	Mercury	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	3.20E-01	1.10E-01	Gamma	Approximate Gamma	1.10E-01	
Sediment	6010B	Nickel	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	4.00E+00	2.35E+00	Non-parametric	Student's-t UCL	2.35E+00	
Sediment	6010B	Potassium	mg/kg	19	19	100%	01-SS-PSS12-S01-D0.0	1.17E+03	7.49E+02	Gamma	Approximate Gamma	7.49E+02	
Sediment	6010B	Selenium	mg/kg	19	1	5%	01-SS-HA16-S01-D0.5	1.90E-01	--	--	--	1.90E-01	X
Sediment	6010B	Sodium	mg/kg	19	7	37%	01-SS-HA17-S01-D0.5	5.32E+01	--	--	--	5.32E+01	X
Sediment	6010B	Vanadium	mg/kg	19	19	100%	01-SS-PSS03-S01-D0.0	1.44E+01	8.86E+00	Non-parametric	Student's-t UCL	8.86E+00	
Sediment	6010B	Zinc	mg/kg	19	19	100%	01-SS-HA17-S01-D0.5	1.96E+01	1.27E+01	Normal	Student's-t UCL	1.27E+01	

NOTES:
RME = reasonable maximum exposure
EPC = exposure point concentration
UCL = upper confidence limit
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
% = percent
-- = Not applicable. Mean, standard deviaion , distribution and UCL were not calculated for data sets with fewer than 11 detections.
Cross mark in the Flag column indicates that the RME EPC for that analyte is the maximum concentration.
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.

Table G-7 : Summary Statistics for Analytical Data from Surface Water Samples at Site 1

Site/Medium	Method	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Sample with Maximum Detected Concentration	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	RME	Fl
Surface Water	8015B DRO	Motor Oils	mg/L	3	3	100%	01-Pond LE524	9.00E-02	--	--	--	9.00E-02	X
Surface Water	8015B DRO	PHC as Diesel Fuel	mg/L	3	3	100%	01-Pond LE524	8.00E-02	--	--	--	8.00E-02	X
Surface Water	8015B DRO	PHC as Gasoline	mg/L	3	2	67%	01-Pond LE524	5.00E-02	--	--	--	5.00E-02	X
Surface Water	8260B	Acetone	ug/L	3	2	67%	01-Pond-Outfall LE619	6.00E+00	--	--	--	6.00E+00	X
Surface Water	8330	RDX	ug/L	3	1	33%	01-Stream LE622	1.00E+00	--	--	--	1.00E+00	X
Surface Water	6010B	Aluminum	ug/L	3	3	100%	01-Pond-Outfall LE619	3.74E+03	--	--	--	3.74E+03	X
Surface Water	6010B	Antimony	ug/L	3	1	33%	01-Stream LE622	4.70E+00	--	--	--	4.70E+00	X
Surface Water	6010B	Arsenic	ug/L	3	2	67%	01-Pond-Outfall LE619	1.20E+00	--	--	--	1.20E+00	X
Surface Water	6010B	Barium	ug/L	3	3	100%	01-Pond LE524	5.02E+01	--	--	--	5.02E+01	X
Surface Water	6010B	Beryllium	ug/L	3	2	67%	01-Pond-Outfall LE619	1.00E-01	--	--	--	1.00E-01	X
Surface Water	6010B	Cadmium	ug/L	3	1	33%	01-Pond LE524	2.40E-01	--	--	--	2.40E-01	X
Surface Water	6010B	Chromium	ug/L	3	3	100%	01-Pond LE524	7.90E+00	--	--	--	7.90E+00	X
Surface Water	6010B	Cobalt	ug/L	3	3	100%	01-Pond-Outfall LE619	1.10E+00	--	--	--	1.10E+00	X
Surface Water	6010B	Copper	ug/L	3	3	100%	01-Stream LE622	9.60E+00	--	--	--	9.60E+00	X
Surface Water	6010B	Iron	ug/L	3	3	100%	01-Pond LE524	1.89E+03	--	--	--	1.89E+03	X
Surface Water	6010B	Lead[i]	ug/L	3	3	100%	01-Pond LE524	3.10E+00	--	--	--	3.10E+00	X
Surface Water	6010B	Manganese	ug/L	3	3	100%	01-Pond LE524	2.64E+01	--	--	--	2.64E+01	X
Surface Water	7470A	Mercury[j]	ug/L	3	3	100%	01-Pond-Outfall LE619	8.90E-01	--	--	--	8.90E-01	X
Surface Water	6010B	Nickel	ug/L	3	3	100%	01-Pond LE524	4.10E+00	--	--	--	4.10E+00	X
Surface Water	6010B	Selenium	ug/L	3	3	100%	01-Pond-Outfall LE619	4.00E-01	--	--	--	4.00E-01	X
Surface Water	6010B	Vanadium	ug/L	3	3	100%	01-Pond LE524	6.10E+00	--	--	--	6.10E+00	X
Surface Water	6010B	Zinc	ug/L	3	3	100%	01-Pond LE524	2.08E+01	--	--	--	2.08E+01	X
Surface Water	300.00	Chloride	mg/L	3	3	100%	01-Pond-Outfall LE619	2.60E+00	--	--	--	2.60E+00	X
Surface Water	300.00	Fluoride	mg/L	3	3	100%	01-Stream LE622	7.50E-02	--	--	--	7.50E-02	X
Surface Water	300.00	Nitrate as N	mg/L	3	3	100%	01-Pond-Outfall LE619	3.60E-01	--	--	--	3.60E-01	X
Surface Water	300.00	Sulfate	mg/L	3	3	100%	01-Pond-Outfall LE619	1.80E+00	--	--	--	1.80E+00	X
Surface Water	6010B-Dissolved	Aluminum	ug/L	2	2	100%	01-Pond-Outfall LE620	1.31E+02	--	--	--	1.31E+02	X
Surface Water	6010B-Dissolved	Antimony	ug/L	2	1	50%	01-Stream LE623	3.40E+00	--	--	--	3.40E+00	X
Surface Water	6010B-Dissolved	Arsenic	ug/L	2	2	100%	01-Pond-Outfall LE620	1.10E+00	--	--	--	1.10E+00	X
Surface Water	6010B-Dissolved	Barium	ug/L	2	2	100%	01-Stream LE623	4.33E+01	--	--	--	4.33E+01	X
Surface Water	6010B-Dissolved	Beryllium	ug/L	2	1	50%	01-Pond-Outfall LE620	4.30E-02	--	--	--	4.30E-02	X
Surface Water	6010B-Dissolved	Chromium	ug/L	2	2	100%	01-Stream LE623	2.50E+00	--	--	--	2.50E+00	X
Surface Water	6010B-Dissolved	Cobalt	ug/L	2	2	100%	01-Pond-Outfall LE620	4.40E-01	--	--	--	4.40E-01	X
Surface Water	6010B-Dissolved	Copper	ug/L	2	2	100%	01-Stream LE623	8.10E+00	--	--	--	8.10E+00	X
Surface Water	6010B-Dissolved	Iron	ug/L	2	2	100%	01-Pond-Outfall LE620	8.13E+01	--	--	--	8.13E+01	X
Surface Water	6010B-Dissolved	Lead[i]	ug/L	2	2	100%	01-Stream LE623	5.90E-01	--	--	--	5.90E-01	X
Surface Water	6010B-Dissolved	Manganese	ug/L	2	2	100%	01-Pond-Outfall LE620	1.51E+01	--	--	--	1.51E+01	X
Surface Water	7470A-Dissolved	Mercury[j]	ug/L	2	2	100%	01-Stream LE623	5.60E-01	--	--	--	5.60E-01	X
Surface Water	6010B-Dissolved	Nickel	ug/L	2	2	100%	01-Stream LE623	3.00E+00	--	--	--	3.00E+00	X
Surface Water	6010B-Dissolved	Selenium	ug/L	2	1	50%	01-Pond-Outfall LE620	2.00E-01	--	--	--	2.00E-01	X
Surface Water	6010B-Dissolved	Vanadium	ug/L	2	2	100%	01-Pond-Outfall LE620	2.50E+00	--	--	--	2.50E+00	X
Surface Water	6010B-Dissolved	Zinc	ug/L	2	2	100%	01-Stream LE623	1.70E+01	--	--	--	1.70E+01	X

NOTES:
RME = reasonable maximum exposure
EPC = exposure point concentration
UCL = upper confidence limit
mg/L = milligrams per liter
ug/L = microgram per liter
% = percent
-- = Not applicable. Mean, standard devialon , distribution and UCL were not calculated for data sets with fewer than 11 detections.
Cross mark in the Flag column indicates that the RME EPC for that analyte is the maximum concentration.
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.

Table G-8. Quantification of 2,3,7,8-TCDD TEQ Concentration for Surface Soil (0 to 2 feet bgs) Samples at Site 1

				01-HA01 1 to 1.5 feet bgs LD110			01-HA09 1 to 1.5 feet bgs LD129			01-HA09 1 to 1.5 feet bgs (dup) LD130			01-HA14 1 to 1.5 feet bgs LD141		
Analyte	Analytical Method	Units	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	3.5 J	3.5	0.00035	11.1	11.1	0.00111	32.4	32.4	0.00324	1.5 U	0.75	0.000075
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	113	113	0.0113	297	297	0.0297	426	426	0.0426	1.8 U	0.9	0.00009
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	2.1 J	2.1	0.021	6.2	6.2	0.062	16.2	16.2	0.162	0.5 U	0.25	0.0025
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	8.5	8.5	0.085	14	14	0.14	34.5	34.5	0.345	0.8 U	0.4	0.004
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.4 U	0.2	0.002	0.7 U	0.35	0.0035	0.9 U	0.45	0.0045	0.7 U	0.35	0.0035
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.36 J	0.36	0.036	0.76 J	0.76	0.076	3.1 J	3.1	0.31	0.3 U	0.15	0.015
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.3 U	0.15	0.015	0.5 U	0.25	0.025	0.7 U	0.35	0.035	0.5 U	0.25	0.025
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.3 U	0.15	0.015	1.4 J	1.4	0.14	0.3 U	0.15	0.015
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.41 J	0.41	0.041	0.5 U	0.25	0.025	0.6 U	0.3	0.03	0.5 U	0.25	0.025
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.4 U	0.2	0.02	0.5 U	0.25	0.025	0.4 U	0.2	0.02
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.3 U	0.15	0.015	0.5 U	0.25	0.025	2.4 J	2.4	0.24	0.5 U	0.25	0.025
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.3 U	0.15	0.0075	0.4 U	0.2	0.01	0.4 U	0.2	0.01	0.3 U	0.15	0.0075
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.3 U	0.15	0.15	0.5 U	0.25	0.25	0.6 U	0.3	0.3	0.3 U	0.15	0.15
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.3 U	0.15	0.015	1.3 J	1.3	0.13	0.3 U	0.15	0.015
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.2 U	0.1	0.05	0.4 U	0.2	0.1	0.5 U	0.25	0.125	0.3 U	0.15	0.075
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.4 U	0.2	0.02	0.71 J	0.71	0.071	0.3 U	0.15	0.015
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.2 U	0.2	0.2	0.5 U	0.25	0.25	0.5 U	0.25	0.25	0.4 U	0.2	0.2
Heptachlorodibenzofurans	8290	ng/kg	NA	7.2	7.2	NA	18.6	18.6	NA	36.6	36.6	NA	0.6 U	0.3	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	15.1	15.1	NA	38	38	NA	119	119	NA	0.8 U	0.4	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	2.6	2.6	NA	9.5	9.5	NA	12.2	12.2	NA	0.3 U	0.15	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	1.7	1.7	NA	4.1	4.1	NA	10.9	10.9	NA	0.5 U	0.25	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.2 U	0.1	NA	0.75	0.75	NA	2	2	NA	0.3 U	0.15	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.3 U	0.15	NA	0.5 U	0.25	NA	0.6 U	0.3	NA	0.4 U	0.2	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.2 U	0.1	NA	0.4 U	0.2	NA	1.5	1.5	NA	0.3 U	0.15	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.2 U	0.1	NA	0.5 U	0.25	NA	0.5 U	0.25	NA	0.4 U	0.2	NA
Total 2,3,7,8-TCDD TEQ						**0.7**			**1.1**			**2.2**			**0.6**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-8. Quantification of 2,3,7,8-TCDD TEQ Concentration for Surface Soil (0 to 2 feet bgs) Sam

				01-DP02 1 to 1.5 feet bgs LE003			01-DP05 1 to 1.5 feet bgs LE009			01-DP05 1 to 1.5 feet bgs (dup) LE010			01-DP11 1 to 1.5 feet bgs LE025		
Analyte	Analytical Method	Units	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.905	0.905	0.0000905	0.179	0.179	0.0000179	2.42	2.42	0.000242	0.595 UJ	0.2975	0.00002975
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	18.5	18.5	0.00185	2.12	2.12	0.000212	30.5	30.5	0.00305	4.6 UJ	2.3	0.00023
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.454	0.454	0.00454	0.107	0.107	0.00107	0.816	0.816	0.00816	0.138 UJ	0.069	0.00069
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	2.3	2.3	0.023	0.423	0.423	0.00423	4.55	4.55	0.0455	0.556 UJ	0.278	0.00278
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.169	0.169	0.00169	0.0668	0.0668	0.000668	0.0937 U	0.04685	0.0004685	0.0477 U	0.02385	0.0002385
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.309	0.309	0.0309	0.0854	0.0854	0.00854	0.107 U	0.0535	0.00535	0.0472	0.0472	0.00472
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0751	0.0751	0.00751	0.0644	0.0644	0.00644	0.11 U	0.055	0.0055	0.0415 U	0.02075	0.002075
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.201	0.201	0.0201	0.0775	0.0775	0.00775	0.103 U	0.0515	0.00515	0.0472	0.0472	0.00472
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.143	0.143	0.0143	0.0678	0.0678	0.00678	0.254	0.254	0.0254	0.0438 U	0.0219	0.00219
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.11	0.11	0.011	0.057	0.057	0.0057	0.125 U	0.0625	0.00625	0.0368 U	0.0184	0.00184
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0711	0.0711	0.00711	0.061	0.061	0.0061	0.236	0.236	0.0236	0.0393 U	0.01965	0.001965
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.0783	0.0783	0.003915	0.0517	0.0517	0.002585	0.0566 U	0.0283	0.001415	0.0346	0.0346	0.00173
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0506	0.0506	0.0506	0.0483	0.0483	0.0483	0.135 U	0.0675	0.0675	0.0337 U	0.01685	0.01685
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.106	0.106	0.0106	0.0521	0.0521	0.00521	0.114 U	0.057	0.0057	0.0335 U	0.01675	0.001675
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.139	0.139	0.0695	0.0556	0.0556	0.0278	0.0818 UJ	0.0409	0.02045	0.0409 UJ	0.02045	0.010225
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.0622	0.0622	0.00622	0.0743	0.0743	0.00743	0.0838 U	0.0419	0.00419	0.0464 U	0.0232	0.00232
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0759	0.0759	0.0759	0.0884	0.0884	0.0884	0.114 U	0.057	0.057	0.0556 U	0.0278	0.0278
Heptachlorodibenzofurans	8290	ng/kg	NA	1.23	1.23	NA	0.195	0.195	NA	2.14	2.14	NA	0.305 UJ	0.1525	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	2.3	2.3	NA	0.761	0.761	NA	8.51	8.51	NA	0.946 UJ	0.473	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	0.851	0.851	NA	0.163	0.163	NA	0.778	0.778	NA	0.253	0.253	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.363	0.363	NA	0.474855	0.474855	NA	0.749	0.749	NA	0.313179 U	0.1565895	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.49	0.49	NA	0.173	0.173	NA	0.0818 UJ	0.0409	NA	0.153 UJ	0.0765	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.413583	0.413583	NA	0.399355	0.399355	NA	0.439832 U	0.21991	NA	0.299015 U	0.1495075	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.06525	0.06525	NA	0.074308	0.074308	NA	0.083767 U	0.0418835	NA	0.046426 U	0.023213	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.299145	0.299145	NA	0.278158	0.278158	NA	0.114489 U	0.0572445	NA	0.250228 U	0.125114	NA
Total 2,3,7,8-TCDD TEQ						**0.3**			**0.2**			**0.3**			**0.1**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-8. Quantification of 2,3,7,8-TCDD TEQ Concentration for Surface Soil (0 to 2 feet bgs) Sam

Analyte	Analytical Method	Units	TEF Value Human/Mammal	01-DP12 1 to 1.5 feet bgs LE027 Original Data	Transformed Data	TEF Value Human/Mammal	01-T05 0.5 feet bgs LE172 Original Data	Transformed Data	TEF Value Human/Mammal	01-T5S 0.5 feet bgs LE173 Original Data	Transformed Data	TEF Value Human/Mammal	01-T34 2 feet bgs LE181 Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0889 U	0.04445	0.000004445	4.6 J	4.6	0.00046	3.2 J	3.2	0.00032	2.37 J	2.37	0.000237
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	1.54 UJ	0.77	0.000077	31.4	31.4	0.00314	24	24	0.0024	98.3	98.3	0.00983
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.101	0.101	0.00101	8.19	8.19	0.0819	2.18 J	2.18	0.0218	2.33 J	2.33	0.0233
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.396 UJ	0.198	0.00198	4.66	4.66	0.0466	2.61 J	2.61	0.0261	14.4	14.4	0.144
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.0721 U	0.03605	0.0003605	0.528 J	0.528	0.00528	0.183 J	0.183	0.00183	0.183 J	0.183	0.00183
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0422 U	0.0211	0.00211	2.03 J	2.03	0.203	0.375 J	0.375	0.0375	0.481 J	0.481	0.0481
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0638 U	0.0319	0.00319	0.434 J	0.434	0.0434	0.269 U	0.1345	0.01345	2.31 J	2.31	0.231
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.044	0.044	0.0044	2.04 J	2.04	0.204	0.437 J	0.437	0.0437	0.365 J	0.365	0.0365
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0671 U	0.03355	0.003355	0.548 J	0.548	0.0548	0.248 J	0.248	0.0248	1.63 J	1.63	0.163
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0491 U	0.02455	0.002455	0.481	0.481	0.0481	0.149 J	0.149	0.0149	0.24 J	0.24	0.024
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0603 U	0.03015	0.003015	0.501 J	0.501	0.0501	0.161 J	0.161	0.0161	1.81 J	1.81	0.181
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.0403	0.0403	0.002015	1.24 J	1.24	0.062	0.267 J	0.267	0.01335	0.261 J	0.261	0.01305
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0436 U	0.0218	0.0218	0.449 J	0.449	0.449	0.269 U	0.1345	0.1345	1.19 J	1.19	1.19
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0447 U	0.02235	0.002235	2.11 J	2.11	0.211	0.556 J	0.556	0.0556	0.411 J	0.411	0.0411
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.0367 UJ	0.01835	0.009175	1.83 J	1.83	0.915	0.487 J	0.487	0.2435	0.462 J	0.462	0.231
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.0493 U	0.02465	0.002465	1.04	1.04	0.104	0.624	0.624	0.0624	0.536 J	0.536	0.0536
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0585 U	0.02925	0.02925	0.424 U	0.212	0.212	0.364 U	0.182	0.182	0.277 U	0.1385	0.1385
Heptachlorodibenzofurans	8290	ng/kg	NA	0.064917 U	0.0324585	NA	11.8	11.8	NA	3.45	3.45	NA	7.21	7.21	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.64 UJ	0.32	NA	13	13	NA	8.23	8.23	NA	61.5	61.5	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	0.044	0.044	NA	20.6	20.6	NA	4.18	4.18	NA	7.96	7.96	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.42178 U	0.21089	NA	4.68	4.68	NA	1.34	1.34	NA	45.6	45.6	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.077 UJ	0.0385	NA	29.2	29.2	NA	5.54	5.54	NA	4.06	4.06	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.379602 U	0.189801	NA	4.18	4.18	NA	0.902	0.902	NA	20.3	20.3	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.04933 U	0.024665	NA	39	39	NA	7.58	7.58	NA	3.78	3.78	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.306249 U	0.1531245	NA	1.6	1.6	NA	0.364097 U	0.1820485	NA	11.7	11.7	NA
Total 2,3,7,8-TCDD TEQ						**0.1**			**2.7**			**0.9**			**2.5**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-9. Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-10ft bgs) Samples at Site 1

Analyte	Analytical Method	Units	TEF Value Human/Mammal	01-HA01 1 to 1.5 feet bgs LD110 Original Data	Transformed Data	TEF Value Human/Mammal	01-HA09 1 to 1.5 feet bgs LD129 Original Data	Transformed Data	TEF Value Human/Mammal	01-HA09 1 to 1.5 feet bgs (dup) LD130 Original Data	Transformed Data	TEF Value Human/Mammal	01-HA14 1 to 1.5 feet bgs LD141 Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	3.5 J	3.5	0.00035	11.1	11.1	0.00111	32.4	32.4	0.00324	1.5 U	0.75	0.000075
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	113	113	0.0113	297	297	0.0297	426	426	0.0426	1.8 U	0.9	0.00009
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	2.1 J	2.1	0.021	6.2	6.2	0.062	16.2	16.2	0.162	0.5 U	0.25	0.0025
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	8.5	8.5	0.085	14	14	0.14	34.5	34.5	0.345	0.8 U	0.4	0.004
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.4 U	0.2	0.002	0.7 U	0.35	0.0035	0.9 U	0.45	0.0045	0.7 U	0.35	0.0035
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.36 J	0.36	0.036	0.76 J	0.76	0.076	3.1 J	3.1	0.31	0.3 U	0.15	0.015
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.3 U	0.15	0.015	0.5 U	0.25	0.025	0.7 U	0.35	0.035	0.5 U	0.25	0.025
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.3 U	0.15	0.015	1.4 J	1.4	0.14	0.3 U	0.15	0.015
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.41 J	0.41	0.041	0.5 U	0.25	0.025	0.6 U	0.3	0.03	0.5 U	0.25	0.025
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.4 U	0.2	0.02	0.5 U	0.25	0.025	0.4 U	0.2	0.02
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.3 U	0.15	0.015	0.5 U	0.25	0.025	2.4 J	2.4	0.24	0.5 U	0.25	0.025
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.3 U	0.15	0.0075	0.4 U	0.2	0.01	0.4 U	0.2	0.01	0.3 U	0.15	0.0075
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.3 U	0.15	0.15	0.5 U	0.25	0.25	0.6 U	0.3	0.3	0.3 U	0.15	0.15
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.3 U	0.15	0.015	1.3 J	1.3	0.13	0.3 U	0.15	0.015
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.2 U	0.1	0.05	0.4 U	0.2	0.1	0.5 U	0.25	0.125	0.3 U	0.15	0.075
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.2 U	0.1	0.01	0.4 U	0.2	0.02	0.71 J	0.71	0.071	0.3 U	0.15	0.015
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.2 U	0.2	0.2	0.5 U	0.25	0.25	0.5 U	0.25	0.25	0.4 U	0.2	0.2
Heptachlorodibenzofurans	8290	ng/kg	NA	7.2	7.2	NA	18.6	18.6	NA	36.6	36.6	NA	0.6 U	0.3	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	15.1	15.1	NA	38	38	NA	119	119	NA	0.8 U	0.4	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	2.6	2.6	NA	9.5	9.5	NA	12.2	12.2	NA	0.3 U	0.15	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	1.7	1.7	NA	4.1	4.1	NA	10.9	10.9	NA	0.5 U	0.25	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.2 U	0.1	NA	0.75	0.75	NA	2	2	NA	0.3 U	0.15	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.3 U	0.15	NA	0.5 U	0.25	NA	0.6 U	0.3	NA	0.4 U	0.2	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.2 U	0.1	NA	0.4 U	0.2	NA	1.5	1.5	NA	0.3 U	0.15	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.2 U	0.1	NA	0.5 U	0.25	NA	0.5 U	0.25	NA	0.4 U	0.2	NA
Total 2,3,7,8-TCDD TEQ						**0.7**			**1.1**			**2.2**			**0.6**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-9. Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-10ft bgs) Samples

				01-DP02 1 to 1.5 feet bgs LE003			01-DP05 1 to 1.5 feet bgs LE009			01-DP05 1 to 1.5 feet bgs (dup) LE010			01-DP11 1 to 1.5 feet bgs LE025		
Analyte	Analytical Method	Units	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.905	0.905	0.0000905	0.179	0.179	0.0000179	2.42	2.42	0.000242	0.595 UJ	0.2975	0.00002975
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	18.5	18.5	0.00185	2.12	2.12	0.000212	30.5	30.5	0.00305	4.6 UJ	2.3	0.00023
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.454	0.454	0.00454	0.107	0.107	0.00107	0.816	0.816	0.00816	0.138 UJ	0.069	0.00069
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	2.3	2.3	0.023	0.423	0.423	0.00423	4.55	4.55	0.0455	0.556 UJ	0.278	0.00278
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.169	0.169	0.00169	0.0668	0.0668	0.000668	0.0937 U	0.04685	0.0004685	0.0477 U	0.02385	0.0002385
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.309	0.309	0.0309	0.0854	0.0854	0.00854	0.107 U	0.0535	0.00535	0.0472	0.0472	0.00472
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0751	0.0751	0.00751	0.0644	0.0644	0.00644	0.11 U	0.055	0.0055	0.0415 U	0.02075	0.002075
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.201	0.201	0.0201	0.0775	0.0775	0.00775	0.103 U	0.0515	0.00515	0.0472	0.0472	0.00472
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.143	0.143	0.0143	0.0678	0.0678	0.00678	0.254	0.254	0.0254	0.0438 U	0.0219	0.00219
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.11	0.11	0.011	0.057	0.057	0.0057	0.125 U	0.0625	0.00625	0.0368 U	0.0184	0.00184
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0711	0.0711	0.00711	0.061	0.061	0.0061	0.236	0.236	0.0236	0.0393 U	0.01965	0.001965
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.0783	0.0783	0.003915	0.0517	0.0517	0.002585	0.0566 U	0.0283	0.001415	0.0346	0.0346	0.00173
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0506	0.0506	0.0506	0.0483	0.0483	0.0483	0.135 U	0.0675	0.0675	0.0337 U	0.01685	0.01685
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.106	0.106	0.0106	0.0521	0.0521	0.00521	0.114 U	0.057	0.0057	0.0335 U	0.01675	0.001675
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.139	0.139	0.0695	0.0556	0.0556	0.0278	0.0818 UJ	0.0409	0.02045	0.0409 UJ	0.02045	0.010225
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.0622	0.0622	0.00622	0.0743	0.0743	0.00743	0.0838 U	0.0419	0.00419	0.0464 U	0.0232	0.00232
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0759	0.0759	0.0759	0.0884	0.0884	0.0884	0.114 U	0.057	0.057	0.0556 U	0.0278	0.0278
Heptachlorodibenzofurans	8290	ng/kg	NA	1.23	1.23	NA	0.195	0.195	NA	2.14	2.14	NA	0.305 UJ	0.1525	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	2.3	2.3	NA	0.761	0.761	NA	8.51	8.51	NA	0.946 UJ	0.473	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	0.851	0.851	NA	0.163	0.163	NA	0.778	0.778	NA	0.253	0.253	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.363	0.363	NA	0.474855	0.474855	NA	0.749	0.749	NA	0.313179 U	0.1565895	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.49	0.49	NA	0.173	0.173	NA	0.0818 UJ	0.0409	NA	0.153 UJ	0.0765	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.413583	0.413583	NA	0.399355	0.399355	NA	0.439832 U	0.21991	NA	0.299015 U	0.1495075	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.06525	0.06525	NA	0.074308	0.074308	NA	0.083767 U	0.0418835	NA	0.046426 U	0.023213	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.299145	0.299145	NA	0.278158	0.278158	NA	0.114489 U	0.0572445	NA	0.250228 U	0.125114	NA
Total 2,3,7,8-TCDD TEQ						**0.3**			**0.2**			**0.3**			**0.1**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-9. Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-10ft bgs) Samples

				01-DP12 1 to 1.5 feet bgs LE027			01-T05 0.5 feet bgs LE172			01-T5S 0.5 feet bgs LE173			01-T34 2 feet bgs LE181		
Analyte	Analytical Method	Units	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0889 U	0.04445	0.000004445	4.6 J	4.6	0.00046	3.2 J	3.2	0.00032	2.37 J	2.37	0.000237
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	1.54 UJ	0.77	0.000077	31.4	31.4	0.00314	24	24	0.0024	98.3	98.3	0.00983
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.101	0.101	0.00101	8.19	8.19	0.0819	2.18 J	2.18	0.0218	2.33 J	2.33	0.0233
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.396 UJ	0.198	0.00198	4.66	4.66	0.0466	2.61 J	2.61	0.0261	14.4	14.4	0.144
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.0721 U	0.03605	0.0003605	0.528 J	0.528	0.00528	0.183 J	0.183	0.00183	0.183 J	0.183	0.00183
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0422 U	0.0211	0.00211	2.03 J	2.03	0.203	0.375 J	0.375	0.0375	0.481 J	0.481	0.0481
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0638 U	0.0319	0.00319	0.434 J	0.434	0.0434	0.269 U	0.1345	0.01345	2.31 J	2.31	0.231
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.044	0.044	0.0044	2.04 J	2.04	0.204	0.437 J	0.437	0.0437	0.365 J	0.365	0.0365
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0671 U	0.03355	0.003355	0.548 J	0.548	0.0548	0.248 J	0.248	0.0248	1.63 J	1.63	0.163
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0491 U	0.02455	0.002455	0.481	0.481	0.0481	0.149 J	0.149	0.0149	0.24 J	0.24	0.024
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.0603 U	0.03015	0.003015	0.501 J	0.501	0.0501	0.161 J	0.161	0.0161	1.81 J	1.81	0.181
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.0403	0.0403	0.002015	1.24 J	1.24	0.062	0.267 J	0.267	0.01335	0.261 J	0.261	0.01305
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0436 U	0.0218	0.0218	0.449 J	0.449	0.449	0.269 U	0.1345	0.1345	1.19 J	1.19	1.19
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.0447 U	0.02235	0.002235	2.11 J	2.11	0.211	0.556 J	0.556	0.0556	0.411 J	0.411	0.0411
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.0367 UJ	0.01835	0.009175	1.83 J	1.83	0.915	0.487 J	0.487	0.2435	0.462 J	0.462	0.231
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.0493 U	0.02465	0.002465	1.04	1.04	0.104	0.624	0.624	0.0624	0.536 J	0.536	0.0536
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.0585 U	0.02925	0.02925	0.424 U	0.212	0.212	0.364 U	0.182	0.182	0.277 U	0.1385	0.1385
Heptachlorodibenzofurans	8290	ng/kg	NA	0.064917 U	0.0324585	NA	11.8	11.8	NA	3.45	3.45	NA	7.21	7.21	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.64 UJ	0.32	NA	13	13	NA	8.23	8.23	NA	61.5	61.5	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	0.044	0.044	NA	20.6	20.6	NA	4.18	4.18	NA	7.96	7.96	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.42178 U	0.21089	NA	4.68	4.68	NA	1.34	1.34	NA	45.6	45.6	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.077 UJ	0.0385	NA	29.2	29.2	NA	5.54	5.54	NA	4.06	4.06	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.379602 U	0.189801	NA	4.18	4.18	NA	0.902	0.902	NA	20.3	20.3	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.04933 U	0.024665	NA	39	39	NA	7.58	7.58	NA	3.78	3.78	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.306249 U	0.1531245	NA	1.6	1.6	NA	0.364097 U	0.1820485	NA	11.7	11.7	NA
Total 2,3,7,8-TCDD TEQ						**0.1**			**2.7**			**0.9**			**2.5**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-9. Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-10ft bgs) Samples

				01-T23 3 feet bgs LE176			01-T33 3 feet bgs LE177			01-T34 6 feet bgs LE182			01-T34 10 feet bgs LE183		
Analyte	Analytical Method	Units	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mamma	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal	Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins															
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	4.15 J	4.15	0.000415	21.1	21.1	0.00211	0.525 U	0.2625	0.00002625	0.5 U	0.25	0.000025
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	90.5	90.5	0.00905	568	568	0.0568	4.27 UJ	2.135	0.0002135	5.37 UJ	2.685	0.0002685
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	5.09	5.09	0.0509	29.1	29.1	0.291	0.262 U	0.131	0.00131	0.154 UJ	0.077	0.00077
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	19.9	19.9	0.199	96.2	96.2	0.962	0.676 UJ	0.338	0.00338	0.963 UJ	0.4815	0.004815
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.522 J	0.522	0.00522	2.39 J	2.39	0.0239	0.262 U	0.131	0.00131	0.25 U	0.125	0.00125
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	1.53 J	1.53	0.153	9.91	9.91	0.991	0.262 U	0.131	0.0131	0.25 U	0.125	0.0125
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	1.01 J	1.01	0.101	4.87	4.87	0.487	0.398 U	0.199	0.0199	0.25 U	0.125	0.0125
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	1.47 J	1.47	0.147	8.22	8.22	0.822	0.262 U	0.131	0.0131	0.25 U	0.125	0.0125
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	1.92 J	1.92	0.192	9.4	9.4	0.94	0.32 U	0.16	0.016	0.152 J	0.076	0.0076
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.496 J	0.496	0.0496	2.88 J	2.88	0.288	0.262 U	0.131	0.0131	0.25 U	0.125	0.0125
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	1.78 J	1.78	0.178	8.53	8.53	0.853	0.335 U	0.1675	0.01675	0.146 J	0.146	0.0146
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.925 J	0.925	0.04625	7.7	7.7	0.385	0.262 U	0.131	0.00655	0.25 U	0.125	0.00625
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.904 J	0.904	0.904	5.69	5.69	5.69	0.262 U	0.131	0.131	0.25 U	0.125	0.125
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	2.11 J	2.11	0.211	13.5	13.5	1.35	0.262 U	0.131	0.0131	0.25 U	0.125	0.0125
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	1.85 J	1.85	0.925	13.7	13.7	6.85	0.262 U	0.131	0.0655	0.25 U	0.125	0.0625
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	1.34	1.34	0.134	11.5	11.5	1.15	0.233 J	0.1165	0.01165	0.166 J	0.166	0.0166
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.394 J	0.394	0.394	2.51	2.51	2.51	0.242 U	0.121	0.121	0.248 U	0.124	0.124
Heptachlorodibenzofurans	8290	ng/kg	NA	8.8	8.8	NA	47.3	47.3	NA	0.262417 U	0.1312085	NA	0.250248 U	0.125124	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	39.9	39.9	NA	176	176	NA	0.676 UJ	0.338	NA	2.53	2.53	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	16.8	16.8	NA	97.5	97.5	NA	0.262417 U	0.1312085	NA	0.250248 U	0.125124	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	23.3	23.3	NA	102	102	NA	0.34807 U	0.174035	NA	1.19	1.19	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	21.4	21.4	NA	148	148	NA	0.262417 U	0.1312085	NA	0.250248 U	0.125124	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	10.9	10.9	NA	54.4	54.4	NA	0.344291 U	0.1721455	NA	0.148	0.148	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	28.8	28.8	NA	249	249	NA	0.137087 U	0.0685435	NA	0.166	0.166	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	7.25	7.25	NA	43.4	43.4	NA	0.242053 U	0.1210265	NA	0.247646 U	0.123823	NA
Total 2,3,7,8-TCDD TEQ						**3.7**			**23.7**			**0.4**			**0.4**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-9. Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-10ft bgs) Samples

Analyte	Analytical Method	Units	TEF Value Human/Mammal	01-T34 10 feet bgs LE184 (dup) Original Data	Transformed Data	TEF Value Human/Mammal
Dioxins						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.471 J	0.471	0.0000471
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	3.08 UJ	1.54	0.000154
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.169 UJ	0.0845	0.000845
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.604 UJ	0.302	0.00302
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.274 U	0.137	0.00137
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.274 U	0.137	0.0137
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.274 U	0.137	0.00685
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.274 U	0.137	0.137
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.274 U	0.137	0.0137
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	0.274 U	0.137	0.0685
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	0.212 J	0.212	0.0212
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	0.216 U	0.108	0.108
Heptachlorodibenzofurans	8290	ng/kg	NA	0.267 UJ	0.1335	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	1.34 UJ	0.67	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	0.273768 U	0.136884	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.479641 U	0.2398205	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	0.273768 U	0.136884	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.273768 U	0.136884	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	0.156595 U	0.0782975	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	0.332902 U	0.166451	NA
Total 2,3,7,8-TCDD TEQ						**0.4**

Notes:

TEQ = Total Equivalents

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table G-10. RME and CTE Exposure Factors for Residential and Industrial Land Uses, Site 1, El Toro

		RME[a]					CTE				
		Soil			Groundwater		Soil			Groundwater	
		Residential		Industrial	Residential		Residential		Industrial	Residential	
Parameter	Definition	Adult	Child		Adult	Child	Adult	Child		Adult	Child
IngR(s)	Ingestion Rate of Soils (mg/d)	100	200	100			50[b]	100[b]	50[b]		
IngR(gw)	Ingestion Rate of Groundwater (L/d)				2.0	1.0				1[b]	0.5[b]
FI(s)	Fraction Ingestion from Source-soils(unitless)	1.0	1.0	1.0			0.5[d]	0.5[d]	0.5[d]	--	--
FI(gw)	Fraction Ingestion from Source-groundwater (unitless)				1.0	1.0				1[d]	1[d]
InhR	Inhalation Rate (m^3/hr)	0.83	0.42	0.83	0.63	0.40	0.63[c]	0.35[c]	0.63[c]	0.63[c]	0.4[c]
PEF	Particlate Emission Factor (m^3/kg)	1.32E+09	1.32E+09	1.32E+09	--	--	1.32E+09	1.32E+09	1.32E+09	--	--
VFw	Volatilization Factor-water (L/m^3)	--	--	--	0.5	0.5				0.5	0.5
SA	Exposed Surface Area (cm^2)	5,700	2,800	3,300	--	--	5700[f]	2800[f]	3300[f]	--	--
AF	Adherence Factor (mg/cm^2)	0.07	0.20	0.20	--	--	0.01[f]	0.04[f]	0.02[f]	--	--
ABS	Absorption Factor (unitless)	c-s	c-s	c-s	--	--	c-s	c-s	c-s	--	--
ET-soil	Exposure Time (hr/d)	24	24	24	--	--	16[d]	16[d]	4[d]	--	--
ET-gw	Exposure Time (hr/d)	--	--	--	24	24	--	--	--	0.125[f]	0.165[f]
EF	Exposure Frequency (d/yr)	350	350	250	350	350	252[h]	252[h]	219[f]	252[h]	252[h]
ED	Exposure Duration (yr)	24	6	25	24	6	9[b]	6[b]	6.6[b]	9[b]	6[b]
CF	Conversion Factor (kg/mg)	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06
BW	Body Weight (kg)	70	15	70	70	15	70[c]	15[c]	70[c]	70[c]	15[c]
AT	Averaging Time (d)										
	Noncarcinogenic	8,760	2,190	9,125	8,760	2,190	3,285	2,190[g]	2,409[g]	3,285[g]	2,409[g]
	Carcinogenic	25,550	5,475	25,550	25,550	25,550	25,550	25,550[g]	25,550[g]	25,550[g]	25,550[g]
TCR	Target Cancer Risk	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06
THQ	Target Hazard Quotient	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

References:

[a] RME exposure parameters are default Region 9 exposure parameters.

[b] Exposure Factors Handbook (EPA 1997a)

[c] Human Health Evaluation Manual, Supplemental Guidance:"Standard Default Values" (EPA 1991b)

[d] Professional judgement

[e] RAGS, Volume I Part B (EPA 1991a).

[f] RAGS, Volume I: HHEM (Part E, Supplemental Guidance for Dermal Risk Assessment)-Final (EPA 2004c).

[g] RAGS, Volume I, Part A (EPA 1989).

[h] CTE value for EF assumes two weeks and weekends away from the residence.

Table G-11: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Residential Receptor

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	83	2%	9.00E+00	–	9.00E+00	–	–	2.23E+07	–	2.9E+07 sat	–	–	–	No	–	–	–	No	4.03E-07	0%	–	–	–	No	–[d]	–
2-Hexanone	3	84	4%	4.40E+01	–	4.40E+01	–	–	1.1E+05 sat	–	1.1E+05 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[d]	–
4-Methyl-2-Pentanone	1	84	1%	2.00E+00	–	2.00E+00	–	–	4.1E+06 sat	–	4.1E+06 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[d]	–
Acetone	2	66	3%	1.70E+01	–	1.70E+01	–	–	1.41E+07	–	6.27E+07	8.00E+02	No	–	No	–	–	–	No	1.20E-08	0%	–	–	–	No	2.71E-07	0%
Benzene	1	84	1%	4.30E+02	–	4.30E+02	–	1.00E+03	3.29E+04	3.99E+03	9.40E+04	2.00E+00	Yes	No	No	No	4.30E-07	6%	No	1.31E-02	0%	No	1.08E-07	10%	No	4.57E-03	0%
Chloroform	5	84	6%	2.20E+00	–	2.20E+00	–	2.21E+02	5.42E+04	1.52E+03	1.70E+05	3.00E+01	No	No	No	No	9.96E-09	0%	No	4.06E-05	0%	No	1.45E-09	0%	No	1.29E-05	0%
Ethylbenzene	1	84	1%	1.40E+04	–	1.40E+04	–	–	4.0E+05 sat	–	4.0E+05 sat	7.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[d]	–
Toluene	10	84	12%	4.10E+04	–	4.10E+04	–	–	6.5E+05 sat	–	6.5E+05 sat	6.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[d]	–
Xylenes, Total	1	84	1%	9.80E+04	–	9.80E+04	–	–	2.71E+05	–	4.1E+05 sat	1.00E+04	Yes	–	No	–	–	–	No	3.62E-01	7%	–	–	–	No	–[d]	–
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	1	72	1%	2.70E+05	–	2.70E+05	–	–	1.69E+05	–	7.35E+05	–	–	–	Yes	–	–	–	Yes	1.59E+00	30%	–	–	–	No	3.67E-01	26%
Bis(2-ethylhexyl) Phthalate	3	71	4%	4.20E+02	–	4.20E+02	–	3.47E+04	1.22E+06	2.81E+05	7.10E+06	–	–	No	No	No	1.21E-08	0%	No	3.44E-04	0%	No	1.50E-09	0%	No	5.92E-05	0%
Diethyl Phthalate	2	72	3%	1.10E+02	–	1.10E+02	–	–	4.89E+07	–	1E+08 Max	–	–	–	No	–	–	–	No	2.25E-06	0%	–	–	–	No	–[d]	–
Di-n-butyl Phthalate	8	72	11%	3.07E+05	–	3.07E+05	–	–	6.11E+08	–	3.55E+07	2.70E+05	Yes	–	No	–	–	–	No	5.02E-02	1%	–	–	–	No	8.65E-03	1%
Fluoranthene	1	72	1%	3.80E+01	–	3.80E+01	–	–	2.29E+08	–	1.35E+07	2.10E+05	No	–	No	–	–	–	No	1.66E-05	0%	–	–	–	No	2.82E-06	0%
Naphthalene	1	72	1%	1.28E+05	–	1.28E+05	–	–	5.59E+04	–	1.41E+05	4.00E+03	Yes	–	Yes	–	–	–	Yes	2.29E+00	42%	–	–	–	No	9.08E-01	64%
n-Nitrosodiphenylamine	5	72	7%	6.67E+04	–	6.67E+04	–	9.93E+04	1.22E+06	8.02E+05	7.10E+06	8.00E+01	Yes	No	No	No	6.72E-07	9%	No	5.46E-02	1%	No	8.32E-08	8%	No	9.39E-03	1%
Phenol	7	72	10%	8.68E+02	–	8.68E+02	–	–	1.83E+07	–	1E+08 Max	5.00E+03	No	–	No	–	–	–	No	4.74E-05	0%	–	–	–	No	–[d]	–
Explosives (ug/kg) by Method 8330																											
2,4-Dinitrotoluene	5	76	7%	7.00E+03	–	7.00E+03	–	–	1.22E+05	–	7.10E+05	4.00E-02	Yes	–	No	–	–	–	No	5.73E-02	1%	–	–	–	No	9.86E-03	1%
2,6-Dinitrotoluene	1	74	1%	4.40E+01	–	4.40E+01	–	–	6.11E+04	–	3.55E+05	3.00E-02	Yes	–	No	–	–	–	No	7.20E-04	0%	–	–	–	No	1.24E-04	0%
2,4,6-Trinitrotoluene	1	73	1%	2.78E+02	–	2.78E+02	–	1.62E+04	3.06E+04	1.31E+05	1.77E+05	–	–	No	No	No	1.71E-08	0%	No	9.10E-03	0%	No	2.12E-09	0%	No	1.57E-03	0%
RDX	3	73	4%	2.20E+03	–	2.20E+03	–	4.42E+03	1.83E+05	3.57E+04	1.07E+06	–	–	No	No	No	4.98E-07	6%	No	1.20E-02	0%	No	6.16E-08	6%	No	2.07E-03	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	24	53	45%	3.90E+01	2.53E+02	3.90E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	10	53	19%	3.70E+04	–	3.70E+04	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Gasoline	5	70	7%	1.60E+03	–	1.60E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	17	17	100%	5.90E+01	2.72E+01	2.72E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	9	17	53%	2.70E+01	–	2.70E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																											
Perchlorate	11	86	13%	6.60E-01	–	6.60E-01	–	–	7.82E+00	–	4.34E+01	–	–	–	No	–	–	–	No	8.44E-02	2%	–	–	–	No	1.52E-02	1%
Nitrate as N	52	52	100%	1.09E+01	2.38E+00	2.38E+00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dioxins/Furans (ug/kg) by Method 8290																											
Total 2,3,7,8-TCDD TEQ	10	10	100%	2.70E-03	–	2.70E-03	–	3.90E-03	–	3.01E-02	–	–	–	No	–	No	6.93E-07	9%	–	–	–	No	8.96E-08	8%	–	–	–
Metals (mg/kg) by Method 6010B																											
Aluminum	72	72	100%	1.28E+04	8.22E+03	6.22E+03	1.48E+04	–	7.61E+04	–	1E+05 max	–	–	–	No	–	–	–	No	8.16E-02	2%	–	–	–	No	–[d]	–
Arsenic	52	72	72%	6.60E+00	2.12E+00	2.12E+00	8.86E+00	3.9E-01	2.16E+01	3.0E+00	1.22E+02	1.00E+00	Yes	Yes	No	Yes	5.44E-06	70%	No	9.78E-02	2%	No	7.06E-07	67%	No	1.74E-02	1%
Barium	72	72	100%	1.70E+02	6.02E+01	6.02E+01	1.73E+02	–	5.37E+03	–	7.77E+04	8.20E+01	Yes	–	No	–	–	–	No	1.12E-02	0%	–	–	–	No	7.75E-04	0%
Beryllium	54	72	75%	9.90E-01	5.55E-01	5.55E-01	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	5.27E-10	0%	No	3.59E-03	0%	No	9.33E-11	0%	No	6.57E-04	0%
Cadmium	49	72	68%	3.17E+01	3.98E+00	3.98E+00	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	Yes	No	No	No	2.84E-09	0%	No	1.08E-01	2%	No	5.03E-10	0%	No	1.84E-02	1%
Calcium	72	72	100%	3.46E+04	9.69E+03	9.69E+03	4.60E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	72	72	100%	2.22E+01	5.78E+00	5.78E+00	2.69E+01	2.1E+02	–	1.2E+03	–	2.00E+00	Yes	No	–	No	2.74E-08	0%	–	–	–	No	4.86E-09	0%	–	–	–
Cobalt	72	72	100%	6.60E+00	2.22E+00	2.22E+00	6.98E+00	9.0E+02	1.38E+03	5.1E+03	6.69E+03	–	–	No	No	No	2.46E-09	0%	No	1.61E-03	0%	No	4.36E-10	0%	No	3.32E-04	0%
Copper	70	72	97%	3.75E+02	4.54E+01	4.54E+01	6.41E+00	–	3.13E+03	–	1.74E+04	–	–	–	No	–	–	–	No	1.45E-02	0%	–	–	–	No	2.61E-03	0%
Iron	72	72	100%	1.45E+04	5.56E+03	5.56E+03	1.84E+04	–	2.35E+04	–	1.0E5 Max	–	–	–	No	–	–	–	No	2.37E-01	4%	–	–	–	No	–[d]	–
Lead[k]	72	72	100%	8.85E+01	1.65E+01	1.65E+01	1.51E+01	–	4.00E+02	–	4.00E+02	–	–	–	No	–	–	–	No	–[k]	–[k]	–	–	–	No	–[k]	–[k]
Magnesium	72	72	100%	6.55E+03	2.83E+03	2.83E+03	8.37E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	71	72	99%	2.28E+02	9.62E+01	9.62E+01	2.91E+02	–	1.76E+03	–	9.13E+03	–	–	–	No	–	–	–	No	5.46E-02	1%	–	–	–	No	1.05E-02	1%
Mercury[l]	63	72	88%	7.10E+00	8.64E-01	8.64E-01	2.20E-01	–	2.35E+01	–	1.30E+02	–	–	–	No	–	–	–	No	3.68E-02	1%	–	–	–	No	6.63E-03	0%
Nickel	72	72	100%	2.63E+01	6.76E+00	6.76E+00	1.53E+01	–	1.56E+03	–	8.69E+03	7.00E+00	Yes	–	No	–	–	–	No	4.32E-03	0%	–	–	–	No	7.78E-04	0%
Potassium	72	72	100%	7.94E+03	1.05E+03	1.05E+03	4.89E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	5	72	7%	1.40E+00	–	1.40E+00	3.20E-01	–	3.91E+02	–	2.17E+03	3.00E-01	Yes	–	No	–	–	–	No	3.58E-03	0%	–	–	–	No	6.44E-04	0%
Sodium	18	72	25%	8.76E+03	1.02E+03	1.02E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vanadium	72	72	100%	6.09E+01	1.60E+01	1.60E+01	7.18E+01	–	7.82E+01	–	4.25E+02	3.00E+02	No	–	No	–	–	–	No	2.04E-01	4%	–	–	–	No	3.76E-02	3%
Zinc	72	72	100%	1.53E+03	2.13E+02	2.13E+02	7.79E+01	–	2.35E+04	–	1.0E5 Max	6.20E+02	Yes	–	No	–	–	–	No	9.10E-03	0%	–	–	–	No	–[d]	–
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	8E-06			5E+00			1E-06			1E+00	

Table G-11: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Residential Receptor

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation				
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic	
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	8E-06			5E+00			1E-06			1E+00	

--	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-9).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

Table G-12: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Residential Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG[e]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG[e]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[h]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	174	1%	9.00E+00	–	9.00E+00	–	–	2.23E+07	–	2.9E+07 sat	–	–	–	No	–	–	–	No	4.03E-07	0%	–	–	–	No	–[j]	–
2-Hexanone	7	175	4%	5.00E+01	–	5.00E+01	–	–	1.1E+05 sat	–	1.1E+05 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
4-Methyl-2-Pentanone	1	175	1%	2.00E+00	–	2.00E+00	–	–	4.1E+06 sat	–	4.1E+06 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Acetone	5	138	4%	8.70E+03	–	8.70E+03	–	–	1.41E+07	–	6.27E+07	8.00E+02	Yes	–	No	–	–	–	No	6.16E-04	0%	–	–	–	No	1.39E-04	0%
Benzene	3	175	2%	6.10E+02	–	6.10E+02	–	1.00E+03	3.29E+04	3.99E+03	9.40E+04	2.00E+00	Yes	No	No	No	6.10E-07	4%	No	1.85E-02	0%	No	1.53E-07	8%	No	6.49E-03	0%
Chloroform	11	175	6%	2.20E+00	4.06E+02	2.20E+00	–	2.20E+02	5.42E+04	1.52E+03	1.70E+05	3.00E+01	No	No	No	No	1.00E-08	0%	No	4.06E-05	0%	No	1.45E-09	0%	No	1.29E-05	0%
Ethylbenzene	5	174	3%	1.40E+04	–	1.40E+04	–	–	4.0E+05 sat	–	4.0E+05 sat	7.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Tetrachloroethylene (PCE)	1	175	1%	2.00E+00	–	2.00E+00	–	4.84E+02	3.80E+04	3.57E+03	1.24E+05	3.00E+00	No	No	No	No	4.14E-09	0%	No	5.27E-05	0%	No	5.60E-10	0%	No	1.61E-05	0%
Toluene	26	175	15%	4.10E+04	1.76E+03	1.76E+03	–	–	6.5E+05 sat	–	6.5E+05 sat	6.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Xylenes, Total	6	175	3%	9.80E+04	–	9.80E+04	–	–	2.71E+05	–	4.1E+05 sat	1.00E+04	Yes	–	No	–	–	–	No	3.62E-01	3%	–	–	–	No	–[j]	–
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	6	148	4%	2.70E+05	–	2.70E+05	–	–	1.69E+05	–	7.35E+05	–	–	–	Yes	–	–	–	Yes	1.59E+00	13%	–	–	–	No	3.67E-01	14%
Bis(2-ethylhexyl) Phthalate	6	148	4%	4.20E+02	–	4.20E+02	–	3.77E+04	1.22E+06	2.81E+05	7.10E+06	–	–	No	No	No	1.11E-08	0%	No	3.44E-04	0%	No	1.50E-09	0%	No	5.92E-05	0%
Diethyl Phthalate	4	148	3%	2.50E+02	–	2.50E+02	–	–	4.89E+07	–	1E8 Max	–	–	–	No	–	–	–	No	5.11E-06	0%	–	–	–	No	–[j]	–
Di-n-butyl Phthalate	12	148	8%	3.07E+05	2.15E+04	2.15E+04	–	–	6.11E+06	–	3.55E+07	2.70E+05	Yes	–	No	–	–	–	No	3.52E-03	0%	–	–	–	No	6.06E-04	0%
Fluoranthene	1	148	1%	3.80E+01	–	3.80E+01	–	–	2.29E+06	–	1.35E+07	2.10E+05	No	–	No	–	–	–	No	1.66E-05	0%	–	–	–	No	2.82E-06	0%
Hexachlorobenzene	1	148	1%	2.20E+02	–	2.20E+02	–	3.30E+02	4.89E+04	2.46E+03	2.84E+05	1.00E+02	Yes	No	No	No	6.67E-07	5%	No	4.50E-03	0%	No	8.94E-08	5%	No	7.75E-04	0%
Naphthalene	6	148	4%	1.28E+05	–	1.28E+05	–	–	5.59E+04	–	1.41E+05	4.00E+03	Yes	–	Yes	–	–	–	Yes	2.29E+00	18%	–	–	–	No	9.08E-01	34%
n-Nitrosodiphenylamine	6	148	4%	6.67E+04	–	6.67E+04	–	9.93E+04	1.22E+06	8.02E+05	7.10E+06	6.00E+01	Yes	No	No	No	6.72E-07	5%	No	5.46E-02	0%	No	8.32E-08	4%	No	9.39E-03	0%
Phenol	15	148	10%	1.20E+03	7.31E+03	1.20E+03	–	–	1.83E+07	–	1.0E8 max	5.00E+03	No	–	No	–	–	–	No	6.56E-05	0%	–	–	–	No	–[j]	–
Explosives (ug/kg) by Method 8330																											
2-Amino-4,6-dinitrotoluene	1	149	1%	3.10E+02	–	3.10E+02	–	–	1.22E+04	–	4.97E+06	–	–	–	No	–	–	–	No	2.54E-02	0%	–	–	–	No	6.24E-05	0%
4-Amino-2,6-dinitrotoluene	1	149	1%	2.28E+02	–	2.28E+02	–	–	1.22E+04	–	3.55E+06	–	–	–	No	–	–	–	No	1.87E-02	0%	–	–	–	No	6.42E-05	0%
1,3-Dinitrobenzene	1	149	1%	6.30E+02	–	6.30E+02	–	–	6.11E+03	–	3.55E+04	–	–	–	No	–	–	–	No	1.03E-01	1%	–	–	–	No	1.77E-02	1%
2,4-Dinitrotoluene	6	152	4%	7.00E+03	–	7.00E+03	–	–	1.22E+05	–	7.10E+05	4.00E-02	Yes	–	No	–	–	–	No	5.73E-02	0%	–	–	–	No	9.86E-03	0%
2,6-Dinitrotoluene	1	150	1%	4.40E+01	–	4.40E+01	–	–	6.11E+04	–	3.55E+05	3.00E-02	Yes	–	No	–	–	–	No	7.20E-04	0%	–	–	–	No	1.24E-04	0%
2,4,6-Trinitrotoluene	3	149	2%	7.86E+03	–	7.86E+03	–	1.62E+04	3.06E+04	1.31E+05	1.77E+05	–	–	No	No	No	4.85E-07	3%	No	2.57E-01	2%	No	6.00E-08	3%	No	4.44E-02	2%
HMX	1	148	1%	1.40E+03	–	1.40E+03	–	–	3.06E+06	–	1.77E+07	–	–	–	No	–	–	–	No	4.58E-04	0%	–	–	–	No	7.89E-05	0%
RDX	6	149	4%	1.40E+04	–	1.40E+04	–	4.42E+03	1.83E+05	3.57E+04	1.07E+06	–	–	Yes	No	Yes	3.17E-06	22%	No	7.64E-02	1%	No	3.92E-07	20%	No	1.31E-02	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	40	112	36%	6.90E+01	2.23E+02	6.90E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	23	112	21%	3.70E+04	2.90E+03	2.90E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Gasoline	11	143	8%	1.60E+03	–	1.60E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	29	31	94%	5.90E+01	1.67E+01	1.67E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	12	31	39%	2.70E+01	1.33E+01	1.33E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																											
Perchlorate	14	170	8%	1.60E+00	8.62E-02	8.62E-02	–	–	7.82E+00	–	4.34E+01	–	–	–	No	–	–	–	No	1.10E-02	0%	–	–	–	No	1.99E-03	0%
Nitrate as N	105	105	100%	5.27E+01	4.37E+00	4.37E+00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dioxins/Furans (ug/kg) by Method 8290																											
Total 2,3,7,8-TCDD TEQ	14	14	100%	2.37E-02	6.08E-03	6.08E-03	–	3.90E-03	–	3.01E-02	–	–	–	Yes	–	Yes	1.56E-06	11%	–	–	–	No	2.02E-07	11%	–	–	–
Metals (mg/kg) by Method 6010B																											
Aluminum	148	148	100%	1.90E+05	1.36E+04	1.36E+04	1.48E+04	–	7.81E+04	–	1E+05 max	–	–	–	Yes	–	–	–	No	1.79E-01	1%	–	–	–	No	–[j]	–
Antimony	6	148	4%	1.03E+02	–	1.03E+02	3.06E+00	–	3.13E+01	–	1.74E+02	3.00E+02	No	–	Yes	–	–	–	Yes	3.29E+00	26%	–	–	–	No	5.93E-01	22%
Arsenic	103	148	70%	1.24E+01	2.79E+00	2.79E+00	8.86E+00	3.90E-01	2.16E+01	3.0E+00	1.22E+02	1.00E+00	Yes	Yes	No	Yes	7.15E-06	50%	No	1.29E-01	1%	No	9.30E-07	48%	No	2.28E-02	1%
Barium	148	148	100%	8.04E+02	9.14E+01	9.14E+01	1.73E+02	–	5.37E+03	–	7.77E+04	8.20E+01	Yes	–	No	–	–	–	No	1.70E-02	0%	–	–	–	No	1.18E-03	0%
Beryllium	108	148	73%	1.10E+00	1.27E+00	1.10E+00	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	1.04E-09	0%	No	7.13E-03	0%	No	1.85E-10	0%	No	1.30E-03	0%
Cadmium	90	148	61%	1.56E+02	8.86E+00	8.86E+00	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	Yes	No	Yes	No	6.31E-09	0%	No	2.39E-01	2%	No	1.12E-09	0%	No	4.09E-02	2%
Calcium	148	148	100%	7.10E+04	8.72E+03	8.72E+03	4.60E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	148	148	100%	1.71E+02	1.16E+01	1.16E+01	2.69E+01	2.1E+02	–	1.2E+03	–	2.00E+00	Yes	No	–	No	5.51E-08	0%	–	–	–	No	9.76E-09	1%	–	–	–
Cobalt	147	148	99%	6.60E+00	4.06E+00	4.06E+00	6.98E+00	1.2E+04	1.38E+03	5.1E+03	6.69E+03	–	–	No	No	No	3.46E-10	0%	No	2.94E-03	0%	No	7.97E-10	0%	No	6.07E-04	0%
Copper	133	148	90%	1.67E+04	8.39E+02	8.39E+02	6.41E+00	–	3.13E+03	–	1.74E+04	–	–	–	Yes	–	–	–	No	2.68E-01	2%	–	–	–	No	4.83E-02	2%
Iron	148	148	100%	1.99E+04	5.94E+03	5.94E+03	1.84E+04	–	2.35E+04	–	1.0E5 Max	–	–	–	No	–	–	–	No	2.53E-01	2%	–	–	–	No	–[j]	–
Lead[m]	147	148	99%	1.58E+03	9.34E+01	9.34E+01	1.51E+01	–	4.00E+02	–	4.00E+02	–	–	–	Yes	–	–[k]	–[k]	No	–[k]	–[k]	–	–[k]	–[k]	No	–[k]	–[k]
Magnesium	148	148	100%	8.34E+03	2.72E+03	2.72E+03	8.37E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	147	148	99%	7.11E+02	1.03E+02	1.03E+02	2.91E+02	–	1.76E+03	–	9.13E+03	–	–	–	No	–	–	–	No	5.84E-02	0%	–	–	–	No	1.13E-02	0%
Mercury[l]	122	148	82%	7.10E+00	4.95E-01	4.95E-01	2.20E-01	–	2.35E+01	–	1.30E+02	–	–	–	No	–	–	–	No	2.11E-02	0%	–	–	–	No	3.80E-03	0%

Table G-12: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Residential Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[h]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Nickel	148	148	99%	1.12E+02	1.24E+01	1.24E+01	1.53E+01	–	1.56E+03	–	8.69E+03	7.00E+00	Yes	–	No	–	–	–	No	7.93E-03	0%	–	–	–	No	1.43E-03	0%
Potassium	148	148	100%	7.94E+03	1.22E+03	1.22E+03	4.89E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	14	148	9%	4.70E+00	2.06E+00	2.06E+00	3.20E-01	–	3.91E+02	–	2.17E+03	3.00E-01	Yes	–	No	–	–	–	No	5.27E-03	0%	–	–	–	No	9.48E-04	0%
Silver	3	148	2%	5.80E+00	–	5.80E+00	5.39E-01	–	3.91E+02	–	2.17E+03	2.00E+00	Yes	–	No	–	–	–	No	1.48E-02	0%	–	–	–	No	2.67E-03	0%
Sodium	49	148	33%	8.76E+03	6.61E+02	6.61E+02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thallium	2	148	1%	1.52E+01	–	1.52E+01		–	5.16E+00	–	2.87E+01	–	–	–	Yes	–	–	–	Yes	2.94E+00	23%	–	–	–	No	5.30E-01	20%
Vanadium	148	148	100%	6.09E+01	1.44E+01	1.44E+01	7.18E+01	–	7.82E+01	–	4.25E+02	3.00E+02	No	–	No	–	–	–	No	1.84E-01	1%	–	–	–	No	3.39E-02	1%
Zinc	148	148	100%	2.91E+04	1.51E+03	1.51E+03	7.79E+01	–	2.35E+04	–	1.0E5 Max	6.20E+02	Yes	–	Yes	–	–	–	No	6.44E-02	1%	–	–	–	No	–[m]	–
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	1E-05			1E+01			2E-06			3E+00	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	1E-05			1E+01			2E-06			3E+00	

–	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-10).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 400 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-13: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Residential Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Acetone	5	138	4%	8.70E+00	8.70E+00	3.7E-02	–	3.30E+00	–	2.04E+01	–	No	–	–	–	No	1.12E-02	0%	–	–	–	No	1.82E-03	0%
Benzene	3	175	2%	6.10E-01	6.10E-01	4.7E-03	2.50E-04	–	1.05E-03	–	Yes	–	Yes	1.88E-05	89%	–	–	–	Yes	4.48E-06	89%	–	–	–
2-Butanone	2	174	1%	9.00E-03	9.00E-03	4.3E-05	–	5.10E+00	–	3.15E+01	–	No	–	–	–	No	8.43E-06		–	–	–	No	1.37E-06	0%
Chloroform	11	175	6%	2.20E-03	2.20E-03	2.3E-05	8.30E-05	–	3.49E-04	–	No	–	No	2.77E-07	1%	–	–	–	No	6.60E-08	1%	–	–	–
Ethylbenzene	5	174	3%	1.40E+01	1.40E+01	1.2E-01	–	1.10E+00	–	6.79E+00	–	No	–	–	–	No	1.09E-01	0%	–	–	–	No	1.77E-02	0%
Hexachlorobenzene	1	148	1%	2.20E-01	2.20E-01	7.4E-06	4.20E-06	–	1.76E-05	–	Yes	–	Yes	1.76E-06	8%	–	–		No	4.20E-07	8%	–	–	–
2-Methylnaphthalene	6	148	4%	2.70E+02	2.70E+02	7.3E-02	–	7.00E-01	–	4.32E+00	–	No	–	–	–	No	1.04E-01	0%	–	–	–	No	1.69E-02	0%
4-Methyl-2-pentanone	1	175	1%	2.00E-03	2.00E-03	1.6E-05	–	3.10E+00	–	1.91E+01	–	No	–	–	–	No	5.16E-06		–	–	–	No	8.37E-07	0%
Naphthalene	6	148	4%	1.30E+02	1.30E+02	4.9E-02	–	3.10E-03	–	1.91E-02	–	Yes	–	–	–	Yes	1.58E+01	66%	–	–	–	Yes	2.56E+00	66%
Tetrachloroethene	1	175	1%	2.00E-03	2.00E-03	8.0E-05	3.20E-04	–	1.34E-03	–	No	–	No	2.50E-07	1%	–	–		No	5.95E-08	1%	–	–	–
Toluene	26	175	15%	–	1.80E+00	1.6E-02	–	4.00E-01	–	2.47E+00	–	No	–	–	–	No	4.00E-02	0%	–	–	–	No	6.48E-03	0%
Xylenes, Total	6	175	3%	9.80E+01	9.80E+01	8.6E-01	–	1.10E-01	–	6.79E-01	–	Yes	–	–	–	Yes	7.82E+00	33%	–	–	–	Yes	1.27E+00	33%
					Cumulative Incremental Lifetime Cancer Risk/Hazard Index:									2E-05			2E+01			5E-06			4E+00	

–	= no data or not applicable
%	= percent
ca	= carcinogenic
CTE	= central tendency exposure
nc	= noncarcinogenic
mg/m^3	= milligrams per kilogram
HI	= hazard index
PRG	= preliminary remediation goal
RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[g] HQ = EPC / CTE Noncarcinogic PRG

Table G-14: Risk-Based Screening of Sediment for (Current/Future) Residential Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
Toluene	2	19	11%	8.00E-01	--	8.00E-01	--	--	6.5E+05 sat	--	6.5E+05 sat	6.00E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Semivolatile Organic Chemicals (ug/kg) by Method 8270C-SIM																											
Pyrene	1	19	5%	2.00E+00	--	2.00E+00	--	--	2.35E+06	--	1.30E+07		Yes	--	No	--	--	--	No	8.52E-07	0%	--	--	--	No	1.53E-07	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	19	19	100%	1.50E+02	5.24E+01	5.24E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	12	19	63%	6.00E+00	8.89E+00	6.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	1	19	5%	1.00E+00	--	1.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (mg/kg) by Method 6010B																											
Aluminum	19	19	100%	1.69E+04	9.77E+03	9.77E+03	1.48E+04	--	7.61E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.28E-01	23%	--	--	--	No	--[d]	--
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	3.9E-01	2.16E+01	3.0E+00	1.22E+02	1.00E+00	Yes	Yes	No	Yes	2.37E-06	99%	No	4.26E-02	8%	No	3.07E-07	99%	No	7.55E-03	19%
Barium	19	19	100%	8.17E+01	4.61E+01	4.61E+01	1.73E+02	--	5.37E+03	--	2.92E+04	8.20E+01	No	--	No	--	--	--	No	8.58E-03	2%	--	--	--	No	1.58E-03	4%
Beryllium	19	19	100%	9.80E-01	3.87E-01	3.87E-01	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	3.67E-10	0%	No	2.51E-03	0%	No	6.51E-11	0%	No	4.58E-04	1%
Cadmium	19	19	100%	3.40E-01	1.29E-01	1.29E-01	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	No	No	No	No	9.21E-11	0%	No	3.49E-03	1%	No	1.63E-11	0%	No	5.97E-04	1%
Calcium	19	19	100%	1.65E+04	1.10E+04	1.10E+04	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	19	19	100%	7.10E+00	4.54E+00	4.54E+00	2.69E+01	2.1E+02	--	1.2E+03	--	2.00E+00	Yes	No	--	No	2.16E-08	1%	--	--	--	No	3.82E-09	1%	--	--	--
Cobalt	19	19	100%	2.70E+00	1.69E+00	1.69E+00	6.98E+00	9.0E+02	1.38E+03	5.1E+03	6.69E+03	--	--	No	No	No	1.87E-09	0%	No	1.22E-03	0%	No	3.31E-10	0%	No	2.52E-04	1%
Copper	19	19	100%	6.40E+00	2.77E+00	2.77E+00	6.41E+00	--	3.13E+03	--	1.74E+04	--	--	--	No	--	--	--	No	8.86E-04	0%	--	--	--	No	1.60E-04	0%
Iron	19	19	100%	7.72E+03	4.83E+03	4.83E+03	1.84E+04	--	2.35E+04	--	1.0E5 Max	--	--	--	No	--	--	--	No	2.06E-01	37%	--	--	--	No	--	--
Lead[m]	19	19	100%	1.21E+01	5.72E+00	5.72E+00	1.51E+01	--	4.00E+02	--	4.00E+02	--	--	--	No	--	--	--	No	--[k]	--[k]	--	--	--	No	--[k]	--[k]
Magnesium	19	19	100%	3.71E+03	2.00E+03	2.00E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	19	19	100%	1.21E+02	7.33E+01	7.33E+01	2.91E+02	--	1.76E+03	--	9.13E+03	--	--	--	No	--	--	--	No	4.16E-02	7%	--	--	--	No	8.03E-03	20%
Mercury[l]	19	19	100%	3.20E-01	1.10E-01	1.10E-01	2.20E-01	--	2.35E+01	--	1.30E+02	--	--	--	No	--	--	--	No	4.68E-03	1%	--	--	--	No	8.43E-04	2%
Nickel	19	19	100%	4.00E+00	2.35E+00	2.35E+00	1.53E+01	--	1.56E+03	--	8.69E+03	7.00E+00	No	--	No	--	--	--	No	1.50E-03	0%	--	--	--	No	2.70E-04	1%
Potassium	19	19	100%	1.17E+03	7.49E+02	7.49E+02	4.89E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	1	19	5%	1.90E-01	--	1.90E-01	3.20E-01	--	3.91E+02	--	2.17E+03	3.00E-01	No	--	No	--	--	--	No	4.86E-04	0%	--	--	--	No	8.75E-05	0%
Sodium	7	19	37%	5.32E+01	--	5.32E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	19	19	100%	1.44E+01	8.86E+00	8.86E+00	7.18E+01	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	No	--	--	--	No	1.13E-01	20%	--	--	--	No	2.08E-02	51%
Zinc	19	19	100%	1.96E+01	1.27E+01	1.27E+01	7.79E+01	--	2.35E+04	--	1.0E5 Max	6.20E+02	No	--	No	--	--	--	No	5.39E-04	0%	--	--	--	No	--	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	2E-06			6E-01			3E-07			4E-02	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	4E-10			1E-01			7E-11			1E-03	

--	= no data or not applicab	ug/kg	= micrograms per kilogram
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
mg/kg	= milligrams per kilogram	CTE	= central tendency exposure
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 400 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-15: Risk-Based Screening of Groundwater for (Future/Current) Residential Receptor

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
Benzene	1	19	5%	4.00E-01	–	4.00E-01	3.36E-01	1.12E+01	7.37E+00	3.98E+02	Yes	No	Yes	1.19E-06	0%	No	3.57E-02	0%	No	5.43E-08	0%	No	1.01E-03	0%
cis-1,2-Dichloroethene	2	19	11%	1.00E+00	–	1.00E+00	–	6.08E+01	–	9.76E+02	–	No	–	–	–	No	1.64E-02	0%	–	–	–	No	1.02E-03	0%
Ethylbenzene	3	19	16%	3.60E+00	–	3.60E+00	–	1.34E+03	–	1.00E+04	–	No	–	–	–	No	2.69E-03	0%	–	–	–	No	3.60E-04	0%
Methylene Chloride	4	19	21%	1.15E+02	–	1.15E+02	4.28E+00	1.62E+03	5.49E+01	6.07E+03	Yes	No	Yes	2.69E-05	2%	No	7.09E-02	1%	Yes	2.09E-06	5%	No	1.89E-02	0%
Toluene	4	19	21%	8.00E-01	–	8.00E-01	–	7.23E+02	–	8.09E+03	–	No	–	–	–	No	1.11E-03	0%	–	–	–	No	9.88E-05	0%
Trichloroethene (TCE)	3	19	16%	2.70E+01	–	2.70E+01	2.80E-02	9.52E+00	9.83E-01	3.04E+01	Yes	Yes	Yes	9.64E-04	88%	Yes	2.84E+00	21%	Yes	2.75E-05	59%	No	8.88E-01	19%
Xylenes, Total	3	19	16%	4.90E+00	–	4.90E+00	–	2.10E+02	–	1.60E+04	–	No	–	–	–	No	2.33E-02	0%	–	–	–	No	3.06E-04	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
Bis(2-ethylhexyl)phthalate	1	16	6%	2.70E+01	–	2.70E+01	4.80E+00	7.30E+02	2.98E+01	2.03E+03	Yes	No	Yes	5.62E-06	1%	No	3.70E-02	0%	No	9.06E-07	2%	No	1.33E-02	0%
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	7	16	44%	1.00E-01	–	1.00E-01	–	–	–	–	–	–	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]
PHC as Diesel Fuel	6	16	38%	2.00E-01	–	2.00E-01	–	–	–	–	–	–	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]
PHC as Gasoline	3	16	19%	4.00E-02	–	4.00E-02	–	–	–	–	–	–	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]	–	–[j]	–[j]
Other Inorganics (mg/L) by Method 300.0 or (ug/L) by Method E314																								
Nitrate as N (Method 300.0)[i]	15	16	94%	2.01E+01	1.02E+01	1.02E+01	–	1.00E+01	–	1.62E+02	–	Yes	–	–	–	Yes	–[j]	–[j]	–	–	–	No	–[j]	–[j]
Perchlorate (Method E314)	145	169	86%	4.80E+02	1.04E+02	1.04E+02	–	2.56E+01	–	7.10E+01	–	Yes	–	–	–	Yes	4.08E+00	30%	–	–	–	Yes	1.47E+00	31%
Metals (ug/L) by Method 6010B																								
Aluminum	2	16	13%	1.02E+02	–	1.02E+02	–	3.65E+04	–	1.01E+05	–	No	–	–	–	No	2.79E-03	0%	–	–	–	No	1.01E-03	0%
Antimony	1	16	6%	2.10E+00	–	2.10E+00	–	1.46E+01	–	4.06E+01	–	No	–	–	–	No	1.44E-01	1%	–	–	–	No	5.17E-02	1%
Arsenic	8	16	50%	4.40E+00	–	4.40E+00	4.48E-02	1.09E+01	2.75E-01	3.04E+01	Yes	No	Yes	9.82E-05	9%	No	4.02E-01	3%	Yes	1.58E-05	34%	No	1.45E-01	3%
Barium	16	16	100%	1.10E+02	5.39E+01	5.39E+01	–	2.55E+03	–	2.03E+04	–	No	–	–	–	No	2.11E-02	0%	–	–	–	No	2.66E-03	0%
Beryllium	1	16	6%	5.70E-01	–	5.70E-01	–	7.30E+01	–	2.03E+02	–	No	–	–	–	No	7.81E-03	0%	–	–	–	No	2.81E-03	0%
Cadmium	2	16	13%	7.70E-01	–	7.70E-01	–	1.82E+01	–	5.07E+01	–	No	–	–	–	No	4.22E-02	0%	–	–	–	No	1.52E-02	0%
Calcium	16	16	100%	1.66E+05	1.03E+05	1.03E+05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	10	16	63%	1.57E+02	–	1.57E+02	–	1.09E+02	–	3.04E+02	–	Yes	–	–	–	Yes	1.43E+00	10%	–	–	–	No	5.16E-01	11%
Cobalt	2	16	13%	5.95E+00	–	5.95E+00	–	7.30E+02	–	2.03E+03	–	No	–	–	–	No	8.15E-03	0%	–	–	–	No	2.93E-03	0%
Copper	2	16	13%	1.70E+01	–	1.70E+01	–	1.46E+03	–	4.06E+03	–	No	–	–	–	No	1.16E-02	0%	–	–	–	No	4.19E-03	0%
Iron	7	16	44%	1.61E+03	–	1.61E+03	–	1.09E+04	–	3.04E+04	–	No	–	–	–	No	1.47E-01	1%	–	–	–	No	5.30E-02	1%
Lead [k]	4	16	25%	9.20E+00	–	9.20E+00	–	–	–	–	–	–	–	–	–	–	–[k]	–[k]	–	–	–	–	–[k]	–[k]
Magnesium	16	16	100%	3.88E+04	1.68E+04	1.68E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	10	16	63%	2.60E+02	–	2.60E+02	–	8.76E+02	–	2.43E+03	–	No	–	–	–	No	2.97E-01	2%	–	–	–	No	1.07E-01	2%
Mercury[l]	16	16	100%	5.00E-01	2.77E-01	2.77E-01	–	1.09E+01	–	3.04E+01	–	No	–	–	–	No	2.53E-02	0%	–	–	–	No	9.12E-03	0%
Nickel	7	16	44%	1.28E+03	–	1.28E+03	–	7.30E+02	–	2.03E+03	–	Yes	–	–	–	Yes	1.75E+00	13%	–	–	–	No	6.28E-01	13%
Potassium	16	16	100%	5.10E+03	2.96E+03	2.96E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	6	16	38%	2.99E+01	–	2.99E+01	–	1.82E+02	–	5.07E+02	–	No	–	–	–	No	1.64E-01	1%	–	–	–	No	5.90E-02	1%
Silver	2	16	13%	2.70E+00	–	2.70E+00	–	1.82E+02	–	5.07E+02	–	No	–	–	–	No	1.48E-02	0%	–	–	–	No	5.33E-03	0%
Sodium	15	15	100%	7.65E+04	6.05E+04	6.05E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thallium	2	16	13%	4.10E+00	–	4.10E+00	–	2.41E+00	–	6.69E+00	–	Yes	–	–	–	Yes	1.70E+00	12%	–	–	–	No	6.13E-01	13%
Vanadium	9	16	56%	1.55E+01	–	1.55E+01	–	3.60E+01	–	1.01E+02	–	No	–	–	–	No	4.31E-01	3%	–	–	–	No	1.53E-01	3%
Zinc	15	16	94%	8.30E+01	2.59E+01	2.59E+01	–	1.09E+04	–	3.04E+04	–	No	–	–	–	No	2.36E-03	0%	–	–	–	No	8.50E-04	0%
							Cumulative Incremental Cancer Risk/Hazard Index including Background:							1E-03			1E+01			5E-05			5E+00	

–	= no data or not applicable	HI	= hazard index
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
ug/L	= micrograms per liter	CTE	= central tendency exposure
mg/L	= milligram per liter		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[i] According to the California Regional Water Quality Control Board (RWQCB 1995), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[j] The tap water PRG for nitrate is based on an infant NOAEL rather than on an oral RfD; therefore, no HQ was estimated for this chemical.

[k] No tap water PRG is available for inorganic lead.

[l] PRG is for mercury chloride

Shading identifies COPCs with maximum detects above PRGs.

Table G-16: Risk-Based Screening of Indoor Air via Vapor Emission from Groundwater for (Current/Future) Residential Receptor

			Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
			RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Groundwater EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Benzene	4.00E-04	4.4E-06	2.60E-04	--	1.05E-03	--	No	--	No	1.76E-08	0%	--	--	--	No	4.19E-09	0%	--	--	--
cis-1,2-Dichloroethene	1.00E-03	7.1E-06	--	3.70E-02	--	2.28E+00	--	No	--	--	--	No	1.92E-04	25%	--	--	--	No	3.11E-06	25%
Ethylbenzene	3.60E-03	4.8E-05	--	1.10E+00	--	6.79E+01	--	No	--	--	--	No	4.36E-05	6%	--	--	--	No	7.07E-07	6%
Methylene Chloride	1.20E-01	5.8E-04	4.10E-03	--	1.72E-02	--	No	--	No	1.41E-07	0%	--	--	--	No	3.37E-08	0%	--	--	--
Toluene	8.00E-04	1.0E-05	--	4.00E-01	--	2.47E+01	--	Yes	--	--	--	No	2.50E-05	3%	--	--	--	No	4.05E-07	3%
Trichloroethene	2.70E-02	5.0E-04	1.70E-05	--	7.14E-05	--	No	--	Yes	2.94E-05	99%	--	--	--	Yes	7.00E-06	99%	--	--	--
Xylenes, Total	4.90E-03	5.7E-05	--	1.10E-01	--	6.79E+00	--	No	--	--	--	No	5.18E-04	67%	--	--	--	No	8.39E-06	67%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:										3E-05			8E-04			7E-06			1E-05	

-- = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m^3 = milligrams per cubic meter
HI = hazard index
PRG = preliminary remediation goal
RME = reasonable maximum exposure

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[g] HQ = EPC / CTE Noncarcinogic PRG

Shading identifies COPCs with indoor air concentrations above PRGs.

Table G-17: Risk-Based Screening of Surface Water (Including Total Metals) for (Current/Future) Residential Receptor

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
Acetone	2	3	67%	6.00E+00	--	6.00E+00	--	6.08E+02	--	8.78E+04	--	No	--	--	--	No	9.86E-03	1%	--	--	--	No	6.83E-05	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
RDX	1	3	33%	1.00E+00	--	1.00E+00	6.11E-01	1.09E+02	3.80E+00	3.04E+02	Yes	No	Yes	1.64E-06	6%	No	9.13E-03	1%	No	2.63E-07	6%	No	3.29E-03	1%
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	3	3	100%	9.00E-02	--	9.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
PHC as Diesel Fuel	3	3	100%	8.00E-02	--	8.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
PHC as Gasoline	2	3	67%	5.00E-02	--	5.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
Other Inorganics (ug/L) by Method 300.0 or (ug/L) by Method E314																								
Chloride	3	3	100%	2.60E+03	--	2.60E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoride	3	3	100%	7.50E+01	--	7.50E+01	--	2.19E+03	--	6.08E+03	--	No	--	--	--	No	3.42E-02	3%	--	--	--	No	1.23E-02	3%
Nitrate as N (Method 300.0)	3	3	100%	3.60E+02	--	3.60E+02	--	1.00E+04	--	1.62E+05	--	No	--	--	--	No	3.60E-02	3%	--	--	--	No	2.22E-03	1%
Sulfate	3	3	100%	1.80E+03	--	1.80E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (ug/L) by Method 6010B																								
Aluminum	3	3	100%	3.74E+03	--	3.74E+03	--	3.65E+04	--	1.01E+05	--	No	--	--	--	No	1.02E-01	9%	--	--	--	No	--	--
Antimony	1	3	33%	4.70E+00	--	4.70E+00	--	1.46E+01	--	4.06E+01	--	No	--	--	--	No	3.22E-01	27%	--	--	--	No	1.16E-01	31%
Arsenic	2	3	67%	1.20E+00	--	1.20E+00	4.48E-02	1.09E+01	2.8E-01	3.04E+01	Yes	No	Yes	2.68E-05	94%	No	1.10E-01	9%	Yes	4.32E-06	94%	No	3.95E-02	10%
Barium	3	3	100%	5.02E+01	--	5.02E+01	--	2.55E+03	--	2.03E+04	--	No	--	--	--	No	1.96E-02	2%	--	--	--	No	2.48E-03	1%
Beryllium	2	3	67%	1.00E-01	--	1.00E-01	--	7.30E+01	--	2.03E+02	--	No	--	--	--	No	1.37E-03	0%	--	--	--	No	4.93E-04	0%
Cadmium	1	3	33%	2.40E-01	--	2.40E-01	--	1.82E+01	--	5.07E+01	--	No	--	--	--	No	1.32E-02	1%	--	--	--	No	4.73E-03	1%
Calcium	3	3	100%	2.29E+04	--	2.29E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	3	3	100%	7.90E+00	--	7.90E+00	--	1.09E+02	--	3.04E+02	--	No	--	--	--	No	7.21E-02	6%	--	--	--	No	2.60E-02	7%
Cobalt	3	3	100%	1.10E+00	--	1.10E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	1.51E-03	0%	--	--	--	No	5.42E-04	0%
Copper	3	3	100%	9.60E+00	--	9.60E+00	--	1.46E+03	--	4.06E+03	--	No	--	--	--	No	6.58E-03	1%	--	--	--	No	2.36E-03	1%
Iron	3	3	100%	1.89E+03	--	1.89E+03	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	1.73E-01	14%	--	--	--	No	6.22E-02	17%
Lead[j]	3	3	100%	3.10E+00	--	3.10E+00	--	--	--	--	--	--	--	--	--	--	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Manganese	3	3	100%	2.64E+01	--	2.64E+01	--	8.76E+02	--	2.43E+03	--	No	--	--	--	No	3.01E-02	3%	--	--	--	No	1.09E-02	3%
Mercury[j]	3	3	100%	8.90E-01	--	8.90E-01	--	1.09E+01	--	3.04E+01	--	No	--	--	--	No	8.13E-02	7%	--	--	--	No	2.93E-02	8%
Nickel	3	3	100%	4.10E+00	--	4.10E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	5.62E-03	0%	--	--	--	No	2.02E-03	1%
Selenium	3	3	100%	4.00E-01	--	4.00E-01	--	1.82E+02	--	5.07E+02	--	No	--	--	--	No	2.19E-03	0%	--	--	--	No	7.89E-04	0%
Vanadium	3	3	100%	6.10E+00	--	6.10E+00	--	3.60E+01	--	1.01E+02	--	No	--	--	--	No	1.69E-01	14%	--	--	--	No	6.04E-02	16%
Zinc	3	3	100%	2.08E+01	--	2.08E+01	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	1.90E-03	0%	--	--	--	No	6.84E-04	0%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:														3E-05			1E+00			5E-06			4E-01	

--	= no data or not applicable	HI	= hazard index
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
ug/L	= micrograms per liter	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.
[e] Incremental cancer risk = 1E-08 x (EPC / Reg. IX Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / Reg. IX Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] No tap water PRG is available for inorganic lead.
[j] PRG is for mercury chloride
Shading identifies COPCs with maximum detects above PRGs.

Table G-18: Risk-Based Screening of Surface Water (Dissolved Metals Only) for (Current/Future) Residential Receptor

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	RME EPC[c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals, Dissolved by Method 6020 (µg/L)																								
Aluminum	2	2	100%	1.31E+02	--	1.31E+02	--	3.65E+04	--	1.01E+05	--	No	--	--	--	No	3.59E-03	1%	--	--	--	No	1.30E-03	1%
Antimony	1	2	50%	3.40E+00	--	3.40E+00	--	1.46E+01	--	4.06E+01	--	No	--	--	--	No	2.33E-01	43%	--	--	--	No	8.37E-02	43%
Arsenic	2	2	100%	1.10E+00	--	1.10E+00	4.48E-02	1.09E+01	2.8E-01	3.04E+01	Yes	No	Yes	2.45E-05	100%	No	1.00E-01	19%	Yes	3.96E-06	100%	No	3.62E-02	19%
Barium	2	2	100%	4.33E+01	--	4.33E+01	--	2.55E+03	--	7.10E+03	--	No	--	--	--	No	1.69E-02	3%	--	--	--	No	6.10E-03	3%
Beryllium	1	2	50%	4.30E-02	--	4.30E-02	--	7.30E+01	--	2.03E+02	--	No	--	--	--	No	5.89E-04	0%	--	--	--	No	2.12E-04	0%
Calcium	2	2	100%	2.34E+04	--	2.34E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	2	2	100%	2.50E+00	--	2.50E+00	--	1.09E+02	--	3.04E+02	--	No	--	--	--	No	2.28E-02	4%	--	--	--	No	8.22E-03	4%
Cobalt	2	2	100%	4.40E-01	--	4.40E-01	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	6.03E-04	0%	--	--	--	No	2.17E-04	0%
Copper	2	2	100%	8.10E+00	--	8.10E+00	--	1.46E+03	--	4.06E+03	--	No	--	--	--	No	5.55E-03	1%	--	--	--	No	2.00E-03	1%
Iron	2	2	100%	8.13E+01	--	8.13E+01	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	7.42E-03	1%	--	--	--	No	2.67E-03	1%
Lead [i]	2	2	100%	5.90E-01	--	5.90E-01	--	--	--	--	--	--	--	--	--	--	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Manganese	2	2	100%	1.51E+01	--	1.51E+01	--	8.76E+02	--	2.43E+03	--	No	--	--	--	No	1.72E-02	3%	--	--	--	No	6.21E-03	3%
Mercury [j]	2	2	100%	5.60E-01	--	5.60E-01	--	1.09E+01	--	3.04E+01	--	No	--	--	--	No	5.11E-02	10%	--	--	--	No	1.84E-02	10%
Nickel	2	2	100%	3.00E+00	--	3.00E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	4.11E-03	1%	--	--	--	No	1.48E-03	1%
Selenium	1	2	50%	2.00E-01	--	2.00E-01	--	1.82E+02	--	5.07E+02	--	No	--	--	--	No	1.10E-03	0%	--	--	--	No	3.94E-04	0%
Vanadium	2	2	100%	2.50E+00	--	2.50E+00	--	3.60E+01	--	1.01E+02	--	No	--	--	--	No	6.94E-02	13%	--	--	--	No	2.48E-02	13%
Zinc	2	2	100%	1.70E+01	--	1.70E+01	--	1.09E+04	--	1.30E+04	--	No	--	--	--	No	1.55E-03	0%	--	--	--	No	1.31E-03	1%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:														2E-05			5E-01			4E-06			2E-01	

--	= no data or not applicable	HI	= hazard index
%	= percent	FOD	= Frequency of Detection
ca	= carcinogenic	RME	= reasonable maximum exposure
nc	= noncarcinogenic	CTE	= central tendency exposure
ug/L	= micrograms per liter		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.
[e] Incremental cancer risk = 1E-06 x (EPC / Reg. IX Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / Reg. IX Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] No tap water PRG is available for inorganic lead.
[j] PRG is for mercury chloride
Shading identifies COPCs with maximum detects above PRGs.

Table G-19: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Industrial Receptor

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b] (mg/kg)	95% UCL (mg/kg)	EPC[c] (mg/kg)	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG [d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG [d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG [d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG [d]	SSL DAF 1[e]	Maximum Detect Evaluation: >BSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[h]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI	Site-Bkgr? HIDE
Volatile Organic Chemicals (ug/kg) by Method 8260B																												
2-Butanone	2	83	2%	9.00E+00	--	9.00E+00	--	--	2.9E+07 sat	--	2.9E+07 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
2-Hexanone	3	84	4%	4.40E+01	--	4.40E+01	--	--	1.1E+06 sat	--	1.1E+06 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
4-Methyl-2-Pentanone	1	84	1%	2.00E+00	--	2.00E+00	--	--	4.1E+06 sat	--	4.1E+06 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Acetone	2	68	3%	1.70E+01	--	1.70E+01	--	--	1.0E+08 max	--	1.0E+08 max	8.00E+02	No	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Benzene	1	84	1%	4.30E+02	--	4.30E+02	--	1.41E+03	1.17E+05	8.10E+04	8.9E+05 sat	2.00E+00	Yes	No	No	No	3.05E-07	14%	No	3.88E-03	0%	No	8.43E-09	3%	No	-[j]	--	
Chloroform	5	84	6%	2.20E+00	--	2.20E+00	--	4.70E+02	1.87E+05	1.87E+04	2.02E+05	3.00E+01	No	No	No	No	4.68E-09	0%	No	1.18E-05	0%	No	1.12E-10	0%	No	1.09E-05	0%	
Ethylbenzene	1	84	1%	1.40E+04	--	1.40E+04	--	--	4.0E+05 sat	--	4.0E+05 sat	7.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Toluene	10	84	12%	4.10E+04	--	4.10E+04	--	--	6.5E+05 sat	--	6.5E+05 sat	6.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Xylenes, Total	1	84	1%	9.80E+04	--	9.80E+04	--	--	4.1E+05 sat	--	4.1E+05 sat	1.00E+04	Yes	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																												
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	8.8E+05 sat	--	8.8E+05 sat	--	--	--	No	--	--	--	No	-[j]	--	--	--	--	No	-[j]	--	
Bis(2-ethylhexyl) Phthalate	3	71	4%	4.20E+02	--	4.20E+02	--	1.23E+05	1.23E+07	2.80E+06	7.38E+07	--	--	No	No	No	3.41E-09	0%	No	3.41E-05	0%	No	1.50E-10	0%	No	5.69E-08	0%	
Diethyl Phthalate	2	72	3%	1.10E+02	--	1.10E+02	--	--	1.0E+08 max	--	1.0E+08 max	--	--	--	No	--	--	--	No	-[j]	--	--	--	--	No	-[j]	--	
Di-n-butyl Phthalate	8	72	11%	3.07E+05	--	3.07E+05	--	--	6.1E+07	--	1.0E+08 max	2.70E+05	Yes	--	No	--	--	--	No	4.99E-03	1%	--	--	--	No	-[j]	--	
Fluoranthene	1	72	1%	3.80E+01	--	3.80E+01	--	--	2.2E+07	--	1.0E+08 max	2.10E+06	No	--	No	--	--	--	No	1.73E-06	0%	--	--	--	No	-[j]	--	
Naphthalene	1	72	1%	1.25E+05	--	1.25E+05	--	--	1.6E+06	--	2.2E+05 sat	4.00E+03	Yes	--	No	--	--	--	No	6.82E-01	91%	--	--	--	No	-[j]	--	
n-Nitrosodiphenylamine	6	72	7%	6.67E+04	--	6.67E+04	--	3.82E+06	1.23E+07	7.89E+06	7.38E+07	6.00E+01	Yes	No	No	No	1.90E-07	9%	No	5.42E-03	1%	No	1.80E-07	67%	No	9.03E-04	7%	
Phenol	7	72	10%	8.68E+02	--	8.68E+02	--	--	1.0E+08 max	--	1.0E+08 max	8.00E+03	No	--	No	--	--	--	No	-[j]	--	--	--	--	No	-[j]	--	
Explosives (ug/kg) by Method 8330																												
2,4-Dinitrotoluene	5	76	7%	7.00E+03	--	7.00E+03	--	--	1.23E+06	--	7.38E+06	4.00E-02	Yes	--	No	--	--	--	No	5.69E-03	1%	--	--	--	No	9.48E-04	8%	
2,6-Dinitrotoluene	1	74	1%	4.40E+01	--	4.40E+01	--	--	6.18E+05	--	3.69E+06	3.00E-02	Yes	--	No	--	--	--	No	7.19E-05	0%	--	--	--	No	1.19E-05	0%	
2,4,6-Trinitrotoluene	1	73	1%	2.78E+02	--	2.78E+02	--	6.75E+04	3.08E+06	1.31E+06	1.85E+08	--	--	No	No	No	4.84E-09	0%	No	9.03E-04	0%	No	2.13E-10	0%	No	1.81E-04	1%	
RDX	3	73	4%	2.20E+03	--	2.20E+03	--	1.67E+04	1.85E+06	3.68E+06	1.11E+07	--	--	No	No	No	1.40E-07	0%	No	1.19E-03	0%	No	6.18E-09	2%	No	1.99E-04	2%	
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																												
Motor Oils	24	53	45%	3.90E+01	2.53E+02	3.90E+01	--	-[j]	-[j]	-[j]	-[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
PHC as Diesel Fuel	10	53	19%	3.70E+04	--	3.70E+04	--	-[j]	-[j]	-[j]	-[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
PHC as Gasoline	6	70	7%	1.60E+03	--	1.60E+03	--	-[j]	-[j]	-[j]	-[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Total Petroleum Hydrocarbons (mg/kg) by 8015B																												
Motor Oils	17	17	100%	5.90E+01	2.72E+01	2.72E+01	--	-[j]	-[j]	-[j]	-[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
PHC as Diesel Fuel	9	17	53%	2.70E+01	--	2.70E+01	--	-[j]	-[j]	-[j]	-[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																												
Perchlorate	11	86	13%	6.60E-01	--	6.60E-01	--	--	1.62E+02	--	4.66E+02	--	--	--	No	--	--	--	No	6.50E-03	1%	--	--	--	No	1.42E-03	12%	
Nitrate as N	52	52	100%	1.09E+01	2.38E+00	2.38E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Dioxins/Furans (ug/kg) by Method 8290																												
Total 2,3,7,8-TCDD TEQ	10	10	100%	2.70E-03	--	2.70E-03	--	1.59E-02	--	3.06E-01	--	--	--	No	--	No	1.70E-07	8%	--	--	--	No	8.83E-09	3%	--	--	--	
Metals (mg/kg) by Method 6010B																												
Aluminum	72	72	100%	1.28E+04	6.22E+03	6.22E+03	1.48E+04	--	1.0E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	bkgr
Arsenic	52	72	72%	8.80E+00	2.12E+00	2.12E+00	5.66E+00	1.58E+00	2.56E+02	3.1E+01	1.30E+03	1.00E+00	Yes	Yes	No	Yes	1.33E-06	62%	No	8.20E-03	1%	No	6.93E-08	24%	No	1.63E-03	13%	
Barium	72	72	100%	1.70E+02	8.02E+01	8.02E+01	1.73E+02	--	1.0E+05 max	--	1.0E+05 max	8.20E+01	Yes	--	No	--	--	--	No	-[j]	--	--	--	--	No	-[j]	--	bkgr
Beryllium	54	72	75%	9.90E-01	5.55E-01	5.55E-01	6.69E-01	2.24E+03	1.94E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	2.47E-10	0%	No	2.86E-04	0%	No	7.21E-12	0%	No	6.10E-05	0%	
Cadmium	49	72	68%	3.17E+01	3.96E+00	3.96E+00	2.35E+00	2.99E+03	4.51E+02	1.0E+05 max	2.33E+03	4.00E-01	Yes	No	No	No	1.33E-09	0%	No	8.83E-03	1%	No	--	--	No	1.71E-03	14%	
Calcium	72	72	100%	3.46E+04	9.89E+03	9.89E+03	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	bkgr
Chromium	72	72	100%	2.22E+01	5.76E+00	5.76E+00	2.86E+01	4.48E+02	--	1.6E+04	--	2.00E+00	Yes	No	--	No	1.29E-08	1%	--	--	--	No	3.76E-10	0%	--	--	--	bkgr
Cobalt	72	72	100%	8.60E+00	2.22E+00	2.22E+00	8.98E+00	1.92E+03	1.33E+04	6.6E+04	7.38E+04	--	--	No	No	No	1.18E-09	0%	No	1.67E-04	0%	No	3.37E-11	0%	No	3.02E-05	0%	bkgr
Copper	70	72	97%	3.75E+02	4.54E+01	4.54E+01	8.41E+00	--	4.09E+04	--	1.0E+05 max	--	--	--	No	--	--	--	No	1.11E-03	0%	--	--	--	No	-[j]	--	
Iron	72	72	100%	1.45E+04	5.56E+03	5.56E+03	1.84E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	bkgr
Lead[k]	72	72	100%	8.85E+01	1.65E+01	1.51E+01	--	8.00E+02	--	8.00E+02	--	--	--	No	--	--	--	--	No	-[j]	-[j]	--	--	--	No	-[j]	-[j]	
Magnesium	72	72	100%	6.55E+03	2.83E+03	2.83E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	bkgr
Manganese	71	72	99%	2.28E+02	9.62E+01	9.62E+01	2.91E+02	--	1.95E+04	--	9.92E+04	--	--	--	No	--	--	--	No	4.94E-03	1%	--	--	--	No	9.88E-04	8%	bkgr
Mercury[l]	63	72	88%	7.10E+00	8.64E-01	8.64E-01	2.20E-01	--	3.07E+02	--	1.40E+03	--	--	--	No	--	--	--	No	2.82E-03	0%	--	--	--	No	6.17E-04	5%	
Nickel	72	72	100%	2.83E+01	6.78E+00	6.78E+00	1.53E+01	--	2.04E+04	--	9.33E+04	7.00E+00	Yes	--	No	--	--	--	No	3.31E-04	0%	--	--	--	No	7.24E-05	1%	
Potassium	72	72	100%	7.94E+03	1.05E+03	1.05E+03	4.59E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Selenium	5	72	7%	1.40E+00	--	1.40E+00	3.20E-01	--	5.11E+03	--	2.33E+04	3.00E-01	Yes	--	No	--	--	--	No	2.74E-04	0%	--	--	--	No	6.00E-05	0%	
Sodium	18	72	25%	8.76E+03	1.02E+03	1.02E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Vanadium	72	72	100%	8.09E+01	1.60E+01	1.60E+01	7.18E+01	--	1.02E+03	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	1.58E-02	2%	--	--	--	No	3.51E-03	29%	bkgr
Zinc	72	72	100%	1.53E+03	2.13E+02	2.13E+02	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	6.20E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	-[j]	--	
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	2.E-06			8.E-01			3.E-07			1.E-02		
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	2.E-06			7.E-01			3.E-07			8.E-03		

--	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-9).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogra	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

APPENDIX G – HUMAN HEALTH RISK ASSESSMENT TABLES

TABLE G-20

THIS TABLE IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY NAVFAC SOUTHWEST RECORDS OFFICE TO LOCATE THE MISSING TABLE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

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Table G-21: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Industrial Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m³)	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Acetone	5	138	4%	8.70E+00	8.70E+00	1.9E-02	--	1.70E+01	--	9.81E+01	--	No	--	--	--	No	1.12E-03	0%	--	--	--	No	1.94E-04	0%
Benzene	3	175	2%	6.10E-01	6.10E-01	2.3E-03	1.30E-03	--	7.50E-03	--	Yes	--	Yes	1.77E-06	89%	--	--	--	No	3.07E-07	89%	--	--	--
2-Butanone	2	174	1%	9.00E-03	9.00E-03	2.2E-05	--	2.60E+01	--	1.50E+02	--	No	--	--	--	No	8.46E-07		--	--	--	No	1.47E-07	0%
Chloroform	11	175	6%	2.20E-03	2.20E-03	1.1E-05	4.20E-04	--	2.42E-03	--	No	--	No	2.62E-08	1%	--	--	--	No	4.54E-09	1%	--	--	--
Ethylbenzene	5	174	3%	1.40E+01	1.40E+01	8.1E-02	--	5.50E+00	--	3.17E+01	--	No	--	--	--	No	1.11E-02	0%	--	--	--	No	1.92E-03	0%
Hexachlorobenzene	1	148	1%	2.20E-01	2.20E-01	3.7E-06	2.10E-05	--	1.21E-04	--	No	--	No	1.76E-07	9%	--	--		No	3.05E-08	9%	--	--	--
2-Methylnaphthalene	6	148	4%	2.70E+02	2.70E+02	3.1E-02	--	3.50E+00	--	2.02E+01	--	No	--	--	--	No	8.86E-03	0%	--	--	--	No	1.54E-03	0%
4-Methyl-2-pentanone	1	175	1%	2.00E-03	2.00E-03	8.0E-06	--	1.60E+01	--	9.23E+01	--	No	--	--	--	No	5.00E-07		--	--	--	No	8.67E-08	0%
Naphthalene	8	148	4%	1.30E+02	1.30E+02	2.4E-02	--	1.60E-02	--	9.23E-02	--	Yes	--	--	--	Yes	1.50E+00	65%	--	--	--	No	2.60E-01	65%
Tetrachloroethene	1	175	1%	2.00E-03	2.00E-03	4.0E-05	1.60E-03	--	9.23E-03	--	No	--	No	2.50E-08	1%	--	--		No	4.33E-09	1%	--	--	--
Toluene	26	175	15%	--	1.80E+03	7.7E-03	--	2.00E+00	--	1.15E+01	--	No	--	--	--	No	3.85E-03	0%	--	--	--	No	6.67E-04	0%
Xylenes, Total	6	175	3%	9.80E+01	9.80E+01	4.3E-01	--	5.50E-01	--	3.17E+00	--	No	--	--	--	No	7.82E-01	34%	--	--	--	No	1.35E-01	34%
							Cumulative Incremental Lifetime Cancer Risk/Hazard Index:							2E-06			2E+00			3E-07			4E-01	

--	= no data or not applicable	= no data or not applicable
%	= percent	= percent
ca	= carcinogenic	= carcinogenic
nc	= noncarcinogenic	= noncarcinogenic
mg/kg	= milligrams per kilogram	= milligrams per kilogram
HI	= hazard index	= hazard index
ug/kg	= micrograms per kilogram	= micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[g] HQ = EPC / CTE Noncarcinogic PRG

Table G-22: Risk-Based Screening of Sediment for (Current/Future) Industrial Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: Region IX PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: Region IX PRGs: Non-carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
Toluene	2	19	11%	8.00E-01	--	8.00E-01	--	--	6.5E+05 sat	--	6.5E+05 sat	6.00E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Semivolatile Organic Chemicals (ug/kg) by Method 8270C-SIM																											
Pyrene	1	19	5%	2.00E+00	--	2.00E+00	--	--	3.07E+07	--	1.0E+08 max		Yes	--	No	--	--	--	No	6.52E-08	0%	--	--	--	No	--[d]	--
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	19	19	100%	1.50E+02	5.24E+01	5.24E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	12	19	63%	6.00E+00	8.89E+00	6.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	1	19	5%	1.00E+00	--	1.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (mg/kg) by Method 6010B																											
Aluminum	19	19	100%	1.69E+04	9.77E+03	9.77E+03	1.48E+04	--	1.0E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	1.6E+00	2.56E+02	3.1E+01	1.30E+03	1.00E+00	Yes	No	No	No	5.80E-07	99%	No	3.60E-03	20%	No	3.02E-08	99%	No	7.11E-04	20%
Barium	19	19	100%	8.17E+01	4.61E+01	4.61E+01	1.73E+02	--	6.98E+04	--	1.0E+05 max	8.20E+01	No	--	No	--	--	--	No	6.61E-04	4%	--	--	--	No	--[d]	--
Beryllium	19	19	100%	9.80E-01	3.87E-01	3.87E-01	6.69E-01	6.8E+03	2.01E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	5.73E-11	0%	No	1.93E-04	1%	No	5.03E-12	0%	No	4.26E-05	1%
Cadmium	19	19	100%	3.40E-01	1.29E-01	1.29E-01	2.35E+00	9.0E+03	5.08E+02	1.0E+05 max	2.33E+03	4.00E-01	No	No	No	No	1.44E-11	0%	No	2.55E-04	1%	No	--[d]	--	No	5.56E-05	2%
Calcium	19	19	100%	1.65E+04	1.10E+04	1.10E+04	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	19	19	100%	7.10E+00	4.54E+00	4.54E+00	2.69E+01	1.4E+03	--	1.5E+04	--	2.00E+00	Yes	No	--	No	3.36E-09	1%	--	--	--	No	2.95E-10	1%	--	--	--
Cobalt	19	19	100%	2.70E+00	1.69E+00	1.69E+00	6.98E+00	5.8E+03	1.74E+04	6.6E+04	7.36E+04	--	--	No	No	No	2.92E-10	0%	No	9.72E-05	1%	No	2.56E-11	0%	No	2.29E-05	1%
Copper	19	19	100%	6.40E+00	2.77E+00	2.77E+00	6.41E+00	--	4.09E+04	--	1.0E+05 max	--	--	--	No	--	--	--	No	6.78E-05	0%	--	--	--	No	--[d]	--
Iron	19	19	100%	7.72E+03	4.83E+03	4.83E+03	1.84E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Lead[m]	19	19	100%	1.21E+01	5.72E+00	5.72E+00	1.51E+01	--	8.00E+02	--	8.00E+02	--	--	--	No	--	--	--	No	--[k]	--[k]	--	--	--	No	--[k]	--[k]
Magnesium	19	19	100%	3.71E+03	2.00E+03	2.00E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	19	19	100%	1.21E+02	7.33E+01	7.33E+01	2.91E+02	--	2.26E+04	--	9.92E+04	--	--	--	No	--	--	--	No	3.24E-03	18%	--	--	--	No	7.39E-04	20%
Mercury[l]	19	19	100%	3.20E-01	1.10E-01	1.10E-01	2.20E-01	--	3.07E+02	--	1.40E+03	--	--	--	No	--	--	--	No	3.58E-04	2%	--	--	--	No	7.85E-05	2%
Nickel	19	19	100%	4.00E+00	2.35E+00	2.35E+00	1.53E+01	--	2.04E+04	--	9.33E+04	7.00E+00	No	--	No	--	--	--	No	1.15E-04	1%	--	--	--	No	2.52E-05	1%
Potassium	19	19	100%	1.17E+03	7.49E+02	7.49E+02	4.89E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	1	19	5%	1.90E-01	--	1.90E-01	3.20E-01	--	5.11E+03	--	2.33E+04	3.00E-01	No	--	No	--	--	--	No	3.72E-05	0%	--	--	--	No	8.14E-06	0%
Sodium	7	19	37%	5.32E+01	--	5.32E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	19	19	100%	1.44E+01	8.86E+00	8.86E+00	7.18E+01	--	9.59E+02	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	9.24E-03	52%	--	--	--	No	1.95E-03	54%
Zinc	19	19	100%	1.96E+01	1.27E+01	1.27E+01	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	6.20E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	6.E-07			2.E-02			3.E-08			4.E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	6.E-11			6.E-04			5.E-12			1.E-04	

--	= no data or not applicable	ug/kg	= micrograms per kilogram
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
mg/kg	= milligrams per kilogram	CTE	= central tendency exposure
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 800 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-23: Toxicity Values Used in Estimating Site-Specific PRGs

Chemical	SFo (mg/kg-d)	RfDo (1/(mg/kg-d))	SFi (mg/kg-d)	RfDi (1/(mg/kg-d))
2-Methylnaphthalene	--	4.0E-03	--	4.0E-03
Naphthalene	--	2.0E-02	--	8.6E-04
RDX	1.1E-01	3.0E-03	1.1E-01	3.0E-03
Dioxins (TCDD TEQ)	1.5E+05	--	1.5E+05	--
Perchlorate	--	1.0E-04	--	--
Aluminum	--	1.0E+00	--	1.4E-03
Antimony	--	4.0E-04	--	--
Arsenic	1.5E+00	3.0E-04	1.5E+01	--
Cadmium	--	5.0E-04	6.3E+00	--
Copper	--	4.0E-02	--	--
Lead	--	--	--	--
Thallium	--	6.6E-05	--	--
Zinc	--	3.0E-01	--	--

Source: EPA Region IX Preliminary Remediation Goals (PRG) Tables, dated October 2004

SFo = Oral slope factor

mg/kg-d = milligrams per kilograms per day

RfDo = Oral reference dose

SFi = Inhalation slope factor

RfDi = Inhalation reference dose

-- = Toxicity value not available

Table G-24: Site-Specific PRGs for Construction/Utility Worker, Casual Trespasser and EOD Range Supervisor

	Construction/Utility Worker				Adult Casual Trespasser				Range Supervisor			
	RME PRGs		CTE PRGs		RME PRGs		CTE PRGs		RME PRGs		CTE PRGs	
Chemical	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG
Semivolatile Organic Chemicals by Method 8270C (ug/kg)												
2-Methylnaphthalene	--	6.29E+05	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat
Naphthalene	--	1.82E+05	--	2.23E+05 sat	--	2.23E+05 sat	--	2.23E+05 sat	--	2.23E+05 sat	--	2.23E+05 sat
Explosives by Method 8330 (ug/kg)												
RDX	5.05E+04	7.15E+05	1.01E+06	2.38E+06	4.93E+04	3.41E+06	4.49E+05	1.24E+07	2.97E+05	9.23E+06	8.66E+06	2.69E+08
Other Inorganics by Method E314 (mg/kg)												
Perchlorate	--	3.09E+01	--	1.23E+02	--	2.03E+02	--	4.66E+02	--	5.08E+02	--	1.13E+04
Dioxins/Furans (ug/kg) by Method 8290												
Total 2,3,7,8-TCDD TEQ	4.42E-02	--	9.90E-01	--	3.75E-02	--	3.30E-01	--	3.02E-01	--	7.44E+00	--
Metals by Method 6010B (mg/kg)												
Aluminum	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max
Antimony	--	1.24E+02	--	4.96E+02	--	8.18E+02	--	1.87E+03	--	1.28E+03	--	4.54E+04
Arsenic	4.42E+00	8.50E+01	9.89E+01	3.18E+02	3.75E+00	4.95E+02	3.30E+01	1.35E+03	7.91E+00	1.28E+03	7.42E+02	3.16E+04
Cadmium	2.49E+04	1.54E+02	2.87E+05	6.16E+02	5.98E+04	1.01E+03	5.17E+05	2.33E+03	9.00E+03	2.54E+03	5.77E+05	5.66E+04
Copper	--	1.24E+04	--	4.96E+04	--	8.18E+04	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max
Lead	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	--	2.04E+01	--	8.18E+01	--	1.35E+02	--	3.08E+02	--	3.37E+02	--	7.49E+03
Zinc	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max

Notes:
PRG = Preliminary remediation goal
-- = PRG not available
mg/kg = Milligrams per kilogram
EOD = Explosive Ordinance Disposal

Table G-25: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for Construction Worker

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.29E+05	--	6.8E+05 sat	--	--	--	No	4.29E-01	37%	--	--	--	No	--[i]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	--	1.82E+05	--	2.2E+05 sat	--	--	--	No	7.03E-01	61%	--	--	--	No	--[i]	--
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	4.42E+00	8.50E+01	9.89E+01	3.18E+02	No	4.79E-07	100%	No	2.49E-02	2%	No	2.14E-08	100%	No	6.66E-03	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													5E-07			1E+00			2E-08			7E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													5E-07			1E+00			2E-08			7E-03	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

Table G-26: Site-Specific Risk-Based Evaluation of Subsurface Soil (0-10 ft bgs) EPCs for Construction Worker

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	6	148	4%	2.70E+05	--	2.70E+05	--	--	6.29E+05	--	6.8E+05 sat	--	--	--	No	4.29E-01	15%	--	--	--	No	--	--
Naphthalene	6	148	4%	1.28E+05	--	1.28E+05	--	--	1.82E+05	--	2.2E+05 sat	--	--	--	No	7.03E-01	24%	--	--	--	No	--	--
Explosives (ug/kg) by Method 8330																							
RDX	6	149	4%	1.40E+04	--	1.40E+04	--	5.05E+04	7.15E+05	1.01E+06	2.38E+06	No	2.77E-07	26%	No	1.96E-02	1%	No	1.39E-08	29%	No	5.88E-03	1%
Dioxins/Furans (ug/kg) by Method 8290																							
Total 2,3,7,8-TCDD TEQ	14	14	100%	2.37E-02	6.08E-03	6.08E-03	--	4.42E-02	--	9.90E-01	--	No	1.38E-07	13%	--	--	--	No	8.14E-09	13%	--	--	--
Metals (mg/kg) by Method 6010B																							
Aluminum	148	148	100%	1.90E+05	1.36E+04	1.36E+04	1.48E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	6	148	4%	1.03E+02	--	1.03E+02	3.06E+00	--	1.24E+02	--	4.96E+02	--	--	--	No	8.31E-01	29%	--	--	--	No	2.08E-01	47%
Arsenic	103	148	70%	1.24E+01	2.79E+00	2.79E+00	6.86E+00	4.42E+00	8.50E+01	9.89E+01	3.18E+02	No	6.31E-07	60%	No	3.28E-02	1%	No	2.82E-08	58%	No	8.77E-03	2%
Cadmium	90	148	61%	1.56E+02	8.86E+00	8.86E+00	2.35E+00	2.49E+04	1.54E+02	2.87E+05	6.16E+02	No	3.56E-10	0%	No	5.75E-02	2%	No	3.08E-11		No	1.44E-02	3%
Copper	133	148	90%	1.67E+04	8.39E+02	8.39E+02	6.41E+00	--	1.24E+04	--	4.96E+04	--	--	--	No	6.77E-02	2%	--	--	--	No	1.69E-02	4%
Lead	147	148	99%	1.58E+03	9.34E+01	9.34E+01	1.51E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	2	148	1%	1.52E+01	--	1.52E+01	4.20E-01	--	2.04E+01	--	8.18E+01	--	--	--	No	7.45E-01	26%	--	--	--	No	1.86E-01	42%
Zinc	148	148	100%	2.91E+04	1.51E+03	1.51E+03	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	--	--	--	--	--	--	--	--	--	--	--	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													1E-06			3E+00			5E-08			4E-01	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													1E-06			3E+00			5E-08			4E-01	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

Table G-27: Site-Specific Risk-Based Evaluation of Sediment EPCs for Construction Worker

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	4.4E+00	8.50E+01	9.9E+01	3.18E+02	No	2.09E-07	100%	No	1.08E-02	100%	No	9.32E-09	100%	No	2.90E-03	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													2E-07			1E-02			9E-09			3E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													--			--			--			--	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects.

[e] Incremental cancer risk = 1E-06 x (EPC / Carcinogenic PRG)

[f] HQ = EPC / Noncarcinogic PRG

Table G-28: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for Adult Trespasser

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.8E+05 sat	--	6.8E+05 sat	--	--	--	No	--[i]	--	--	--	--	No	--[i]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	--	2.2E+05 sat	--	2.2E+05 sat	--	--	--	No	--[i]	--	--	--	--	No	--[i]	--
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	3.75E+00	4.95E+02	3.30E+01	1.35E+03	No	5.64E-07	100%	No	4.28E-03	100%	No	6.42E-08	100%	No	1.57E-03	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													6E-07			4E-03			6E-08			2E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													6E-07			4E-03			6E-08			2E-03	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[i] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-29: Site-Specific Risk-Based Evaluation of Sediment EPCs for Adult Trespasser

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	3.75E+00	4.95E+02	3.30E+01	1.35E+03	No	2.46E-07	100%	No	1.86E-03	100%	No	2.80E-08	100%	No	6.85E-04	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													2E-07			2E-03			3E-08			7E-04	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													–			–			–			–	

Notes:

–	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[i] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-30: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for EOD Range Supervisor

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.8E+05 sat	--	6.8E+05 sat	--	--	--	No	--[l]	--	--	--	--	No	--[l]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	--	2.2E+05 sat	--	2.2E+05 sat	--	--	--	No	--[l]	--	--	--	--	No	--[l]	--
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	7.9E+00	1.28E+03	7.4E+02	3.16E+04	No	2.68E-07	100%	No	1.66E-03	100%	No	2.86E-09	100%	No	6.71E-05	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													3E-07			2E-03			3E-09			7E-05	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													3E-07			2E-03			3E-09			7E-05	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index	EOD	= Explosive Ordinance Disposal

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[l] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-31: Site-Specific Risk-Based Evaluation of Sediment EPCs for EOD Range Supervisor

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	7.91E+00	1.28E+03	7.42E+02	3.16E+04	No	1.17E-07	100%	No	7.21E-04	100%	No	1.24E-09	100%	No	2.92E-05	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													1E-07			7E-04			1E-09			3E-05	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													--			--			--			--	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index	EOD	= Explosive Ordinance Disposal

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects.
[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG

Attachment A
Human Health Risk Assessment Tables Using California-Modified Toxicity Values

Table G-A-1: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria, Utilizing California-Modified Toxicity Values

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Surface Soil[d]				
VOCs by EPA SW-846 Method 8260B (µg/kg)[e]				
1,1,2,2-Tetrachloroethane	408	4.4 - 6,100	5	1%
1,1,2-Trichloroethane	729	4.4 - 6,100	5	1%
1,2-Dichloroethane	278	4.4 - 6,100	5	1%
1,2-Dichloropropane	342	4.4 - 6,100	5	1%
Bromodichloromethane	824	4.4 - 6,100	5	1%
Bromomethane	3,897	4.4 - 6,100	5	1%
Carbon Tetrachloride	251	4.4 - 6,100	5	1%
Chloroethane	3,026	4.4 - 6,100	5	1%
Chloroform	*0.94*	4.4 - 6,100	5	1%
cis-1,3-Dichloropropene	777	4.4 - 6,100	5	1%
Dibromochloromethane	1,109	4.4 - 6,100	5	1%
Tetrachloroethene (PCE)	484	4.4 - 6,100	5	1%
trans-1,3-Dichloropropene	777	4.4 - 6,100	5	1%
Trichloroethene (TCE)	*2.90*	4.4 - 6,100	5	1%
Vinyl Chloride	79	4.4 - 6,100	5	1%
SVOCS by EPA SW-846 Method 8270C (µg/kg)[f]				
1,4-Dichlorobenzene	3,447	350 - 120,000	10	1%
2,4,6-Trichlorophenol	*6.90*	350 - 120,000	10	1%
2,4-Dinitrophenol	122,206	1,700 - 610,000	50	1%
2-Chlorophenol	63,398	350 - 120,000	10	1%
2-Nitroaniline	182,772	1,700 - 610,000	50	1%
3,3'-Dichlorobenzidine	1,081	350 - 120,000	10	1%
3-Nitroaniline	18,331	1,700 - 610,000	50	1%
4-Nitroaniline	23,161	1,700 - 610,000	50	1%
Benzo(a)anthracene	621	350 - 120,000	10	3%
Benzo(b)fluoranthene	621	350 - 120,000	10	3%
Benzo(k)fluoranthene	*0.38*	350 - 120,000	10	1%
Bis(2-Chloroethyl) Ether	218	170 - 40,000	10	36%
Bis(2-Chloroisopropyl) Ether	2,884	510 - 120,000	10	1%
Bis(2-ethylhexyl) Phthalate	34,741	510 - 120,000	10	1%
Carbazole	24,319	350 - 120,000	10	1%
Chrysene	*3.80*	350 - 120,000	10	1%
Dibenz(a,h)anthracene	62	37 - 8,800	10	23%
Hexachlorobenzene	304	350 - 120,000	10	100%
Hexachlorobutadiene	6,236	350 - 120,000	10	1%
Hexachlorocyclopentadiene	365,487	1,700 - 610,000	50	1%
Hexachloroethane	34,741	350 - 120,000	10	1%
Indeno(1,2,3-c,d)pyrene	621	350 - 120,000	10	3%
n-nitrosodi-n-propylamine	69	46 - 11,000	10	53%
n-nitrosodiphenylamine	99,261	350 - 120,000	10	1%
Pentachlorophenol	2,979	1,700 - 420,000	50	1%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	62	26 - 6,100	10	7%
Perchlorate by EPA E314 (mg/kg)				
Perchlorate	7.8	0.02 - 24	20	37%
Metals by EPA 6010B (mg/kg)[g]				
Arsenic	0.39	0.29 - 4.5	0.3	91%
Subsurface Soil[d]				
VOCs by EPA SW-846 Method 8260B (µg/kg)[e]				
1,1,2,2-Tetrachloroethane	408	4.3 - 6,100	5	4%
1,1,2-Trichloroethane	729	4.3 - 6,100	5	2%
1,2-Dichloroethane	278	4.3 - 6,100	5	4%
1,2-Dichloropropane	342	4.3 - 6,100	5	4%

Table G-A-1: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria, Utilizing California-Modified Toxicity Values

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Benzene	643	4.3 - 1,100	5	1%
Bromodichloromethane	824	4.3 - 6,100	5	2%
Bromomethane	3,897	4.3 - 6,100	5	1%
Carbon Tetrachloride	251	4.3 - 6,100	5	4%
Chloroethane	3,026	4.3 - 6,100	5	1%
Chloroform	221	0.6 - 6,100	5	4%
cis-1,3-Dichloropropene	777	4.3 - 6,100	5	2%
Dibromochloromethane	1,109	4.3 - 6,100	5	1%
Tetrachloroethene (PCE)	484	4.3 - 6,100	5	4%
trans-1,3-Dichloropropene	777	4.3 - 6,100	5	2%
Trichloroethene (TCE)	53	4.3 - 6,100	5	4%
Vinyl Chloride	79	4.3 - 6,100	5	4%
SVOCS by EPA SW-846 Method 8270C (μg/kg)[f]				
1,4-Dichlorobenzene	3,447	350 - 120,000	10	3%
2,4,6-Trichlorophenol	6,110	350 - 120,000	10	3%
2,4-Dinitrophenol	122,206	540 - 610,000	50	1%
2-Chlorophenol	63,398	350 - 120,000	10	1%
2-Nitroaniline	182,772	540 - 610,000	50	1%
3,3'-Dichlorobenzidine	1,081	350 - 120,000	10	3%
3-Nitroaniline	18,331	540 - 610,000	50	3%
4-Nitroaniline	23,161	540 - 610,000	50	3%
Benzo(a)anthracene	621	350 - 120,000	10	6%
Benzo(b)fluoranthene	621	27 - 120,000	10	6%
Benzo(k)fluornthene	6,215	350 - 120,000	10	1%
Bis(2-Chloroethyl) Ether	218	170 - 40,000	10	37%
Bis(2-Chloroisopropyl) Ether	2,884	180 - 120,000	10	3%
Bis(2-ethylhexyl) Phthalate	34,741	510 - 120,000	10	1%
Carbazole	24,319	350 - 120,000	10	1%
Chrysene	62,146	350 - 120,000	10	1%
Dibenz(a,h)anthracene	62	37 - 8,800	10	28%
Hexachlorobenzene	304	350 - 120,000	10	100%
Hexachlorobutadiene	6,236	350 - 120,000	10	2%
Hexachlorocyclopentadiene	365,487	540 - 610,000	50	1%
Hexachloroethane	34,741	350 - 120,000	10	1%
Indeno(1,2,3-c,d)pyrene	621	350 - 120,000	10	6%
Naphthalene	*1.70*	350 - 120,000	10	1%
n-nitrosodi-n-propylamine	69	46 - 11,000	10	58%
n-nitrosodiphenylamine	99,261	49 - 120,000	10	1%
Pentachlorophenol	2,979	540 - 420,000	50	4%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	62	26 - 6,100	10	9%
Perchlorate by EPA E314 (mg/kg)				
Perchlorate	7.8	0.02 - 24	20	38%
Metals by EPA 6010B (mg/kg)[g]				
Arsenic	0.39	0.17 - 35	0.3	87%
Thallium	5.2	0.077 - 47	0.4	1%
Groundwater[h]				
VOCs by EPA SW-846 Method 8260B (μg/L)[e]				
1,1,2,2-Tetrachloroethane	0.055	1 - 5	1	100%
cis-1,3-Dichloropropene	0.395	0.5 - 1	0.5	100%
trans-1,3-Dichloropropene	0.395	0.5	0.5	100%
SVOCS by EPA SW-846 Method 8270C (μg/L)				
2,4,6-Trichlorophenol	3.650	4.8 - 5	5	100%
3,3'-Dichlorobenzidine	0.149	9.6 - 14	10	100%
3-Nitroaniline	3.202	48 - 50	50	100%
4-Nitroaniline	3.202	48 - 50	50	100%

Table G-A-1: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria, Utilizing California-Modified Toxicity Values

Chemical	Screening Criteria[a]	SQL Ranges	Laboratory EQL[b]	FOE[c]
Benzo(a)anthracene	0.092	9.6 - 10	10	100%
Benzo(b)fluoranthene	0.092	9.6 - 10	10	100%
Benzo(k)fluornthene	0.921	9.6 - 10	10	100%
Bis(2-Chloroethyl) Ether	0.010	9.6 - 10	10	100%
Bis(2-Chloroisopropyl) Ether	0.274	10	--	100%
Bis(2-ethylhexyl) Phthalate	6[i]	9.6 - 10	10	100%
Carbazole	3.362	48 - 50	50	100%
Dibenz(a,h)anthracene	0.009	9.6 - 10	10	100%
Hexachlorobenzene	1[i]	1.1 - 3.2	1	100%
Hexachlorobutadiene	0.862	9.6 - 10	10	100%
Hexachloroethane	4.802	4.8 - 5	5	79%
Indeno(1,2,3-c,d)pyrene	0.092	9.6 - 10	10	100%
Nitrobenzene	3.395	4.8 - 5	5	100%
n-nitrosodi-n-propylamine	0.010	9.6 - 10	10	100%
n-nitrosodimethylamine	0.0013	0.002	NP	100%
Pentachlorophenol	1[i]	4 - 12	1	100%
Explosives by EPA SW-846 Method 8330 (μg/L)[d]				
1,3-Dinitrobenzene	3.650	1 - 5	5	74%
2,4,6-Trinitrotoluene	2.241	1 - 5	5	74%
RDX	0.611	1 - 5	5	100%
PAHs by EPA SIM (ug/kg)				
Benzo(a)pyrene	0.2[i]	0.2 - 1.3	0.2	21%
Perchlorate by EPA E314 (ug/L)				
Perchlorate	3.65	4	5	100%
Metals by EPA 6010B (ug/L)				
Antimony	14.6	1.8 - 60	5	21%
Arsenic	*0.062*	1.5 - 10	0.3	100%
Lead	0.015[i]	1.2 - 5	0.3	100%
Thallium	2.409	1.2 - 3.7	0.5	20%

Notes:

mg/kg = micrograms per kilogram
mg/L = micrograms per liter
EQL = estimated quantitation limit
FOE = frequency of exceedence; percentage of times SQL of nondetect exceeds PRG
SQL = sample quantitation limit of nondetect value
VOC = volatile organic compound
SVOC = semivolatile organic compound

[a] Unless otherwise noted, the screening criteria for soil are equivalent to EPA Region IX (2004) residential preliminary remediation goals. For groundwater, the EPA Region IX (2004) tap water PRGs are only used if nothing more applicable is available. Values that are italized are based on CAL-Modified PRG where available.

[b] This value is the laboratory estimated quantitation limit from the *Work Plan,* (Earth Tech 2001).

[c] Total number of samples includes the field duplicate sample.

[d] Because PRGs are currently unavailable for 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene (Method 8330), no comparison was conducted.

[e] Because a PRG is currently unavailable for 2-hexanone, no comparison was conducted.

[f] Because PRGs are currently unavailable for 2-methylnaphthalene, 2-nitrophenol, 4,6-dinitro-2-methylphenol, 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, 4-nitrophenol, acenaphthylene, benzo(g,h,i)perylene, bis(2-chloroethoxy)methane, and phenanthrene, no comparison was conducted.

[g] Because a PRG is currently unavailable for sodium, no comparison was conducted.

[h] No groundwater standard is currently available for TPHs.

[i] Federal maximum contaminant level (EPA 2004)

-- = not presented
na = not applicable
NP = Not provided.

Table G-A-2: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	83	2%	9.00E+00	--	9.00E+00	--	--	2.23E+07	--	2.9E+07 sat	--	--	--	No	--	--	--	No	4.03E-07	0%	--	--	--	No	--[j]	--
2-Hexanone	3	84	4%	4.40E+01	--	4.40E+01	--	--	1.1E+05 sat	--	1.1E+05 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[j]	--
4-Methyl-2-Pentanone	1	84	1%	2.00E+00	--	2.00E+00	--	--	4.1E+06 sat	--	4.1E+06 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[j]	--
Acetone	2	68	3%	1.70E+01	--	1.70E+01	--	--	1.41E+07	--	6.27E+07	8.00E+02	No	--	No	--	--	--	No	1.20E-06	0%	--	--	--	No	2.712E-07	0%
Benzene	1	84	1%	4.30E+02	--	4.30E+02	--	1.00E+03	3.29E+04	3.99E+03	9.40E+04	2.00E+00	Yes	No	No	No	4.30E-07	0%	No	1.31E-02	0%	No	1.08E-07	1%	No	4.574E-03	0%
Chloroform	5	84	6%	2.20E+00	--	2.20E+00	--	9.41E+02	5.42E+04	6.23E+03	1.70E+05	3.00E+01	No	No	No	No	2.34E-09	0%	No	4.06E-05	0%	No	3.53E-10	0%	No	1.294E-05	0%
Ethylbenzene	1	84	1%	1.40E+04	--	1.40E+04	--	--	4.0E+05 sat	--	4.0E+05 sat	7.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[j]	--
Toluene	10	84	12%	4.10E+04	--	4.10E+04	--	--	8.5E+05 sat	--	8.5E+05 sat	6.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[j]	--
Xylenes, Total	1	84	1%	9.80E+04	--	9.80E+04	--	--	2.71E+05	--	4.1E+05 sat	1.00E+04	Yes	--	No	--	--	--	No	3.62E-01	7%	--	--	--	No	--[j]	--
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	1.69E+05	--	7.35E+05	--	--	--	Yes	--	--	--	Yes	1.59E+00	30%	--	--	--	No	3.673E-01	26%
Bis(2-ethylhexyl) Phthalate	3	71	4%	4.20E+02	--	4.20E+02	--	3.47E+04	1.22E+06	2.81E+05	7.10E+06	--	--	No	No	No	1.21E-08	0%	No	3.44E-04	0%	No	1.50E-09	0%	No	5.915E-05	0%
Diethyl Phthalate	2	72	3%	1.10E+02	--	1.10E+02	--	--	4.89E+07	--	1E+08 Max	--	--	--	No	--	--	--	No	2.25E-06	0%	--	--	--	No	--[j]	--
Di-n-butyl Phthalate	8	72	11%	3.07E+05	--	3.07E+05	--	--	6.11E+06	--	3.55E+07	2.70E+05	Yes	--	No	--	--	--	No	5.02E-02	1%	--	--	--	No	8.648E-03	1%
Fluoranthene	1	72	1%	3.80E+01	--	3.80E+01	--	--	2.29E+06	--	1.35E+07	2.10E+05	No	--	No	--	--	--	No	1.66E-05	0%	--	--	--	No	2.823E-06	0%
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	1.70E+03	5.59E+04	4.81E+04	1.41E+05	4.00E+03	Yes	Yes	Yes	Yes	7.53E-05	67%	Yes	2.29E+00	42%	Yes	3.19E-06	40%	No	9.075E-01	64%
n-Nitrosodiphenylamine	5	72	7%	6.67E+04	--	6.67E+04	--	9.93E+04	1.22E+06	8.02E+05	7.10E+06	6.00E+01	Yes	No	No	No	6.72E-07	1%	No	5.46E-02	1%	No	6.32E-08	1%	No	9.394E-03	1%
Phenol	7	72	10%	8.68E+02	--	8.68E+02	--	--	1.83E+07	--	1E+08 Max	5.00E+03	No	--	No	--	--	--	No	4.74E-05	0%	--	--	--	No	--[j]	--
Explosives (ug/kg) by Method 8330																											
2,4-Dinitrotoluene	5	76	7%	7.00E+03	--	7.00E+03	--	--	1.22E+05	--	7.10E+05	4.00E-02	Yes	--	No	--	--	--	No	5.73E-02	1%	--	--	--	No	9.860E-03	1%
2,6-Dinitrotoluene	1	74	1%	4.40E+01	--	4.40E+01	--	--	8.11E+04	--	3.55E+05	3.00E-02	Yes	--	No	--	--	--	No	7.20E-04	0%	--	--	--	No	1.240E-04	0%
2,4,6-Trinitrotoluene	1	73	1%	2.78E+02	--	2.78E+02	--	1.62E+04	3.06E+04	1.31E+05	1.77E+05	--	--	No	No	No	1.71E-08	0%	No	9.10E-03	0%	No	2.12E-09	0%	No	1.571E-03	0%
RDX	3	73	4%	2.20E+03	--	2.20E+03	--	4.42E+03	1.83E+05	3.57E+04	1.07E+06	--	--	No	No	No	4.98E-07	0%	No	1.20E-02	0%	No	6.16E-08	1%	No	2.066E-03	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	24	53	45%	3.90E+01	2.53E+02	3.90E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	10	53	19%	3.70E+04	--	3.70E+04	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	5	70	7%	1.60E+03	--	1.60E+03	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	17	17	100%	5.90E+01	2.72E+01	2.72E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	9	17	53%	2.70E+01	--	2.70E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314														No	No												
Perchlorate	11	86	13%	6.60E-01	--	6.60E-01	--	--	7.82E+00	--	4.34E+01	--	--	--	No	--	--	--	No	8.44E-02	2%	--	--	--	No	1.522E-02	1%
Nitrate as N	52	52	100%	1.09E+01	2.38E+00	2.38E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans (ug/kg) by Method 8290														No	No												
Total 2,3,7,8-TCDD TEQ	10	10	100%	2.70E-03	--	2.70E-03	--	3.90E-03	--	3.01E-02	--	--	--	No	--	No	6.93E-07	1%	--	--	--	No	8.98E-08	1%	--	--	--
Metals (mg/kg) by Method 6010B																											
Aluminum	72	72	100%	1.28E+04	6.22E+03	6.22E+03	1.48E+04	--	7.61E+04	--	1E+05 max	--	--	--	No	--	--	--	No	8.16E-02	2%	--	--	--	No	--[j]	--
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	9.2E-02	2.16E+01	4.8E-01	1.22E+02	1.00E+00	Yes	Yes	No	Yes	3.44E-05	31%	No	9.78E-02	2%	Yes	4.46E-06	56%	No	1.736E-02	1%
Barium	72	72	100%	1.70E+02	6.02E+01	6.02E+01	1.73E+02	--	5.37E+03	--	7.77E+04	8.20E+01	Yes	--	No	--	--	--	No	1.12E-02	0%	--	--	--	No	7.753E-04	0%
Beryllium	54	72	75%	9.90E-01	5.55E-01	5.55E-01	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	5.27E-10	0%	No	3.59E-03	0%	No	9.33E-11	0%	No	6.573E-04	0%
Cadmium	49	72	68%	3.17E+01	3.98E+00	3.98E+00	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	Yes	No	No	No	2.84E-09	0%	No	1.08E-01	2%	No	5.03E-10	0%	No	1.838E-02	1%
Calcium	72	72	100%	3.46E+04	9.69E+03	9.69E+03	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	72	72	100%	2.22E+01	5.78E+00	5.78E+00	2.69E+01	2.1E+02	--	1.2E+03	--	2.00E+00	Yes	No	--	No	2.74E-08	0%	--	--	--	No	4.86E-09	0%	--	--	--
Cobalt	72	72	100%	6.60E+00	2.22E+00	2.22E+00	6.98E+00	9.0E+02	1.38E+03	5.1E+03	6.69E+03	--	--	No	No	No	2.46E-09	0%	No	1.61E-03	0%	No	4.38E-10	0%	No	3.317E-04	0%
Copper	70	72	97%	3.75E+02	4.54E+01	4.54E+01	8.41E+00	--	3.13E+03	--	1.74E+04	--	--	--	No	--	--	--	No	1.45E-02	0%	--	--	--	No	2.610E-03	0%
Iron	72	72	100%	1.45E+04	5.56E+03	5.56E+03	1.84E+04	--	2.35E+04	--	1.0E5 Max	--	--	--	No	--	--	--	No	2.37E-01	4%	--	--	--	No	--[j]	--
Lead[m]	72	72	100%	8.85E+01	1.65E+01	1.65E+01	1.51E+01	--	1.50E+02	--	1.50E+02	--	--	--	No	--	--	--	No	--[k]	--[k]	--	--	--	No	--[k]	--[k]
Magnesium	72	72	100%	6.55E+03	2.83E+03	2.83E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	71	72	99%	2.28E+02	9.62E+01	9.62E+01	2.91E+02	--	1.76E+03	--	9.13E+03	--	--	--	No	--	--	--	No	5.46E-02	1%	--	--	--	No	1.054E-02	1%
Mercury[l]	63	72	88%	7.10E+00	8.64E-01	8.64E-01	2.20E-01	--	2.35E+01	--	1.30E+02	--	--	--	No	--	--	--	No	3.68E-02	1%	--	--	--	No	6.628E-03	0%
Nickel	72	72	100%	2.63E+01	6.76E+00	6.76E+00	1.53E+01	--	1.56E+03	--	8.69E+03	7.00E+00	Yes	--	No	--	--	--	No	4.32E-03	0%	--	--	--	No	7.776E-04	0%
Potassium	72	72	100%	7.94E+03	1.05E+03	1.05E+03	4.89E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	5	72	7%	1.40E+00	--	1.40E+00	3.20E-01	--	3.91E+02	--	2.17E+03	3.00E-01	Yes	--	No	--	--	--	No	3.58E-03	0%	--	--	--	No	8.444E-04	0%
Sodium	18	72	25%	8.76E+03	1.02E+03	1.02E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	72	72	100%	6.09E+01	1.60E+01	1.60E+01	7.18E+01	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	No	--	--	--	No	2.04E-01	4%	--	--	--	No	3.760E-02	3%
Zinc	72	72	100%	1.53E+03	2.13E+02	2.13E+02	7.79E+01	--	2.35E+04	--	1.0E5 Max	6.20E+02	Yes	--	No	--	--	--	No	9.10E-03	0%	--	--	--	No	--[j]	--
Cumulative Incremental Cancer Risk/Hazard Index including Background:																	1E-04			5E+00			8E-06			1E+00	

Table G-A-2: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	1E-04			5E+00			8E-06			1E+00	

--	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-9).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

Table G-A-3: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[h]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[i]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	174	1%	9.00E+00	–	9.00E+00	–	–	2.23E+07	–	2.9E+07 sat	–	–	–	No	–	–	–	No	4.03E-07	0%	–	–	–	No	–[j]	–
2-Hexanone	7	175	4%	5.00E+01	–	5.00E+01	–	–	1.1E+05 sat	–	1.1E+05 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
4-Methyl-2-Pentanone	1	175	1%	2.00E+00	–	2.00E+00	–	–	4.1E+06 sat	–	4.1E+06 sat	–	–	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Acetone	5	138	4%	8.70E+03	–	8.70E+03	–	–	1.41E+07	–	6.27E+07	8.00E+02	Yes	–	No	–	–	–	No	6.16E-04	0%	–	–	–	No	1.39E-04	0%
Benzene	3	175	2%	6.10E+02	–	6.10E+02	–	1.00E+03	3.29E+04	3.99E+03	9.40E+04	2.00E+00	Yes	No	No	No	6.10E-07	0%	No	1.85E-02	0%	No	1.53E-07	2%	No	6.49E-03	0%
Chloroform	11	175	6%	2.20E+00	4.06E+02	2.20E+00	–	9.41E+02	5.42E+04	6.20E+04	1.70E+05	3.00E+01	No	No	No	No	2.34E-09	0%	No	4.06E-05	0%	No	3.55E-11	0%	No	1.29E-05	0%
Ethylbenzene	5	174	3%	1.40E+04	–	1.40E+04	–	–	4.0E+05 sat	–	4.0E+05 sat	7.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Tetrachloroethylene (PCE)	1	175	1%	2.00E+00	–	2.00E+00	–	4.84E+02	3.80E+04	3.57E+03	1.24E+05	3.00E+00	No	No	No	No	4.14E-09	0%	No	5.27E-05	0%	No	5.60E-10	0%	No	1.61E-05	0%
Toluene	26	175	15%	4.10E+04	1.76E+03	1.76E+03	–	–	6.5E+05 sat	–	6.5E+05 sat	6.00E+02	Yes	–	No	–	–	–	No	–	–	–	–	–	No	–[j]	–
Xylenes, Total	6	175	3%	9.80E+04	–	9.80E+04	–	–	2.71E+05	–	4.1E+05 sat	1.00E+04	Yes	–	No	–	–	–	No	3.62E-01	3%	–	–	–	No	–[j]	–
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	6	148	4%	2.70E+05	–	2.70E+05	–	–	1.69E+05	–	7.35E+05	–	–	–	Yes	–	–	–	Yes	1.59E+00	13%	–	–	–	No	3.67E-01	14%
Bis(2-ethylhexyl) Phthalate	6	148	4%	4.20E+02	–	4.20E+02	–	3.77E+04	1.22E+06	2.81E+05	7.10E+06	–	–	No	No	No	1.11E-08	0%	No	3.44E-04	0%	No	1.50E-09	0%	No	5.92E-05	0%
Diethyl Phthalate	4	148	3%	2.50E+02	–	2.50E+02	–	–	4.89E+07	–	1E8 Max	–	–	–	No	–	–	–	No	5.11E-06	0%	–	–	–	No	–[j]	–
Di-n-butyl Phthalate	12	148	8%	3.07E+05	2.15E+04	2.15E+04	–	–	6.11E+06	–	3.55E+07	2.70E+05	Yes	–	No	–	–	–	No	3.52E-03	0%	–	–	–	No	6.06E-04	0%
Fluoranthene	1	148	1%	3.80E+01	–	3.80E+01	–	–	2.29E+06	–	1.35E+07	2.10E+05	No	–	No	–	–	–	No	1.66E-05	0%	–	–	–	No	2.82E-06	0%
Hexachlorobenzene	1	148	1%	2.20E+02	–	2.20E+02	–	3.30E+02	4.89E+04	2.46E+03	2.84E+05	1.00E+02	Yes	No	No	No	6.67E-07	1%	No	4.50E-03	0%	No	8.94E-08	1%	No	7.75E-04	0%
Naphthalene	6	148	4%	1.28E+05	–	1.28E+05	–	1.70E+03	5.59E+04	4.01E+04	1.41E+05	4.00E+03	Yes	Yes	Yes	Yes	7.53E-05	59%	Yes	2.29E+00	18%	Yes	3.19E-08	32%	No	9.06E-01	34%
n-Nitrosodiphenylamine	6	148	4%	6.67E+04	–	6.67E+04	–	9.83E+04	1.22E+06	8.02E+05	7.10E+06	6.00E+01	Yes	No	No	No	6.72E-07	1%	No	5.46E-02	0%	No	8.32E-08	1%	No	9.39E-03	0%
Phenol	15	148	10%	1.20E+03	7.31E+03	1.20E+03	–	–	1.63E+07	–	1.0E8 max	5.00E+03	No	–	No	–	–	–	No	6.56E-05	0%	–	–	–	No	–[j]	–
Explosives (ug/kg) by Method 8330																											
2-Amino-4,6-dinitrotoluene	1	149	1%	3.10E+02	–	3.10E+02	–	–	1.22E+04	–	4.97E+06	–	–	–	No	–	–	–	No	2.54E-02	0%	–	–	–	No	6.24E-05	0%
4-Amino-2,6-dinitrotoluene	1	149	1%	2.28E+02	–	2.28E+02	–	–	1.22E+04	–	3.55E+06	–	–	–	No	–	–	–	No	1.87E-02	0%	–	–	–	No	6.42E-05	0%
1,3-Dinitrobenzene	1	149	1%	6.30E+02	–	6.30E+02	–	–	6.11E+03	–	3.55E+04	–	–	–	No	–	–	–	No	1.03E-01	1%	–	–	–	No	1.77E-02	1%
2,4-Dinitrotoluene	6	152	4%	7.00E+03	–	7.00E+03	–	–	1.22E+05	–	7.10E+05	4.00E-02	Yes	–	No	–	–	–	No	5.73E-02	0%	–	–	–	No	9.86E-03	0%
2,6-Dinitrotoluene	1	150	1%	4.40E+01	–	4.40E+01	–	–	6.11E+04	–	3.55E+05	3.00E-02	Yes	–	No	–	–	–	No	7.20E-04	0%	–	–	–	No	1.24E-04	0%
2,4,6-Trinitrotoluene	3	149	2%	7.86E+03	–	7.86E+03	–	1.62E+04	3.06E+04	1.31E+05	1.77E+05	–	–	No	No	No	4.85E-07	0%	No	2.57E-01	2%	No	6.00E-08	1%	No	4.44E-02	2%
HMX	1	148	1%	1.40E+03	–	1.40E+03	–	–	3.06E+06	–	1.77E+07	–	–	–	No	–	–	–	No	4.58E-04	0%	–	–	–	No	7.89E-05	0%
RDX	6	149	4%	1.40E+04	–	1.40E+04	–	4.42E+03	1.83E+05	3.57E+04	1.07E+06	–	–	Yes	No	Yes	3.17E-06	2%	No	7.64E-02	1%	No	3.92E-07	4%	No	1.31E-02	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	40	112	36%	6.90E+01	2.23E+02	6.90E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	23	112	21%	3.70E+04	2.90E+03	2.90E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Gasoline	11	143	8%	1.60E+03	–	1.60E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	29	31	94%	5.90E+01	1.67E+01	1.67E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	12	31	39%	2.70E+01	1.33E+01	1.33E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																											
Perchlorate	14	170	8%	1.60E+00	8.62E-02	8.62E-02	–	–	7.82E+00	–	4.34E+01	–	–	–	No	–	–	–	No	1.10E-02	0%	–	–	–	No	1.99E-03	0%
Nitrate as N	105	105	100%	5.27E+01	4.37E+00	4.37E+00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dioxins/Furans (ug/kg) by Method 8290																											
Total 2,3,7,8-TCDD TEQ	14	14	100%	2.37E-02	6.08E-03	6.08E-03	–	3.90E-03	–	3.01E-02	–	–	–	Yes	–	Yes	1.56E-06	1%	–	–	–	No	2.02E-07	2%	–	–	–
Metals (mg/kg) by Method 6010B																											
Aluminum	148	148	100%	1.90E+05	1.36E+04	1.36E+04	1.48E+04	–	7.61E+04	–	1E+05 max	–	–	–	Yes	–	–	–	No	1.79E-01	1%	–	–	–	No	–[j]	–
Antimony	6	148	4%	1.03E+02	–	1.03E+02	3.06E+00	–	3.13E+01	–	1.74E+02	3.00E+02	No	–	Yes	–	–	–	Yes	3.29E+00	26%	–	–	–	No	5.93E-01	22%
Arsenic	103	148	70%	1.24E+01	2.79E+00	2.79E+00	6.86E+00	6.16E-02	2.16E+01	4.8E-01	1.22E+02	1.00E+00	Yes	Yes	No	Yes	4.53E-05	35%	No	1.29E-01	1%	Yes	5.87E-08	58%	No	2.29E-02	1%
Barium	148	148	100%	8.04E+02	9.14E+01	9.14E+01	1.73E+02	–	5.37E+03	–	7.77E+04	8.20E+01	Yes	–	No	–	–	–	No	1.70E-02	0%	–	–	–	No	1.18E-03	0%
Beryllium	108	148	73%	1.10E+00	1.27E+00	1.10E+00	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	1.04E-09	0%	No	7.13E-03	0%	No	1.85E-10	0%	No	1.30E-03	0%
Cadmium	90	148	61%	1.56E+02	8.86E+00	8.86E+00	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	Yes	No	Yes	No	6.31E-09	0%	No	2.39E-01	2%	No	1.12E-09	0%	No	4.09E-02	2%
Calcium	148	148	100%	7.10E+04	8.72E+03	8.72E+03	4.60E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	148	148	100%	1.71E+02	1.16E+01	1.16E+01	2.69E+01	2.1E+02	–	1.2E+03	–	2.00E+00	Yes	No	–	No	5.51E-08	0%	–	–	–	No	9.76E-09	0%	–	–	–
Cobalt	147	148	99%	8.60E+00	4.06E+00	4.06E+00	6.98E+00	1.2E+04	1.38E+03	5.1E+03	6.69E+03	–	–	No	No	No	3.46E-10	0%	No	2.94E-03	0%	No	7.97E-10	0%	No	6.07E-04	0%
Copper	133	148	90%	1.67E+04	8.39E+02	8.39E+02	6.41E+00	–	3.13E+03	–	1.74E+04	–	–	–	Yes	–	–	–	No	2.68E-01	2%	–	–	–	No	4.83E-02	2%
Iron	148	148	100%	1.99E+04	5.94E+03	5.94E+03	1.84E+04	–	2.35E+04	–	1.0E5 Max	–	–	–	No	–	–	–	No	2.53E-01	2%	–	–	–	No	–[j]	–
Lead[m]	147	148	99%	1.58E+03	9.34E+01	9.34E+01	1.51E+01	–	1.50E+02	–	1.50E+02	–	–	–	Yes	–	–	–	No	–[k]	–[k]	–	–	–	No	–[k]	–[k]
Magnesium	148	148	100%	8.34E+03	2.72E+03	2.72E+03	8.37E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	147	148	99%	7.11E+02	1.03E+02	1.03E+02	2.91E+02	–	1.76E+03	–	9.13E+03	–	–	–	No	–	–	–	No	5.84E-02	0%	–	–	–	No	1.13E-02	0%
Mercury[l]	122	148	82%	7.10E+00	4.95E-01	4.95E-01	2.20E-01	–	2.35E+01	–	1.30E+02	–	–	–	No	–	–	–	No	2.11E-02	0%	–	–	–	No	3.80E-03	0%
Nickel	146	148	99%	1.12E+02	1.24E+01	1.24E+01	1.53E+01	–	1.56E+03	–	8.69E+03	7.00E+00	Yes	–	No	–	–	–	No	7.93E-03	0%	–	–	–	No	1.43E-03	0%
Potassium	148	148	100%	7.94E+03	1.22E+03	1.22E+03	4.89E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table G-A-3: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Selenium	14	148	9%	4.70E+00	2.06E+00	2.06E+00	3.20E-01	--	3.91E+02	--	2.17E+03	3.00E-01	Yes	--	No	--	--	--	No	5.27E-03	0%	--	--	--	No	9.48E-04	0%
Silver	3	148	2%	5.80E+00	--	5.80E+00	5.39E-01	--	3.91E+02	--	2.17E+03	2.00E+00	Yes	--	No	--	--	--	No	1.48E-02	0%	--	--	--	No	2.67E-03	0%
Sodium	49	148	33%	8.76E+03	8.61E+02	6.61E+02		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	2	148	1%	1.52E+01	--	1.52E+01		--	5.16E+00	--	2.87E+01	--	--	--	Yes	--	--	--	Yes	2.94E+00	23%	--	--	--	No	5.30E-01	20%
Vanadium	148	148	100%	6.09E+01	1.44E+01	1.44E+01	7.18E+01	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	No	--	--	--	No	1.84E-01	1%	--	--	--	No	3.39E-02	1%
Zinc	148	148	100%	2.91E+04	1.51E+03	1.51E+03	7.79E+01	--	2.35E+04	--	1.0E5 Max	6.20E+02	Yes	--	Yes	--	--	--	No	6.44E-02	1%	--	--	--	No	--[k]	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	1E-04			1E+01			1E-05			3E+00	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	1E-04			1E+01			1E-05			3E+00	

--	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-10).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 400 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-A-4: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Residential Receptor, Utilizing California-Modiffied Toxicity Values

				Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
				RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m³)	Carcinogenic PRG[c]	Non-carcinogenic PRG[c]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Acetone	8.70E+00	8.70E+00	3.7E-02	--	3.30E+00	--	2.04E+01	--	No	--	--	--	No	1.12E-02	0%	--	--	--	No	1.82E-03	0%
Benzene	6.10E-01	6.10E-01	4.7E-03	2.50E-04	--	1.05E-03	--	Yes	--	Yes	1.88E-05	2%	--	--	--	Yes	4.48E-06	2%	--	--	--
Chloroform	2.20E-03	2.20E-03	2.3E-05	8.30E-05	--	3.49E-04	--	No	--	No	2.77E-07	0%	--	--	--	No	6.60E-08	0%	--	--	--
Ethylbenzene	1.40E+01	1.40E+01	1.2E-01	--	1.10E+00	--	6.79E+00	--	No	--	--	--	No	1.09E-01	0%	--	--	--	No	1.77E-02	0%
Hexachlorobenzene	2.20E-01	2.20E-01	7.4E-06	4.20E-06	--	1.76E-05	--	Yes	--	Yes	1.76E-06	0%	--	--		No	4.20E-07	0%	--	--	--
Methyl ethyl ketone	9.00E-03	9.00E-03	4.3E-05	--	5.10E+00	--	3.15E+01	--	No	--	--	--	No	8.43E-06		--	--	--	No	1.37E-06	0%
Methyl Isobutyl ketone	2.00E-03	2.00E-03	1.6E-05	--	3.10E+00	--	1.91E+01	--	No	--	--	--	No	5.16E-06		--	--	--	No	8.37E-07	0%
2-Methylnaphthalene	2.70E+02	2.70E+02	7.3E-02	--	7.00E-01	--	4.32E+00	--	No	--	--	--	No	1.04E-01	0%	--	--	--	No	1.69E-02	0%
Naphthalene	1.30E+02	1.30E+02	4.9E-02	5.60E-05	3.10E-03	2.35E-04	1.91E-02	Yes	Yes	Yes	8.75E-04	98%	Yes	1.58E+01	66%	Yes	2.08E-04	98%	Yes	2.56E+00	66%
Tetrachloroethene	2.00E-03	2.00E-03	8.0E-05	3.20E-04	--	1.34E-03	--	No	--	No	2.50E-07	0%	--	--		No	5.95E-08	0%	--	--	--
Toluene	--	1.80E+00	1.6E-02	--	4.00E-01	--	2.47E+00	--	No	--	--	--	No	4.00E-02	0%	--	--	--	No	6.48E-03	0%
Xylenes, Total	9.80E+01	9.80E+01	6.6E-01	--	1.10E-01	--	6.79E-01	--	Yes	--	--	--	Yes	7.82E+00	33%	--	--	--	Yes	1.27E+00	33%
			Cumulative Incremental Lifetime Cancer Risk/Hazard Index:								9E-04			2E+01			2E-04			4E+00	

--	= no data or not applicable
%	= percent
ca	= carcinogenic
CTE	= central tendency exposure
nc	= noncarcinogenic
mg/m³	= milligrams per kilogram
HI	= hazard index
PRG	= preliminary remediation goal
RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[g] HQ = EPC / CTE Noncarcinogic PRG

Table G-A-5: Risk-Based Screening of Sediment for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[j]	% Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
Toluene	2	19	11%	8.00E-01	–	8.00E-01	–	–	6.5E+05 sat	–	6.5E+05 sat	6.00E+02	No	–	No	–	–	–	No	–[d]	–	–	–	–	No	–[d]	–
Semivolatile Organic Chemicals (ug/kg) by Method 8270C-SIM																											
Pyrene	1	19	5%	2.00E+00	–	2.00E+00	–	–	2.35E+06	–	1.30E+07		Yes	–	No	–	–	–	No	8.52E-07	0%	–	–	–	No	1.53E-07	0%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	19	19	100%	1.50E+02	5.24E+01	5.24E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	12	19	63%	6.00E+00	8.89E+00	6.00E+00	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Gasoline	1	19	5%	1.00E+00	–	1.00E+00	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Metals (mg/kg) by Method 6010B																											
Aluminum	19	19	100%	1.69E+04	9.77E+03	9.77E+03	1.48E+04	–	7.61E+04	–	1E+05 max	–	–	–	No	–	–	–	No	1.28E-01	23%	–	–	–	No	–[d]	–
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	6.16E-02	2.16E+01	4.8E+01	1.22E+02	1.00E+00	Yes	Yes	No	Yes	1.50E-05	100%	No	4.26E-02	8%	No	1.94E-08	82%	No	7.56E-03	19%
Barium	19	19	100%	8.17E+01	4.61E+01	4.61E+01	1.73E+02	–	5.37E+03	–	2.92E+04	8.20E+01	No	–	No	–	–	–	No	8.58E-03	2%	–	–	–	No	1.58E-03	4%
Beryllium	19	19	100%	9.80E-01	3.87E-01	3.87E-01	6.69E-01	1.1E+03	1.54E+02	5.9E+03	8.44E+02	3.00E+00	No	No	No	No	3.67E-10	0%	No	2.51E-03	0%	No	6.51E-11	0%	No	4.58E-04	1%
Cadmium	19	19	100%	3.40E-01	1.29E-01	1.29E-01	2.35E+00	1.4E+03	3.70E+01	7.9E+03	2.17E+02	4.00E-01	No	No	No	No	9.21E-11	0%	No	3.49E-03	1%	No	1.63E-11	0%	No	5.97E-04	1%
Calcium	19	19	100%	1.65E+04	1.10E+04	1.10E+04	4.60E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	19	19	100%	7.10E+00	4.54E+00	4.54E+00	2.69E+01	2.1E+02	–	1.2E+03	–	2.00E+00	Yes	No	–	No	2.16E-08	0%	–	–	–	No	3.82E-09	16%	–	–	–
Cobalt	19	19	100%	2.70E+00	1.69E+00	1.69E+00	8.98E+00	9.0E+02	1.38E+03	5.1E+03	6.69E+03	–	–	No	No	No	1.87E-09	0%	No	1.22E-03	0%	No	3.31E-10	1%	No	2.52E-04	1%
Copper	19	19	100%	6.40E+00	2.77E+00	2.77E+00	6.41E+00	–	3.13E+03	–	1.74E+04	–	–	–	No	–	–	–	No	8.86E-04	0%	–	–	–	No	1.60E-04	0%
Iron	19	19	100%	7.72E+03	4.83E+03	4.83E+03	1.84E+04	–	2.35E+04	–	1.0E5 Max	–	–	–	No	–	–	–	No	2.06E-01	37%	–	–	–	No	–	–
Lead[m]	19	19	100%	1.21E+01	5.72E+00	5.72E+00	1.51E+01	–	1.50E+02	–	1.50E+02	–	–	–	No	–	–	–	No	–[k]	–[k]	–	–	–	No	–[k]	–[k]
Magnesium	19	19	100%	3.71E+03	2.00E+03	2.00E+03	8.37E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	19	19	100%	1.21E+02	7.33E+01	7.33E+01	2.91E+02	–	1.76E+03	–	9.13E+03	–	–	–	No	–	–	–	No	4.16E-02	7%	–	–	–	No	8.03E-03	20%
Mercury[l]	19	19	100%	3.20E-01	1.10E-01	1.10E-01	2.20E-01	–	2.35E+01	–	1.30E+02	–	–	–	No	–	–	–	No	4.68E-03	1%	–	–	–	No	8.43E-04	2%
Nickel	19	19	100%	4.00E+00	2.35E+00	2.35E+00	1.53E+01	–	1.56E+03	–	8.69E+03	7.00E+00	No	–	No	–	–	–	No	1.50E-03	0%	–	–	–	No	2.70E-04	1%
Potassium	19	19	100%	1.17E+03	7.49E+02	7.49E+02	4.89E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	1	19	5%	1.90E-01	–	1.90E-01	3.20E-01	–	3.91E+02	–	2.17E+03	3.00E-01	No	–	No	–	–	–	No	4.86E-04	0%	–	–	–	No	8.75E-05	0%
Sodium	7	19	37%	5.32E+01	–	5.32E+01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vanadium	19	19	100%	1.44E+01	8.86E+00	8.86E+00	7.18E+01	–	7.82E+01	–	4.25E+02	3.00E+02	No	–	No	–	–	–	No	1.13E-01	20%	–	–	–	No	2.08E-02	51%
Zinc	19	19	100%	1.96E+01	1.27E+01	1.27E+01	7.79E+01	–	2.35E+04	–	1.0E5 Max	6.20E+02	No	–	No	–	–	–	No	5.39E-04	0%	–	–	–	No	–	–
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	2E-05			6E-01			2E-08			4E-02	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	4E-10			1E-01			7E-11			1E-03	

–	= no data or not applicable	ug/kg	= micrograms per kilogram
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
mg/kg	= milligrams per kilogram	CTE	= central tendency exposure
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 400 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-A-8: Risk-Based Screening of Groundwater for (Future/Current) Residential Receptor, Utilizing California-Modified Toxicity Values

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
Benzene	1	19	5%	4.00E-01	--	4.00E-01	3.36E-01	1.12E+01	7.37E+00	3.98E+02	Yes	No	Yes	1.19E-06	0%	No	3.57E-02	0%	No	5.43E-08	0%	No	1.01E-03	0%
cis-1,2-Dichloroethene	2	19	11%	1.00E+00	--	1.00E+00	--	6.08E+01	--	9.76E+02	--	No	--	--	--	No	1.64E-02	0%	--	--	--	No	1.02E-03	0%
Ethylbenzene	3	19	16%	3.60E+00	--	3.60E+00	--	1.34E+03	--	1.00E+04	--	No	--	--	--	No	2.69E-03	0%	--	--	--	No	3.60E-04	0%
Methylene Chloride	4	19	21%	1.15E+02	--	1.15E+02	4.28E+00	1.62E+03	5.49E+01	6.07E+03	Yes	No	Yes	2.69E-05	4%	No	7.09E-02	0%	Yes	2.09E-06	2%	No	1.89E-02	0%
Toluene	4	19	21%	8.00E-01	--	8.00E-01	--	7.23E+02	--	8.09E+03	--	No	--	--	--	No	1.11E-03	0%	--	--	--	No	9.88E-05	0%
Trichloroethene (TCE)	3	19	16%	2.70E+01	--	2.70E+01	1.40E+00	9.52E+00	3.11E+01	3.04E+01	Yes	Yes	Yes	1.93E-05	3%	Yes	2.84E+00	19%	No	8.68E-07	1%	No	8.88E-01	18%
Xylenes, Total	3	19	16%	4.90E+00	--	4.90E+00	--	2.10E+02	--	1.60E+04	--	No	--	--	--	No	2.33E-02	0%	--	--	--	No	3.06E-04	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
Bis(2-ethylhexyl)phthalate	1	16	6%	2.70E+01	--	2.70E+01	4.80E+00	7.30E+02	2.98E+01	2.03E+03	Yes	No	Yes	5.62E-06	1%	No	3.70E-02	0%	No	9.06E-07	1%	No	1.33E-02	0%
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	7	16	44%	1.00E-01	--	1.00E-01	--	--	--	--	--	--	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]
PHC as Diesel Fuel	6	16	38%	2.00E-01	--	2.00E-01	--	--	--	--	--	--	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]
PHC as Gasoline	3	16	19%	4.00E-02	--	4.00E-02	--	--	--	--	--	--	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]	--	-[j]	-[j]
Other Inorganics (mg/L) by Method 300.0 or (ug/L) by Method E314																								
Nitrate as N (Method 300.0)	15	16	94%	2.01E+01	1.02E+01	1.02E+01	--	1.00E+01	--	1.82E+02	--	Yes	--	--	--	Yes	1.02E+00	7%	--	--	--	No	6.30E-02	1%
Perchlorate (Method E314)	145	169	86%	4.60E+02	1.04E+02	1.04E+02	--	2.56E+01	--	7.10E+01	--	Yes	--	--	--	Yes	4.08E+00	28%	--	--	--	Yes	1.47E+00	30%
Metals (ug/L) by Method 6010B																								
Aluminum	2	16	13%	1.02E+02	--	1.02E+02	--	3.65E+04	--	1.01E+05	--	No	--	--	--	No	2.79E-03	0%	--	--	--	No	1.01E-03	0%
Antimony	1	16	6%	2.10E+00	--	2.10E+00	--	1.46E+01	--	4.06E+01	--	No	--	--	--	No	1.44E-01	1%	--	--	--	No	5.17E-02	1%
Arsenic	8	16	50%	4.40E+00	--	4.40E+00	7.10E-03	1.09E+01	4.39E-02	3.04E+01	Yes	No	Yes	6.20E-04	92%	No	4.02E-01	3%	Yes	1.00E-04	96%	No	1.45E-01	3%
Barium	16	16	100%	1.10E+02	5.39E+01	5.39E+01	--	2.55E+03	--	2.03E+04	--	No	--	--	--	No	2.11E-02	0%	--	--	--	No	2.66E-03	0%
Beryllium	1	16	6%	5.70E-01	--	5.70E-01	--	7.30E+01	--	2.03E+02	--	No	--	--	--	No	7.81E-03	0%	--	--	--	No	2.81E-03	0%
Cadmium	2	16	13%	7.70E-01	--	7.70E-01	--	1.82E+01	--	5.07E+01	--	No	--	--	--	No	4.22E-02	0%	--	--	--	No	1.52E-02	0%
Calcium	16	16	100%	1.66E+05	1.03E+05	1.03E+05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	10	16	63%	1.57E+02	--	1.57E+02	--	1.09E+02	--	3.04E+02	--	Yes	--	--	--	Yes	1.43E+00	10%	--	--	--	No	5.16E-01	11%
Cobalt	2	16	13%	5.95E+00	--	5.95E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	8.15E-03	0%	--	--	--	No	2.93E-03	0%
Copper	2	16	13%	1.70E+01	--	1.70E+01	--	1.46E+03	--	4.06E+03	--	No	--	--	--	No	1.16E-02	0%	--	--	--	No	4.18E-03	0%
Iron	7	16	44%	1.61E+03	--	1.61E+03	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	1.47E-01	1%	--	--	--	No	5.30E-02	1%
Lead [i]	4	16	25%	9.20E+00	--	9.20E+00	--	--	--	--	--	--	--	--	--	--	-[j]	-[j]	--	--	--	--	-[j]	-[j]
Magnesium	16	16	100%	3.88E+04	1.68E+04	1.68E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	10	16	63%	2.60E+02	--	2.60E+02	--	8.76E+02	--	2.43E+03	--	No	--	--	--	No	2.97E-01	2%	--	--	--	No	1.07E-01	2%
Mercury [k]	16	16	100%	5.00E-01	2.77E-01	2.77E-01	--	1.09E+01	--	3.04E+01	--	No	--	--	--	No	2.53E-02	0%	--	--	--	No	9.12E-03	0%
Nickel	7	16	44%	1.28E+03	--	1.28E+03	--	7.30E+02	--	2.03E+03	--	Yes	--	--	--	Yes	1.75E+00	12%	--	--	--	No	6.28E-01	13%
Potassium	16	16	100%	5.10E+03	2.96E+03	2.96E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	6	16	38%	2.99E+01	--	2.99E+01	--	1.82E+02	--	5.07E+02	--	No	--	--	--	No	1.64E-01	1%	--	--	--	No	5.90E-02	1%
Silver	2	16	13%	2.70E+00	--	2.70E+00	--	1.82E+02	--	5.07E+02	--	No	--	--	--	No	1.48E-02	0%	--	--	--	No	5.33E-03	0%
Sodium	15	15	100%	7.65E+04	6.05E+04	6.05E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	2	16	13%	4.10E+00	--	4.10E+00	--	2.41E+00	--	6.69E+00	--	Yes	--	--	--	Yes	1.70E+00	12%	--	--	--	No	6.13E-01	13%
Vanadium	9	16	56%	1.55E+01	--	1.55E+01	--	3.60E+01	--	1.01E+02	--	No	--	--	--	No	4.31E-01	3%	--	--	--	No	1.53E-01	3%
Zinc	15	16	94%	8.30E+01	2.59E+01	2.59E+01	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	2.36E-03	0%	--	--	--	No	8.50E-04	0%
							Cumulative Incremental Cancer Risk/Hazard Index including Background:							7E-04			1E+01			1E-04			5E+00	

-- = no data or not applicable
% = percent
ca = carcinogenic
nc = noncarcinogenic
ug/L = micrograms per liter
mg/L = milligram per liter
HI = hazard index
PHC = petroleum hydrocarbon
FOD = Frequency of Detection
RME = reasonable maximum exposure
CTE = central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure; CAL-Modified PRG used, where available.
[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).
[j] No tap water PRG is available for inorganic lead.
[k] PRG is for mercury chloride

Shading identifies COPCs with maximum detects above PRGs.

Table G-A-7: Risk-Based Screening of Indoor Air via Vapor Emission from Groundwater for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

			Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
			RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Groundwater EPC[a]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG [c]	Non-carcinogenic PRG [c]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Benzene	4.00E-04	4.4E-06	2.50E-04	–	1.05E-03	–	No	–	No	1.76E-08	3%	–	–	–	No	4.19E-09	3%	–	–	–
cis-1,2-Dichloroethene	1.00E-03	7.1E-06	–	3.70E-03	–	2.28E-02	–	No	–	–	–	No	1.92E-03	25%	–	–	–	No	3.11E-04	25%
Ethylbenzene	3.60E-03	4.8E-05	–	1.10E-01	–	6.79E-01	–	No	–	–	–	No	4.36E-04	6%	–	–	–	No	7.07E-05	6%
Methylene Chloride	1.20E-01	5.8E-04	4.10E-03	–	1.72E-02	–	No	–	No	1.41E-07	21%	–	–	–	No	3.37E-08	21%	–	–	–
Toluene	8.00E-04	1.0E-05	–	4.00E-02	–	2.47E-01	–	Yes	–	–	–	No	2.50E-04	3%	–	–	–	No	4.05E-05	3%
Trichloroethene	2.70E-02	5.0E-04	9.60E-04	–	4.03E-03	–	No		No	5.21E-07	77%	–	–	–	No	1.24E-07	77%	–	–	–
Xylenes, Total	4.90E-03	5.7E-05	–	1.10E-02	–	6.79E-02	–	No	–	–	–	No	5.18E-03	67%	–	–	–	No	8.40E-04	67%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:										7E-07			8E-03			2E-07			1E-03	

– = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m^3 = milligrams per cubic meter
HI = hazard index
PRG = preliminary remediation goal
RME = reasonable maximum exposure

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[g] HQ = EPC / CTE Noncarcinogic PRG

Shading identifies COPCs with indoor air concentrations above PRGs.

Table G-A-8: Risk-Based Screening of Surface Water (Including Total Metals) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
Acetone	2	3	67%	6.00E+00	--	6.00E+00	--	6.08E+02	--	8.78E+04	--	No	--	--	--	No	9.86E-03	1%	--	--	--	No	6.83E-05	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
RDX	1	3	33%	1.00E+00	--	1.00E+00	6.11E-01	1.09E+02	3.80E+00	3.04E+02	Yes	No	Yes	1.64E-06	1%	No	9.13E-03	1%	No	2.63E-07	1%	No	3.29E-03	1%
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	3	3	100%	9.00E-02	--	9.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
PHC as Diesel Fuel	3	3	100%	8.00E-02	--	8.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
PHC as Gasoline	2	3	67%	5.00E-02	--	5.00E-02	--	--	--	--	--	--	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]	--	--[i]	--[i]
Other Inorganics (ug/L) by Method 300.0 or (ug/L) by Method E314																								
Chloride	3	3	100%	2.60E+03	--	2.60E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoride	3	3	100%	7.50E+01	--	7.50E+01	--	2.19E+03	--	6.08E+03	--	No	--	--	--	No	3.42E-02	3%	--	--	--	No	1.23E-02	3%
Nitrate as N (Method 300.0)	3	3	100%	3.60E+02	--	3.60E+02	--	1.00E+04	--	1.62E+05	--	No	--	--	--	No	3.60E-02	3%	--	--	--	No	2.22E-03	1%
Sulfate	3	3	100%	1.80E+03	--	1.80E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (ug/L) by Method 6010B																								
Aluminum	3	3	100%	3.74E+03	--	3.74E+03	--	3.65E+04	--	1.01E+05	--	No	--	--	--	No	1.02E-01	9%	--	--	--	No	--	--
Antimony	1	3	33%	4.70E+00	--	4.70E+00	--	1.46E+01	--	4.06E+01	--	No	--	--	--	No	3.22E-01	27%	--	--	--	No	1.16E-01	31%
Arsenic	2	3	67%	1.20E+00	--	1.20E+00	7.10E-03	1.09E+01	4.39E-02	3.04E+01	Yes	No	Yes	1.69E-04	99%	No	1.10E-01	9%	Yes	2.73E-05	99%	No	3.95E-02	10%
Barium	3	3	100%	5.02E+01	--	5.02E+01	--	2.55E+03	--	2.03E+04	--	No	--	--	--	No	1.96E-02	2%	--	--	--	No	2.48E-03	1%
Beryllium	2	3	67%	1.00E-01	--	1.00E-01	--	7.30E+01	--	2.03E+02	--	No	--	--	--	No	1.37E-03	0%	--	--	--	No	4.93E-04	0%
Cadmium	1	3	33%	2.40E-01	--	2.40E-01	--	1.82E+01	--	5.07E+01	--	No	--	--	--	No	1.32E-02	1%	--	--	--	No	4.73E-03	1%
Calcium	3	3	100%	2.29E+04	--	2.29E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	3	3	100%	7.90E+00	--	7.90E+00	--	1.09E+02	--	3.04E+02	--	No	--	--	--	No	7.21E-02	6%	--	--	--	No	2.60E-02	7%
Cobalt	3	3	100%	1.10E+00	--	1.10E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	1.51E-03	0%	--	--	--	No	5.42E-04	0%
Copper	3	3	100%	9.60E+00	--	9.60E+00	--	1.46E+03	--	4.06E+03	--	No	--	--	--	No	6.58E-03	1%	--	--	--	No	2.36E-03	1%
Iron	3	3	100%	1.89E+03	--	1.89E+03	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	1.73E-01	14%	--	--	--	No	6.22E-02	17%
Lead[i]	3	3	100%	3.10E+00	--	3.10E+00	--	--	--	--	--	--	--	--	--	--	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Manganese	3	3	100%	2.64E+01	--	2.64E+01	--	8.76E+02	--	2.43E+03	--	No	--	--	--	No	3.01E-02	3%	--	--	--	No	1.09E-02	3%
Mercury[j]	3	3	100%	8.90E-01	--	8.90E-01	--	1.09E+01	--	3.04E+01	--	No	--	--	--	No	8.13E-02	7%	--	--	--	No	2.93E-02	8%
Nickel	3	3	100%	4.10E+00	--	4.10E+00	--	7.30E+02	--	2.03E+03	--	No	--	--	--	No	5.62E-03	0%	--	--	--	No	2.02E-03	1%
Selenium	3	3	100%	4.00E-01	--	4.00E-01	--	1.82E+02	--	5.07E+02	--	No	--	--	--	No	2.19E-03	0%	--	--	--	No	7.89E-04	0%
Vanadium	3	3	100%	6.10E+00	--	6.10E+00	--	3.60E+01	--	1.01E+02	--	No	--	--	--	No	1.69E-01	14%	--	--	--	No	6.04E-02	16%
Zinc	3	3	100%	2.08E+01	--	2.08E+01	--	1.09E+04	--	3.04E+04	--	No	--	--	--	No	1.90E-03	0%	--	--	--	No	6.84E-04	0%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:														2E-04			1E+00			3E-05			4E-01	

--	= no data or not applicable	HI	= hazard index
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
ug/L	= micrograms per liter	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure; CAL-Modified PRG used, where available.
[e] Incremental cancer risk = 1E-06 x (EPC / Reg. IX Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / Reg. IX Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] No tap water PRG is available for inorganic lead.
[j] PRG is for mercury chloride
Shading identifies COPCs with maximum detects above PRGs.

Table G-A-9: Risk-Based Screening of Surface Water (Dissolved Metals Only) for (Current/Future) Residential Receptor, Utilizing California-Modified Toxicity Values

							Preliminary Remedial Goals				Maximum Detect Evaluation		RME Evaluation						CTE Evaluation					
							Region IX PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	RME EPC[c]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals, Dissolved by Method 6020 (µg/L)																								
Aluminum	2	2	100%	1.31E+02	--	1.31E+02	--	3.65E+04	--	5.21E+04	--	No	--	--	--	No	3.59E-03	1%	--	--	--	No	2.51E-03	1%
Antimony	1	2	50%	3.40E+00	--	3.40E+00	--	1.46E+01	--	2.09E+01	--	No	--	--	--	No	2.33E-01	49%	--	--	--	No	1.63E-01	49%
Arsenic	2	2	100%	1.10E+00	--	1.10E+00	7.10E-03	1.09E+01	1.75E-02	1.56E+01	Yes	No	Yes	1.55E-04	100%	No	1.00E-01	21%	Yes	6.29E-05	100%	No	7.03E-02	21%
Barium	2	2	100%	4.33E+01	--	4.33E+01	--	2.55E+03	--	3.65E+03	--	No	--	--	--	No	1.69E-02	4%	--	--	--	No	1.19E-02	4%
Beryllium	1	2	50%	4.30E-02	--	4.30E-02	--	7.30E+01	--	1.04E+02	--	No	--	--	--	No	5.89E-04	0%	--	--	--	No	4.12E-04	0%
Calcium	2	2	100%	2.34E+04	--	2.34E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	2	2	100%	2.50E+00	--	2.50E+00	--	1.09E+02	--	1.56E+02	--	No	--	--	--	No	2.28E-02	5%	--	--	--	No	1.60E-02	5%
Cobalt	2	2	100%	4.40E-01	--	4.40E-01	--	7.30E+02	--	1.04E+03	--	No	--	--	--	No	6.03E-04	0%	--	--	--	No	4.22E-04	0%
Copper	2	2	100%	8.10E+00	--	8.10E+00	--	1.46E+03	--	2.09E+03	--	No	--	--	--	No	5.55E-03	1%	--	--	--	No	3.88E-03	1%
Iron	2	2	100%	8.13E+01	--	8.13E+01	--	1.09E+04	--	1.56E+04	--	No	--	--	--	No	7.42E-03	2%	--	--	--	No	5.20E-03	2%
Lead[i]	2	2	100%	5.90E-01	--	5.90E-01	--	--	--	--	--	--	--	--	--	No	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Manganese	2	2	100%	1.51E+01	--	1.51E+01	--	8.76E+02	--	1.25E+03	--	No	--	--	--	No	1.72E-02	4%	--	--	--	No	1.21E-02	4%
Mercury[j]	2	2	100%	5.60E-01	--	5.60E-01	--	1.09E+01	--	1.56E+01	--	No	--	--	--	No	5.11E-02	11%	--	--	--	No	3.58E-02	11%
Nickel	2	2	100%	3.00E+00	--	3.00E+00	--	7.30E+02	--	1.04E+03	--	No	--	--	--	No	4.11E-03	1%	--	--	--	No	2.88E-03	1%
Selenium	1	2	50%	2.00E-01	--	2.00E-01	--	1.82E+02	--	2.61E+02	--	No	--	--	--	No	1.10E-03	0%	--	--	--	No	7.67E-04	0%
Vanadium	2	2	100%	2.50E+00	--	2.50E+00	--	2.55E+02	--	3.65E+02	--	No	--	--	--	No	9.78E-03	2%	--	--	--	No	6.85E-03	2%
Zinc	2	2	100%	1.70E+01	--	1.70E+01	--	1.09E+04	--	1.56E+04	--	No	--	--	--	No	1.55E-03	0%	--	--	--	No	1.09E-03	0%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:														2E-04			5E-01			6E-05			3E-01	

--	= no data or not applicable	HI	= hazard index
%	= percent	FOD	= Frequency of Detection
ca	= carcinogenic	RME	= reasonable maximum exposure
nc	= noncarcinogenic	CTE	= central tendency exposure
ug/L	= micrograms per liter		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure; CAL-Modified PRG used, where available.
[e] Incremental cancer risk = 1E-06 x (EPC / Reg. IX Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / Reg. IX Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] No tap water PRG is available for inorganic lead.
[j] PRG is for mercury chloride
Shading identifies COPCs with maximum detects above PRGs.

Table G-A-10: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b] (mg/kg)	95% UCL (mg/kg)	EPC[c] (mg/kg)	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	83	2%	9.00E+00	--	9.00E+00	--	--	2.9E+07 sat	--	2.9E+07 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
2-Hexanone	3	84	4%	4.40E+01	--	4.40E+01	--	--	1.1E+05 sat	--	1.1E+05 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
4-Methyl-2-Pentanone	1	84	1%	2.00E+00	--	2.00E+00	--	--	4.1E+06 sat	--	4.1E+06 sat	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Acetone	2	66	3%	1.70E+01	--	1.70E+01	--	--	1.0E+08 max	--	1.0E+08 max	8.00E+02	No	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Benzene	1	84	1%	4.30E+02	--	4.30E+02	--	1.41E+03	1.17E+05	5.10E+04	8.9E+05 sat	2.00E+00	Yes	No	No	No	3.05E-07	1%	No	3.68E-03	0%	No	8.43E-09	1%	No	--[d]	--
Chloroform	5	84	6%	2.20E+00	--	2.20E+00	--	2.00E+03	1.87E+05	7.98E+04	2.02E+06	3.00E+01	No	No	No	No	1.10E-09	0%	No	1.18E-05	0%	No	2.76E-11	0%	No	1.09E-06	0%
Ethylbenzene	1	84	1%	1.40E+04	--	1.40E+04	--	--	4.0E+05 sat	--	4.0E+05 sat	7.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Toluene	10	84	12%	4.10E+04	--	4.10E+04	--	--	6.5E+05 sat	--	6.5E+05 sat	6.00E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Xylenes, Total	1	84	1%	9.80E+04	--	9.80E+04	--	--	4.1E+05 sat	--	4.1E+05 sat	1.00E+04	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.8E+05 sat	--	6.8E+05 sat	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Bis(2-ethylhexyl) Phthalate	3	71	4%	4.20E+02	--	4.20E+02	--	1.23E+05	1.23E+07	2.80E+06	7.38E+07	--	--	No	No	No	3.41E-09	0%	No	3.41E-05	0%	No	1.50E-10	0%	No	5.69E-06	0%
Diethyl Phthalate	2	72	3%	1.10E+02	--	1.10E+02	--	--	1.0E+08 max	--	1.0E+08 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Di-n-butyl Phthalate	8	72	11%	3.07E+05	--	3.07E+05	--	--	6.16E+07	--	1.0E+08 max	2.70E+05	Yes	--	No	--	--	--	No	4.99E-03	1%	--	--	--	No	--[d]	--
Fluoranthene	1	72	1%	3.80E+01	--	3.80E+01	--	--	2.20E+07	--	1.0E+08 max	2.10E+05	No	--	No	--	--	--	No	1.73E-06	0%	--	--	--	No	--[d]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	4.20E+03	1.88E+05	4.12E+05	2.2E+05 sat	4.00E+03	Yes	Yes	No	Yes	3.05E-05	77%	No	6.62E-01	91%	No	3.11E-07	32%	No	--[d]	--
n-Nitrosodiphenylamine	5	72	7%	6.67E+04	--	6.67E+04	--	3.52E+05	1.23E+07	7.99E+06	7.38E+07	6.00E+01	Yes	No	No	No	1.90E-07	0%	No	5.42E-03	1%	No	1.90E-07	20%	No	9.03E-04	7%
Phenol	7	72	10%	8.68E+02	--	8.68E+02	--	--	1.0E+08 max	--	1.0E+08 max	5.00E+03	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Explosives (ug/kg) by Method 8330																											
2,4-Dinitrotoluene	5	76	7%	7.00E+03	--	7.00E+03	--	--	1.23E+06	--	7.38E+06	4.00E-02	Yes	--	No	--	--	--	No	5.69E-03	1%	--	--	--	No	9.48E-04	8%
2,6-Dinitrotoluene	1	74	1%	4.40E+01	--	4.40E+01	--	--	6.16E+05	--	3.69E+06	3.00E-02	Yes	--	No	--	--	--	No	7.15E-05	0%	--	--	--	No	1.19E-05	0%
2,4,6-Trinitrotoluene	1	73	1%	2.78E+02	--	2.78E+02	--	5.75E+04	3.08E+05	1.31E+06	1.85E+06	--	--	No	No	No	4.84E-09	0%	No	9.03E-04	0%	No	2.13E-10	0%	No	1.51E-04	1%
RDX	3	73	4%	2.20E+03	--	2.20E+03	--	1.57E+04	1.85E+06	3.56E+05	1.11E+07	--	--	No	No	No	1.40E-07	0%	No	1.19E-03	0%	No	6.18E-09	1%	No	1.99E-04	2%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	24	53	45%	3.90E+01	2.53E+02	3.90E+01	--	--[j]	--J	--[j]	--J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	10	53	19%	3.70E+04	--	3.70E+04	--	--[j]	--J	--[j]	--J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	5	70	7%	1.60E+03	--	1.60E+03	--	--[j]	--J	--[j]	--J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	17	17	100%	5.90E+01	2.72E+01	2.72E+01	--	--[j]	--J	--[j]	--J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	9	17	53%	2.70E+01	--	2.70E+01	--	--[j]	--J	--[j]	--J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																											
Perchlorate	11	86	13%	6.60E-01	--	6.60E-01	--	--	1.02E+02	--	4.65E+02	--	--	--	No	--	--	--	No	6.50E-03	1%	--	--	--	No	1.42E-03	12%
Nitrate as N	52	52	100%	1.09E+01	2.38E+00	2.38E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans (ug/kg) by Method 8290																											
Total 2,3,7,8-TCDD TEQ	10	10	100%	2.70E-03	--	2.70E-03	--	1.59E-02	--	3.06E-01	--	--	--	No	--	No	1.70E-07	0%	--	--	--	No	8.83E-09	1%	--	--	--
Metals (mg/kg) by Method 6010B																											
Aluminum	72	72	100%	1.28E+04	6.22E+03	6.22E+03	1.48E+04	--	1.0E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Arsenic	52	72	72%	6.60E+00	2.12E+00	2.12E+00	6.86E+00	2.81E-01	2.6E+02	4.83E+00	1.30E+03	1.00E+00	Yes	Yes	No	Yes	6.42E-06	21%	No	8.28E-03	1%	No	4.38E-07	46%	No	1.63E-03	13%
Barium	72	72	100%	1.70E+02	6.02E+01	6.02E+01	1.73E+02	--	1.0E+05 max	--	1.0E+05 max	8.20E+01	Yes	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Beryllium	54	72	75%	9.90E-01	5.55E-01	5.55E-01	6.69E-01	2.24E+03	1.94E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	2.47E-10	0%	No	2.86E-04	0%	No	7.21E-12	0%	No	6.10E-05	0%
Cadmium	49	72	68%	3.17E+01	3.98E+00	3.98E+00	2.35E+00	2.99E+03	4.51E+02	1.0E+05 max	2.33E+03	4.00E-01	Yes	No	No	No	1.33E-09	0%	No	8.83E-03	1%	No	--	--	No	1.71E-03	14%
Calcium	72	72	100%	3.46E+04	9.69E+03	9.69E+03	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	72	72	100%	2.22E+01	5.78E+00	5.78E+00	2.69E+01	4.48E+02	--	1.5E+04	--	2.00E+00	Yes	No	--	No	1.29E-08	0%	--	--	--	No	3.76E-10	0%	--	--	--
Cobalt	72	72	100%	6.60E+00	2.22E+00	2.22E+00	6.98E+00	1.92E+03	1.33E+04	6.6E+04	7.36E+04	--	--	No	No	No	1.16E-09	0%	No	1.67E-04	0%	No	3.37E-11	0%	No	3.02E-05	0%
Copper	70	72	97%	3.75E+02	4.54E+01	4.54E+01	6.41E+00	--	4.09E+04	--	1.0E+05 max	--	--	--	No	--	--	--	No	1.11E-03	0%	--	--	--	No	--[d]	--
Iron	72	72	100%	1.45E+04	5.56E+03	5.56E+03	1.84E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Lead[m]	72	72	100%	8.85E+01	1.65E+01	1.65E+01	1.51E+01	--	--	--	--	--	--	--	--	--	--	--	--	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Magnesium	72	72	100%	6.55E+03	2.83E+03	2.83E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	71	72	99%	2.28E+02	9.62E+01	9.62E+01	2.91E+02	--	1.95E+04	--	9.92E+04	--	--	--	No	--	--	--	No	4.94E-03	1%	--	--	--	No	9.69E-04	8%
Mercury[l]	63	72	88%	7.10E+00	8.64E-01	8.64E-01	2.20E-01	--	3.07E+02	--	1.40E+03	--	--	--	No	--	--	--	No	2.82E-03	0%	--	--	--	No	6.17E-04	5%
Nickel	72	72	100%	2.63E+01	6.76E+00	6.76E+00	1.53E+01	--	2.04E+04	--	9.33E+04	7.00E+00	Yes	--	No	--	--	--	No	3.31E-04	0%	--	--	--	No	7.24E-05	1%
Potassium	72	72	100%	7.94E+03	1.05E+03	1.05E+03	4.89E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	5	72	7%	1.40E+00	--	1.40E+00	3.20E-01	--	5.11E+03	--	2.33E+04	3.00E-01	Yes	--	No	--	--	--	No	2.74E-04	0%	--	--	--	No	6.00E-05	0%
Sodium	18	72	25%	8.76E+03	1.02E+03	1.02E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	72	72	100%	6.09E+01	1.60E+01	1.60E+01	7.18E+01	--	1.02E+03	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	1.56E-02	2%	--	--	--	No	3.51E-03	29%
Zinc	72	72	100%	1.53E+03	2.13E+02	2.13E+02	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	6.20E+02	Yes	--	No	--	--	--	No	--	--	--	--	--	No	--[d]	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	4.E-05			8.E-01			1.E-06			1.E-02	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	4.E-05			7.E-01			1.E-06			8.E-03	

Table G-A-10: Risk-Based Screening of Surface Soil (0-2 ft bgs) for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b] (mg/kg)	95% UCL (mg/kg)	EPC[c] (mg/kg)	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental. Cancer Risk[h]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI

-- = no data or not applicable
% = percent
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
ug/kg = micrograms per kilogram
PHC = petroleum hydrocarbon
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
HMX = Octahydro-1357-tetranitro-1357-tetrazocine
TEQ = toxicity equivalent (as estimated in Table D-9).
FOD = Frequency of Detection
RME = reasonable maximum exposure
CTE = central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[i] HQ = EPC / CTE Noncarcinogic PRG
[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).
[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.
[l] PRG is for mercury chloride

Table G-A-11: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remedial Goals: RME PRGs: Carcinogenic PRG [d]	Preliminary Remedial Goals: RME PRGs: Non-carcinogenic PRG [d]	Preliminary Remedial Goals: CTE PRGs: Carcinogenic PRG [d]	Preliminary Remedial Goals: CTE PRGs: Non-carcinogenic PRG [d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Region IX PRGs: >PRG (ca)	Maximum Detect Evaluation: Region IX PRGs: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Incremental Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[f]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
2-Butanone	2	174	1%	9.00E+00	–	9.00E+00	–	–	2.9E+07 sat	–	2.9E+07 sat	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
2-Hexanone	7	175	4%	5.00E+01	–	5.00E+01	–	–	1.1E+05 sat	–	1.1E+05 sat	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
4-Methyl-2-Pentanone	1	175	1%	2.00E+00	–	2.00E+00	–	–	4.1E+06 sat	–	4.1E+06 sat	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Acetone	5	138	4%	8.70E+03	–	8.70E+03	–	–	1.0E+08 max	–	1.0E+08 max	8.00E+02	Yes	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Benzene	3	175	2%	6.10E+02	–	6.10E+02	–	1.41E+03	1.17E+05	5.10E+04	1.11E+06	2.00E+00	Yes	No	No	No	4.33E-07	1%	No	5.23E-03	0%	No	1.20E-08	1%	No	5.48E-04	0%
Chloroform	11	175	6%	2.20E+00	4.06E+02	2.20E+00	–	2.00E+03	1.9E+05	7.96E+04	2.02E+06	3.00E+01	No	No	No	No	1.10E-09	0%	No	1.16E-05	0%	No	2.78E-11	0%	No	1.09E-06	0%
Ethylbenzene	5	174	3%	1.40E+04	–	1.40E+04	–	–	4.0E+05 sat	–	1.23E+07	7.00E+02	Yes	–	No	–	–	–	No	–[h]	–	–	–	–	No	–	–
Tetrachloroethylene (PCE)	1	175	1%	2.00E+00	–	2.00E+00	–	1.31E+03	1.29E+05	4.19E+04	1.48E+06	3.00E+00	No	No	No	No	1.53E-09	0%	No	1.55E-05	0%	No	4.77E-11	0%	No	1.35E-06	0%
Toluene	26	175	15%	4.10E+04	1.76E+03	1.76E+03	–	–	6.5E+05 sat	–	6.5E+05 sat	6.00E+02	Yes	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Xylenes, Total	6	175	3%	9.80E+04	–	9.80E+04	–	–	4.1E+05 sat	–	4.1E+05 sat	1.00E+04	Yes	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																											
2-Methylnaphthalene	6	148	4%	2.70E+05	–	2.70E+05	–	–	6.8E+05 sat	–	6.8E+05 sat	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Bis(2-ethylhexyl) Phthalate	6	148	4%	4.20E+02	–	4.20E+02	–	1.23E+05	1.23E+07	2.80E+06	7.38E+07	–	–	No	No	No	3.41E-09	0%	No	3.41E-05	0%	No	1.50E-10	0%	No	5.69E-06	0%
Diethyl Phthalate	4	148	3%	2.50E+02	–	2.50E+02	–	–	1.0E+08 max	–	1.0E+08 max	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Di-n-butyl Phthalate	12	148	8%	3.07E+05	2.15E+04	2.15E+04	–	–	6.16E+07	–	1.0E+08 max	2.70E+05	Yes	–	No	–	–	–	No	3.49E-04	0%	–	–	–	No	–[h]	–
Fluoranthene	1	148	1%	3.80E+01	–	3.80E+01	–	–	2.20E+07	–	1.0E+08 max	2.10E+05	No	–	No	–	–	–	No	1.73E-06	0%	–	–	–	No	–[h]	–
Hexachlorobenzene	1	148	1%	2.20E+02	–	2.20E+02	–	1.08E+03	4.92E+05	2.45E+04	2.95E+06	1.00E+02	Yes	No	No	No	2.04E-07	0%	No	4.47E-04	0%	No	8.99E-09	1%	No	7.45E-05	0%
Naphthalene	6	148	4%	1.28E+05	–	1.28E+05	–	4.20E+03	1.88E+05	4.12E+05	2.2E+05 sat	4.00E+03	Yes	Yes	No	Yes	3.05E-05	70%	No	6.82E-01	52%	No	3.11E-07	32%	No	–[h]	–
n-Nitrosodiphenylamine	6	148	4%	6.67E+04	–	6.67E+04	–	3.52E+05	1.23E+07	7.99E+06	7.38E+07	6.00E+01	Yes	No	No	No	1.90E-07	0%	No	5.42E-03	0%	No	8.35E-09	1%	No	9.03E-04	1%
Phenol	15	148	10%	1.20E+03	7.31E+03	1.20E+03	–	–	1.0E+08 max	–	1.0E+08 max	5.00E+03	No	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Explosives (ug/kg) by Method 8330																											
2-Amino-4,6-dinitrotoluene	1	149	1%	3.10E+02	–	3.10E+02	–	–	1.23E+05	–	5.17E+07	–	–	–	No	–	–	–	No	2.52E-03	0%	–	–	–	No	6.00E-06	0%
4-Amino-2,6-dinitrotoluene	1	149	1%	2.28E+02	–	2.28E+02	–	–	1.23E+05	–	3.69E+07	–	–	–	No	–	–	–	No	1.85E-03	0%	–	–	–	No	6.18E-06	0%
1,3-Dinitrobenzene	1	149	1%	6.30E+02	–	6.30E+02	–	–	6.16E+04	–	3.69E+05	–	–	–	No	–	–	–	No	1.02E-02	1%	–	–	–	No	1.71E-03	1%
2,4-Dinitrotoluene	6	152	4%	7.00E+03	–	7.00E+03	–	–	1.23E+06	–	7.38E+06	4.00E-02	Yes	–	No	–	–	–	No	5.69E-03	0%	–	–	–	No	9.48E-04	1%
2,6-Dinitrotoluene	1	150	1%	4.40E+01	–	4.40E+01	–	–	6.16E+05	–	3.69E+06	3.00E-02	Yes	–	No	–	–	–	No	7.15E-05	0%	–	–	–	No	1.19E-05	0%
2,4,6-Trinitrotoluene	3	149	2%	7.86E+03	–	7.86E+03	–	5.75E+04	3.08E+05	1.31E+06	1.85E+06	–	–	No	No	No	1.37E-07	0%	No	2.55E-02	2%	No	6.02E-09	1%	No	4.26E-03	3%
HMX	1	148	1%	1.40E+03	–	1.40E+03	–	–	3.08E+07	–	1.0E+08 max	–	–	–	No	–	–	–	No	4.55E-05	0%	–	–	–	No	–[h]	–
RDX	6	149	4%	1.40E+04	–	1.40E+04	–	1.57E+04	1.85E+06	3.56E+05	1.11E+07	–	–	No	No	No	6.93E-07	2%	No	7.58E-03	1%	No	3.93E-08	4%	No	1.26E-03	1%
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	40	112	36%	6.90E+01	2.23E+02	6.90E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	23	112	21%	3.70E+04	2.90E+03	2.90E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Gasoline	11	143	8%	1.60E+03	–	1.60E+03	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg) by 8015E																											
Motor Oils	29	31	94%	5.90E+01	1.67E+01	1.67E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Diesel Fuel	12	31	39%	2.70E+01	1.33E+01	1.33E+01	–	–[j]	–[j]	–[j]	–[j]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other Inorganics (mg/kg) by Method 300.0 or (mg/kg) by Method E314																											
Perchlorate	14	170	8%	1.60E+00	8.62E-02	8.62E-02	–	–	1.02E+02	–	4.65E+02	–	–	–	No	–	–	–	No	8.49E-04	0%	–	–	–	No	1.85E-04	0%
Nitrate as N	105	105	100%	5.27E+01	4.37E+00	4.37E+00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dioxins/Furans (ug/kg) by Method 8290															No	No											
Total 2,3,7,8-TCDD TEQ	14	14	100%	2.37E-02	6.08E-03	6.08E-03	–	1.59E-02	–	3.06E-01	–	–	–	Yes	–	No	3.82E-07	1%	–	–	–	No	1.99E-08	2%	–	–	–
Metals (mg/kg) by Method 6010B															No	No											
Aluminum	148	148	100%	1.90E+05	1.36E+04	1.36E+04	1.48E+04	–	1.0E+05 max	–	1.0E+05 max	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–	–
Antimony	6	148	4%	1.03E+02	–	1.03E+02	3.06E+00	–	4.09E+02	–	1.87E+03	3.00E+02	No	–	No	–	–	–	No	2.52E-01	19%	–	–	–	No	5.52E-02	44%
Arsenic	103	148	70%	1.24E+01	2.79E+00	2.79E+00	6.86E+00	2.51E-01	2.6E+02	4.83E+00	1.30E+03	1.00E+00	Yes	Yes	No	Yes	1.11E-05	25%	No	1.09E-02	1%	No	5.78E-07	59%	No	2.15E-03	2%
Barium	148	148	100%	8.04E+02	9.14E+01	9.14E+01	1.73E+02	–	1.0E+05 max	–	1.0E+05 max	8.20E+01	Yes	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Beryllium	108	148	73%	1.10E+00	1.27E+00	1.10E+00	6.69E-01	2.24E+03	1.94E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	4.91E-10	0%	No	5.67E-04	0%	No	1.43E-11	0%	No	1.21E-04	0%
Cadmium	90	148	61%	1.56E+02	8.86E+00	8.86E+00	2.35E+00	2.99E+03	4.51E+02	1.0E+05 max	2.33E+03	4.00E-01	Yes	No	No	No	2.96E-09	0%	No	1.96E-02	2%	No	–	–	No	3.81E-03	3%
Calcium	148	148	100%	7.10E+04	8.72E+03	8.72E+03	4.60E+04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	148	148	100%	1.71E+02	1.16E+01	1.16E+01	2.69E+01	4.48E+02	–	1.5E+04	–	2.00E+00	Yes	No	–	No	2.59E-08	0%	–	–	–	No	7.54E-10	0%	–	–	–
Cobalt	147	148	99%	6.60E+00	4.06E+00	4.06E+00	6.98E+00	1.92E+03	1.33E+04	6.6E+04	7.38E+04	–	–	No	No	No	2.11E-09	0%	No	3.05E-04	0%	No	6.16E-11	0%	No	5.52E-05	0%
Copper	133	148	90%	1.67E+04	8.39E+02	8.39E+02	6.41E+00	–	4.09E+04	–	1.0E+05 max	–	–	–	No	–	–	–	No	2.05E-02	2%	–	–	–	No	–[h]	–
Iron	148	148	100%	1.99E+04	5.94E+03	5.94E+03	1.84E+04	–	1.0E+05 max	–	1.0E+05 max	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Lead[m]	147	148	99%	1.58E+03	9.34E+01	9.34E+01	1.51E+01	–	–	–	–	–	–	–	–	–	–	–	–	–[k]	–[k]	–	–	–	–	–[k]	–[k]
Magnesium	148	148	100%	8.34E+03	2.72E+03	2.72E+03	8.37E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	147	148	99%	7.11E+02	1.03E+02	1.03E+02	2.91E+02	–	1.95E+04	–	9.92E+04	–	–	–	No	–	–	–	No	5.29E-03	0%	–	–	–	No	1.04E-03	1%
Mercury[l]	122	148	82%	7.10E+00	4.95E-01	4.95E-01	2.20E-01	–	3.07E+02	–	1.40E+03	–	–	–	No	–	–	–	No	1.61E-03	0%	–	–	–	No	3.54E-04	0%
Nickel	148	148	99%	1.12E+02	1.24E+01	1.24E+01	1.53E+01	–	2.04E+04	–	9.33E+04	7.00E+00	Yes	–	No	–	–	–	No	6.07E-04	0%	–	–	–	No	1.33E-04	0%

Table G-A-11: Risk-Based Screening of Subsurface Soil (0-10 ft bgs) for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[j]	% Contribution to HI
Potassium	148	148	100%	7.94E+03	1.22E+03	1.22E+03	4.89E+03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	14	148	9%	4.70E+00	2.06E+00	2.06E+00	3.20E-01	–	5.11E+03	–	2.33E+04	3.00E-01	Yes	–	No	–	–	–	No	4.03E-04	0%	–	–	–	No	8.83E-05	0%
Silver	3	148	2%	5.80E+00	–	5.80E+00	5.39E-01	–	5.11E+03	–	2.33E+04	2.00E+00	Yes	–	No	–	–	–	No	1.14E-03	0%	–	–	–	No	2.49E-04	0%
Sodium	49	148	33%	6.76E+03	6.61E+02	6.61E+02		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thallium	2	148	1%	1.52E+01	–	1.52E+01		–	6.75E+01	–	3.08E+02	–	–	–	No	–	–	–	No	2.25E-01	17%	–	–	–	No	4.94E-02	39%
Vanadium	148	148	100%	6.09E+01	1.44E+01	1.44E+01	7.18E+01	–	1.02E+03	–	4.55E+03	3.00E+02	No	–	No	–	–	–	No	1.41E-02	1%	–	–	–	No	3.17E-03	3%
Zinc	148	148	100%	2.91E+04	1.51E+03	1.51E+03	7.79E+01	–	1.0E+05 max	–	1.0E+05 max	6.20E+02	Yes	–	No	–	–	–	No	–[g]	–	–	–	–	No	–[g]	–
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	4E-05			1E+00			1E-06			1E-01	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	4E-05			1E+00			1E-06			1E-01	

–	= no data or not applicable	PHC	= petroleum hydrocarbon
%	= percent	RDX	= Hexahydro-1,3,5-trinitro-1,3,5-triazine
ca	= carcinogenic	HMX	= Octahydro-1357-tetranitro-1357-tetrazocine
nc	= noncarcinogenic	TEQ	= toxicity equivalent (as estimated in Table D-10).
mg/kg	= milligrams per kilogram	FOD	= Frequency of Detection
HI	= hazard index	RME	= reasonable maximum exposure
ug/kg	= micrograms per kilogram	CTE	= central tendency exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

Table G-A-12: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

				Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
				RME PRGs		CTE PRGs		Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG[c]	Non-carcinogenic PRG[c]	Carcinogenic PRG[c]	Non-carcinogenic PRG[c]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[d]	% Contribution to Risk	>PRG (nc)	HQ[e]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Acetone	8.70E+00	8.70E+00	1.9E-02	--	1.70E+01	--	9.81E+01	--	No	--	--	--	No	1.12E-03	0%	--	--	--	No	1.94E-04	0%
Benzene	6.10E-01	6.10E-01	2.3E-03	1.30E-03	--	7.50E-03	--	Yes	--	Yes	1.77E-06	3%	--	--	--	No	3.07E-07	3%	--	--	--
Chloroform	2.20E-03	2.20E-03	1.1E-05	4.20E-04	--	2.42E-03	--	No	--	No	2.62E-08	0%	--	--	--	No	4.54E-09	0%	--	--	--
Ethylbenzene	1.40E+01	1.40E+01	6.1E-02	--	5.50E+00	--	3.17E+01	--	No	--	--	--	No	1.11E-02	0%	--	--	--	No	1.92E-03	0%
Hexachlorobenzene	2.20E-01	2.20E-01	3.7E-06	2.10E-05	--	1.21E-04	--	No	--	No	1.76E-07	0%	--	--		No	3.05E-08	0%	--	--	--
Methyl ethyl ketone	9.00E-03	9.00E-03	2.2E-05	--	2.60E+01	--	1.50E+02	--	No	--	--	--	No	8.46E-07		--	--	--	No	1.47E-07	0%
Methyl isobutyl ketone	2.00E-03	2.00E-03	8.0E-06	--	1.60E+01	--	9.23E+01	--	No	--	--	--	No	5.00E-07		--	--	--	No	8.67E-08	0%
2-Methylnaphthalene	2.70E+02	2.70E+02	3.1E-02	--	3.50E+00	--	2.02E+01	--	No	--	--	--	No	8.86E-03	0%	--	--	--	No	1.54E-03	0%
Naphthalene	1.30E+02	1.30E+02	2.4E-02	3.58E-04	1.60E-02	2.06E-03	9.23E-02	Yes	Yes	Yes	6.70E-05	97%	Yes	1.50E+00	65%	Yes	1.17E-05	97%	No	2.60E-01	65%
Tetrachloroethene	2.00E-03	2.00E-03	4.0E-05	1.60E-03	--	9.23E-03	--	No	--	No	2.50E-08	0%	--	--		No	4.33E-09	0%	--	--	--
Toluene	--	1.80E+03	7.7E-03	--	2.00E+00	--	1.15E+01	--	No	--	--	--	No	3.85E-03	0%	--	--	--	No	6.67E-04	0%
Xylenes, Total	9.80E+01	9.80E+01	4.3E-01	--	5.50E-01	--	3.17E+00	--	No	--	--	--	No	7.82E-01	34%	--	--	--	No	1.35E-01	34%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:											7E-05			2E+00			1E-05			4E-01	

-- = no data or not applicable
% = percent
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
ug/kg = micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[c] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[d] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[e] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[f] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

Table G-A-13: Risk-Based Screening of Sediment for (Current/Future) Industrial Receptor, Utilizing California-Modified Toxicity Values

								Preliminary Remedial Goals					Maximum Detect Evaluation			RME Evaluation						CTE Evaluation					
								Region IX PRGs		CTE PRGs				Region IX PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[i]	% Contribution to HI
Volatile Organic Chemicals (ug/kg) by Method 8260B																											
Toluene	2	19	11%	8.00E-01	--	8.00E-01	--	--	6.5E+05 sat	--	6.5E+05 sat	6.00E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Semivolatile Organic Chemicals (ug/kg) by Method 8270C-SIM																											
Pyrene	1	19	5%	2.00E+00	--	2.00E+00	--	--	3.07E+07	--	1.0E+08 max		Yes	--	No	--	--	--	No	6.52E-08	0%	--	--	--	No	--[d]	--
Total Petroleum Hydrocarbons (mg/kg) by 8015B DRO																											
Motor Oils	19	19	100%	1.50E+02	5.24E+01	5.24E+01	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Diesel Fuel	12	19	63%	6.00E+00	8.89E+00	6.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Gasoline	1	19	5%	1.00E+00	--	1.00E+00	--	--[j]	--[j]	--[j]	--[j]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (mg/kg) by Method 6010B																											
Aluminum	19	19	100%	1.69E+04	9.77E+03	9.77E+03	1.48E+04	--	1.0E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	2.51E-01	2.56E+02	4.83E+00	1.30E+03	1.00E+00	Yes	Yes	No	Yes	3.67E-06	100%	No	3.60E-03	20%	No	1.91E-07	100%	No	7.11E-04	20%
Barium	19	19	100%	8.17E+01	4.61E+01	4.61E+01	1.73E+02	--	6.98E+04	--	1.0E+05 max	8.20E+01	No	--	No	--	--	--	No	6.61E-04	4%	--	--	--	No	--[d]	--
Beryllium	19	19	100%	9.80E-01	3.87E-01	3.87E-01	6.69E-01	6.8E+03	2.01E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	5.73E-11	0%	No	1.93E-04	1%	No	5.03E-12	0%	No	4.26E-05	1%
Cadmium	19	19	100%	3.40E-01	1.29E-01	1.29E-01	2.35E+00	9.0E+03	5.08E+02	1.0E+05 max	2.33E+03	4.00E-01	No	No	No	No	1.44E-11	0%	No	2.55E-04	1%	No	--	--	No	5.56E-05	2%
Calcium	19	19	100%	1.65E+04	1.10E+04	1.10E+04	4.60E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	19	19	100%	7.10E+00	4.54E+00	4.54E+00	2.69E+01	1.4E+03	--	1.5E+04	--	2.00E+00	Yes	No	--	No	3.36E-09	0%	--	--	--	No	2.95E-10	0%	--	--	--
Cobalt	19	19	100%	2.70E+00	1.69E+00	1.69E+00	6.98E+00	5.8E+03	1.74E+04	6.6E+04	7.36E+04	--	--	No	No	No	2.92E-10	0%	No	9.72E-05	1%	No	2.56E-11	0%	No	2.29E-05	1%
Copper	19	19	100%	6.40E+00	2.77E+00	2.77E+00	6.41E+00	--	4.09E+04	--	1.0E+05 max	--	--	--	No	--	--	--	No	6.78E-05	0%	--	--	--	No	--[d]	--
Iron	19	19	100%	7.72E+03	4.83E+03	4.83E+03	1.84E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Lead[m]	19	19	100%	1.21E+01	5.72E+00	5.72E+00	1.51E+01	--	--	--	--	--	--	--	--	--	--	--	--	--[k]	--[k]	--	--	--	--	--[k]	--[k]
Magnesium	19	19	100%	3.71E+03	2.00E+03	2.00E+03	8.37E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	19	19	100%	1.21E+02	7.33E+01	7.33E+01	2.91E+02	--	2.26E+04	--	9.92E+04	--	--	--	No	--	--	--	No	3.24E-03	18%	--	--	--	No	7.39E-04	20%
Mercury[l]	19	19	100%	3.20E-01	1.10E-01	1.10E-01	2.20E-01	--	3.07E+02	--	1.40E+03	--	--	--	No	--	--	--	No	3.58E-04	2%	--	--	--	No	7.85E-05	2%
Nickel	19	19	100%	4.00E+00	2.35E+00	2.35E+00	1.53E+01	--	2.04E+04	--	9.33E+04	7.00E+00	No	--	No	--	--	--	No	1.15E-04	1%	--	--	--	No	2.52E-05	1%
Potassium	19	19	100%	1.17E+03	7.49E+02	7.49E+02	4.89E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	1	19	5%	1.90E-01	--	1.90E-01	3.20E-01	--	5.11E+03	--	2.33E+04	3.00E-01	No	--	No	--	--	--	No	3.72E-05	0%	--	--	--	No	8.14E-06	0%
Sodium	7	19	37%	5.32E+01	--	5.32E+01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	19	19	100%	1.44E+01	8.86E+00	8.86E+00	7.18E+01	--	9.59E+02	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	9.24E-03	52%	--	--	--	No	1.95E-03	54%
Zinc	19	19	100%	1.96E+01	1.27E+01	1.27E+01	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	6.20E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:																	4.E-06			2.E-02			2.E-07			4.E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:																	6.E-11			6.E-04			5.E-12			1.E-04	

--	= no data or not applicable	ug/kg	= micrograms per kilogram
%	= percent	PHC	= petroleum hydrocarbon
ca	= carcinogenic	FOD	= Frequency of Detection
nc	= noncarcinogenic	RME	= reasonable maximum exposure
mg/kg	= milligrams per kilogram	CTE	= central tendency exposure
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text; CAL-Modified PRG used, where available.

[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.

[f] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[g] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[h] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[i] HQ = EPC / CTE Noncarcinogic PRG

[j] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).

[k] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

[l] PRG is for mercury chloride

[m] The 800 mg/kg screening level for lead was assigned for both the RME PRG and the CTE PRG since this value is based on blood-lead levels and not a reference dose.

Shading identifies COPCs with maximum detects above PRGs.

Table G-A-14: Toxicity Values Used in Estimating Site-Specific PRGs, Utilizing California-Modified Toxicity Values Where Appropriate

Chemical	SFo (mg/kg-d)	RfDo (1/(mg/kg-d))	SFi (mg/kg-d)	RfDi (1/(mg/kg-d))
2-Methylaphthalene	--	4.0E-03	--	4.0E-03
Naphthalene	1.2E-01	2.0E-02	1.2E-01	8.6E-04
RDX	1.1E-01	3.0E-03	1.1E-01	3.0E-03
Dioxins (TCDD TEQ)	1.5E+05	--	1.5E+05	--
Perchlorate	--	1.0E-04	--	--
Aluminum	--	1.0E+00	--	1.4E-03
Antimony	--	4.0E-04	--	--
Arsenic	9.5E+00	3.0E-04	1.2E+01	--
Cadmium	--	5.0E-04	6.3E+00	--
Copper	--	4.0E-02	--	--
Lead	--	--	--	--
Thallium	--	6.6E-05	--	--
Zinc	--	3.0E-01	--	--

Source: EPA Region IX Preliminary Remediation Goals (PRG) Tables, dated October 2004

SFo = Oral slope factor

mg/kg-d = milligrams per kilograms per day

RfDo = Oral reference dose

SFi = Inhalation slope factor

RfDi = Inhalation reference dose

-- = Toxicity value not available

CAL-Modified Toxicity values shaded in pumpkin.

Table G-A-15: Site-Specific PRGs for Construction/Utility Worker, Casual Trespasser and EOD Range Supervisor, Utilizing California-Modified Toxicity Values

		Construction/Utility Worker				Adult Casual Trespasser				Range Supervisor			
		RME PRGs		CTE PRGs		RME PRGs		CTE PRGs		RME PRGs		CTE PRGs	
Chemical	CAS No.	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG
Semivolatile Organic Chemicals by Method 8270C (ug/kg)													
2-Methylnaphthalene	91203	--	6.29E+05	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat	--	6.77E+05 sat
Naphthalene	91203	6.02E+04	1.82E+05	2.23E+05 sat	2.23E+05 sat	4.77E+04	2.23E+05 sat	2.23E+05 sat	2.23E+05 sat	2.23E+05 sat	2.23E+05 sat	2.23E+05 sat	2.23E+05 sat
Explosives by Method 8330 (ug/kg)													
RDX	121824	5.05E+04	7.15E+05	1.01E+06	2.38E+06	4.93E+04	3.41E+06	4.49E+05	1.24E+07	2.97E+05	9.23E+06	8.66E+06	2.69E+08
Other Inorganics by Method E314 (mg/kg)													
Perchlorate	7601903	--	3.09E+01	--	1.23E+02	--	2.03E+02	--	4.66E+02	--	5.08E+02	--	1.13E+04
Dioxins/Furans (ug/kg) by Method 8290													
Total 2,3,7,8-TCDD TEQ	7601903	4.42E-02	--	9.90E-01	--	3.75E-02	--	3.30E-01	--	3.02E-01	--	7.44E+00	--
Metals by Method 6010B (mg/kg)													
Aluminum	7429905	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max
Antimony	7440360	--	1.24E+02	--	4.96E+02	--	8.18E+02	--	1.87E+03	--	1.28E+03	--	4.54E+04
Arsenic	7440382	6.98E-01	8.50E+01	1.56E+01	3.18E+02	5.93E-01	4.95E+02	5.21E+00	1.35E+03	4.76E+00	1.28E+03	1.17E+02	3.16E+04
Cadmium	7440439	2.49E+04	1.54E+02	2.87E+05	6.16E+02	5.98E+04	1.01E+03	5.17E+05	2.33E+03	9.00E+03	2.54E+03	5.77E+05	5.66E+04
Copper	7440508	--	1.24E+04	--	4.96E+04	--	8.18E+04	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max
Lead	7439921	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	7440280	--	2.04E+01	--	8.18E+01	--	1.35E+02	--	3.08E+02	--	3.37E+02	--	7.49E+03
Zinc	7440666	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max	--	1.00E+05 max

Notes:
PRG = Preliminary remediation goal
-- = PRG not available
mg/kg = Milligrams per kilogram
EOD = Explosive Ordinance Disposal
CAL-Modified PRGs shaded in pumpkin.

Table G-A-16: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for Construction Worker, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.29E+05	--	6.8E+05 sat	--	--	--	No	4.29E-01	37%	--	--	--	No	--[i]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	6.02E+04	1.82E+05	2.2E+05 sat	2.2E+05 sat	Yes	2.13E-06	41%	No	7.03E-01	61%	No	--[i]	--	No	--[i]	--
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	6.98E-01	8.50E+01	1.56E+01	3.18E+02	Yes	3.04E-06	59%	No	2.49E-02	2%	No	1.36E-07	100%	No	6.66E-03	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													5E-06			1E+00			1E-07			7E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													5E-06			1E+00			1E-07			7E-03	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

Table G-A-17: Site-Specific Risk-Based Evaluation of Subsurface Soil (0-10 ft bgs) EPCs for Construction Worker, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	6	148	4%	2.70E+05	--	2.70E+05	--	--	6.29E+05	--	6.8E+05 sat	--	--	--	No	4.29E-01	15%	--	--	--	No	--[j]	--
Naphthalene	6	148	4%	1.28E+05	--	1.28E+05	--	6.02E+04	1.62E+05	2.2E+05 sat	2.2E+05 sat	Yes	2.13E-06	33%	No	7.03E-01	24%	No	--[j]	--	No	--[j]	--
Explosives (ug/kg) by Method 8330																							
RDX	6	149	4%	1.40E+04	--	1.40E+04	--	5.05E+04	7.15E+05	1.01E+06	2.38E+06	No	2.77E-07	4%	No	1.96E-02	1%	No	1.39E-08	7%	No	5.88E-03	1%
Dioxins/Furans (ug/kg) by Method 8290																							
Total 2,3,7,8-TCDD TEQ	14	14	100%	2.37E-02	6.08E-03	6.08E-03	--	4.42E-02	--	9.90E-01	--	No	1.36E-07	2%	--	--	--	No	6.14E-09	3%	--	--	--
Metals (mg/kg) by Method 6010B																							
Aluminum	148	148	100%	1.90E+05	1.36E+04	1.36E+04	1.48E+04	--	1.0E+05 max	--	1.0E+05 max	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	6	148	4%	1.03E+02	--	1.03E+02	3.06E+00	--	1.24E+02	--	4.96E+02	--	--	--	No	8.31E-01	29%	--	--	--	No	2.08E-01	47%
Arsenic	103	148	70%	1.24E+01	2.79E+00	2.79E+00	6.86E+00	7.0E-01	8.50E+01	1.56E+01	3.18E+02	Yes	4.00E-06	61%	No	3.28E-02	1%	No	1.79E-07	90%	No	8.77E-03	2%
Cadmium	90	148	61%	1.56E+02	8.86E+00	8.86E+00	2.35E+00	2.49E+04	1.54E+02	2.87E+05	6.16E+02	No	3.56E-10	0%	No	5.75E-02	2%	No	3.08E-11		No	1.44E-02	3%
Copper	133	148	90%	1.67E+04	8.39E+02	8.39E+02	6.41E+00	--	1.24E+04	--	4.96E+04	--	--	--	No	6.77E-02	2%	--	--	--	No	1.69E-02	4%
Lead	147	148	99%	1.58E+03	9.34E+01	9.34E+01	1.51E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	2	148	1%	1.52E+01	--	1.52E+01	4.20E-01	--	2.04E+01	--	8.18E+01	--	--	--	No	7.45E-01	26%	--	--	--	No	1.86E-01	42%
Zinc	148	148	100%	2.91E+04	1.51E+03	1.51E+03	7.79E+01	--	1.0E+05 max	--	1.0E+05 max	--	--	--	--	--	--	--	--	--	--	--	--
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													7E-06			3E+00			2E-07			4E-01	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													7E-06			3E+00			2E-07			4E-01	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

Table G-A-18: Site-Specific Risk-Based Evaluation of Sediment EPCs for Construction Worker, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	7.00E-01	8.50E+01	1.56E+01	3.18E+02	Yes	1.32E-06	100%	No	1.08E-02	100%	No	5.91E-08	100%	No	2.90E-03	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													1E-06			1E-02			6E-08			3E-03	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													--			--			--			--	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects.

[e] Incremental cancer risk = 1E-06 x (EPC / Carcinogenic PRG)

[f] The excess risks/hazards provided in these columns are the potential risks or hazards due to exposure to estimated background concentrations at Lualualei Branch.

Shading identifies COPCs with maximum detects above PRGs.

Table G-A-19: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for Adult Trespasser, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylnaphthalene	1	72	1%	2.70E+05	--	2.70E+05	--	--	6.8E+05 sat	--	6.8E+05 sat	--	--	--	No	--[i]	--	--	--	--	No	--[i]	--
Naphthalene	1	72	1%	1.28E+05	--	1.28E+05	--	4.77E+04	2.2E+05 sat	2.2E+05 sat	2.2E+05 sat	Yes	2.68E-06	43%	No	--[i]	--	No	--[i]	--	No	--[i]	--
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	5.93E-01	4.95E+02	5.21E+00	1.35E+03	Yes	3.57E-06	57%	No	4.28E-03	100%	No	4.07E-07	100%	No	1.57E-03	100%
							Cumulative Incremental Cancer Risk/Hazard Index Including Background:						6E-06			4E-03			4E-07			2E-03	
							Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:						6E-06			4E-03			4E-07			2E-03	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[i] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-A-20: Site-Specific Risk-Based Evaluation of Sediment EPCs for Adult Trespasser, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	5.93E-01	4.95E+02	5.21E+00	1.35E+03	Yes	1.56E-06	100%	No	1.86E-03	100%	No	1.77E-07	100%	No	6.85E-04	100%
							Cumulative Incremental Cancer Risk/Hazard Index Including Background:						2E-06			2E-03			2E-07			7E-04	
							Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:						--			--			--			--	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index		

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

[i] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-A-21: Site-Specific Risk-Based Evaluation of Surface Soil (0-2 ft bgs) EPCs for EOD Range Supervisor, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	Carcinogenic PRG [d]	Non-carcinogenic PRG [d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Semivolatile Organic Chemicals (ug/kg) by Method 8270C																							
2-Methylaphthalene	1	72	1%	2.70E+05	–	2.70E+05	–	–	6.8E+05 sat	–	6.8E+05 sat	–	–	–	No	–[i]	–	–	–	–	No	–[i]	–
Naphthalene	1	72	1%	1.28E+05	–	1.28E+05	–	2.2E+05 sat	2.2E+05 sat	2.2E+05 sat	2.2E+05 sat	No	–[i]	–	No	–[i]	–	No	–[i]	–	No	–[i]	–
Metals (mg/kg) by Method 6010B																							
Arsenic	52	72	72%	8.60E+00	2.12E+00	2.12E+00	6.86E+00	4.8E+00	1.28E+03	1.2E+02	3.16E+04	No	4.45E-07	100%	No	1.66E-03	100%	No	1.81E-08	100%	No	6.71E-05	100%
							Cumulative Incremental Cancer Risk/Hazard Index Including Background:						4E-07			2E-03			2E-08			7E-05	
							Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:						4E-07			2E-03			2E-08			7E-05	

Notes:

–	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index	EOD	= Explosive Ordinance Disposal

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.
[b] Maximum detect is the maximum detected concentration of an analyte in the medium.
[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum detect. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. PRGs for noncarcinogens consider only the adult exposure.
[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogic PRG
[i] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.

Table G-A-22: Site-Specific Risk-Based Evaluation of Sediment EPCs for EOD Range Supervisor, Utilizing California-Modified Toxicity Values

								Preliminary Remediation Goals				RME Evaluation						CTE Evaluation					
								RME PRGs		CTE PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals (mg/kg) by Method 6010B																							
Arsenic	19	19	100%	1.50E+00	9.22E-01	9.22E-01	6.86E+00	4.76E+00	1.28E+03	1.17E+02	3.18E+04	No	1.94E-07	100%	No	7.21E-04	100%	No	7.88E-09	100%	No	2.92E-05	100%
Cumulative Incremental Cancer Risk/Hazard Index Including Background:													2E-07			7E-04			8E-09			3E-05	
Cumulative Incremental Cancer Risk/Hazard Index Excluding Background:													--			--			--			--	

Notes:

--	= no data or not applicable		
%	= percent	ug/kg	= micrograms per kilogram
ca	= carcinogenic	mg/kg	= milligrams per kilogram
nc	= noncarcinogenic	FOD	= Frequency of Detection
HI	= hazard index	EOD	= Explosive Ordinance Disposal

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result. Nondetected results were excluded if the SQL exceeded 2X the maximum detected concentration.

[b] Maximum detect is the maximum detected concentration of an analyte in the medium.

[c] EPC is the minimum of either the 95% upper confidence limit (UCL) of the mean or the maximum detect. The 95% UCL is calculated using ProUCL.

[d] PRGs are based on cancer risk or noncarcinogenic health effects.

[e] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[f] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[g] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[h] HQ = EPC / CTE Noncarcinogic PRG

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Ecological Risk Assessment

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ACRONYMS AND ABBREVIATIONS

%	percent
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ATSDR	Agency for Toxic Substances and Disease Registry
BCF_i	soil-to-invertebrate bioconcentration factor
BCF_p	soil-to-plant bioconcentration factor
BCMOELP	British Columbia Ministry of Environment Lands and Parks
BERA	baseline ecological risk assessment
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
BTEX	benzene-toluene-ethylbenzene-xylenes, total
BTF_a	prey-to-predator bioconcentration factor
BW	body weight
CCC	criterion continuous concentration
CCME	Canadian Council of Ministers of the Environment
CDFG	California Department of Fish and Game
CDI	chronic daily intake
COPC	chemical of potential ecological concern
CSS	coastal sage scrub
DOI	Department of Interior
DON	Department of the Navy
EFAW	Engineering Field Activity West
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency, United States
EPC	exposure point concentration
ERA	ecological risk assessment
ERL	effects range low
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient
IRP	Installation Restoration Program
J	indicates an estimated value
JEG	Jacobs Engineering Group, Inc.
KEA	KEA Environmental
kg	kilograms
K_{oc}	organic carbon partition coefficient
K_{ow}	octanol/water partition coefficient
LOAEL	lowest-observed-adverse-effect-level
LD_{50}	lethal dose
MCAS	Marine Corps Air Station
MEC	Munitions and Explosives of Concern
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/kg/d	milligrams per kilogram per day
mg/kg dw	milligrams per kilogram on a dry weight basis
mg/L	milligrams per liter
mL/day	milliliters per day
mm	millimeter
MSL	mean sea level
NA	not analyzed or analyte is not a COPC in this medium

nd	not detected
NEESA	Naval Energy and Environmental Support Activity
ng/kg	nanograms per kilogram
NIS	sodium/iodide symporter
NOAEL	no-observed-adverse-effect level
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
RDX	cyclotrimethylenetrinitramine
RI	remedial investigation
SCV	secondary chronic value
SRA	screening risk assessment
SSL	soil screening level
SUF	site-use factor
SVOC	semivolatile organic compound
T3	triiodothyronine
T4	thyroid hormones thyroxine
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-ρ-dioxin
TEC	threshold effect concentration
TEF	toxicity equivalence factor
TEL	threshold effect level
TEQ	toxicity equivalence quotient
TRV	toxicity reference value
UCL	upper confidence limit
U.S.	United States
USACE	United States Army Corps of Engineers
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WESCO	Western Ecological Services

1. INTRODUCTION

This report documents the procedures and findings of the ecological risk assessment (ERA), conducted as part of the remedial investigation (RI) at Installation Restoration Program (IRP) Site 1, the Explosive Ordnance Disposal (EOD) Range, at Former Marine Corps Air Station (MCAS), El Toro, California. The investigation was performed by Earth Tech Inc. on behalf of the United States (U.S.) Department of Navy, Pacific Division, Naval Facilities Engineering Command under contract task order no. 0072 of the Comprehensive Long-Term Environmental Action Navy II program, contract number N62742-94-D-0048.

The phase II RI (and subsequent ERA) was performed in accordance with the Phase II RI Work Plan (Earth Tech 2001a) finalized in November 2001 and Environmental Protection Agency (EPA) guidance document, *Guidance for Conducting Remedial Investigation and Feasibility Studies Under Comprehensive Environmental Response, Compensation and Liability Act* (EPA 1988).

1.1 REPORT OBJECTIVES

The purpose of this report is to present the results of the Tier 1 ecological screening risk assessment (SRA) and Tier 2, Step 3a baseline ecological risk assessment (BERA) conducted at Site 1 in accordance with the Phase II RI Work Plan (Earth Tech 2001a). It should be noted that although the essential approach presented in the work plan was followed, certain terminologies and sequence of screening steps have been revised and/or updated in response to U. S. EPA, Region 9 comments that the technical approach and terminology be consistent with the document, *Ecological Risk Assessment Guidance for Superfund* (EPA 1997). Section 2 presents the results of the Tier 1 ecological SRA and the Scientific/Management Decision Point. Section 3 presents the results of the follow-on Tier 2, Step 3a BERA.

1.2 SITE BACKGROUND

1.2.1 Site Description

Former MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). Former MCAS El Toro covers approximately 4,738 acres. Land use around Former MCAS El Toro includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the Base Realignment and Closure (BRAC) Act.

IRP Site 1 is located in the northeast portion of Former MCAS El Toro in the foothills of the Santa Ana Mountains (Figure 1-2). Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above mean sea level (MSL). Site 1 includes the Northern EOD Range (16.9 acres) and the Southern EOD Range (16.6 acres) (BNI 1995).

Training for EOD and detonation of munitions has been conducted at Site 1 since 1952 (BNI 1995). Use of the EOD Range has been discontinued with the closure of MCAS El Toro on 2 July 1999.

The majority of recent military EOD training took place at the Northern EOD Training Range. The Southern EOD Training Range was used for EOD training by the Orange County Sheriff's Department and federal agencies (BNI 1995). Several demolition pits, a range building, and a former observation bunker constructed from metal ammunition cans are present at Site 1. Many of these metal cans were reported to be filled with the burned residue of disposed munitions such as cartridge-actuated devices and 20 millimeter (mm) ammunition (USACE 1998).

Military ordnance used at the site included hand grenades, land mines, cluster bombs, smoke bombs, and rocket warheads. Civilian and commercial explosives, such as dynamite, and plastic and gelatinous explosives have been used at the EOD Training Range. Munitions were detonated in trenches and pits, which were continually filled with soil and then reexcavated. In 1982, approximately 2,000 gallons of sulfur trioxide chlorosulfonic acid (FS smoke) were reportedly burned in trenches located in the northern portion of the site. An estimated 300,000 gallons of petroleum fuels were burned during disposal from 1952 through 1993 (JEG 1993).

In addition, there are unconfirmed reports that low-level radioactive material was disposed at the site (NEESA 1986). Perchlorate was identified as a potential contaminant of concern at Site 1 due to its use in explosives and solid rocket propellants.

1.3 RELEVANT DATA

Surface water, sediment and soil samples were collected and analyzed for traces of chemicals that may be present as a result of site activities. Groundwater samples were also collected, but the results were not used in the SRA because groundwater does not discharge to the surface in the area of the site and there are no exposure pathways to ecological receptors.

1.3.1 Surface Water

Surface water is not normally present within the Site 1 boundary and thus aquatic habitat and aquatic communities are not normally present. The Ephemeral Pond represents a unique aquatic habitat called a vernal pool. Vernal pool habitat is dry much of the year and may remain dry for several years. The habitat floods in response to major sustained precipitation events. When such an event occurs, specially adapted plants and animals that have persisted in the sediments of the Ephemeral Pond in a dormant state emerge to complete their life cycle before the habitat dries and they go dormant again.

During most of the RI investigation the Ephemeral Pond remained dry. During the winter of 2004-2005, the El Toro region experienced sufficient rainfall to flood the Ephmeral Pond and trigger reproduction of the vernal pool community. During February and March 2005, the Navy was able to sample surface water in both the Ephemeral Pond at the top of the site and runoff in the drainage swale leaving Site 1 at the bottom of the area.

One sample was collected in the Ephemeral Pond in January 2005, within two weeks of the flooding of the Ephemeral Pond. A second sample was collected from the Ephemeral Pond and one sample was collected from the swale leaving the site at the south boundary after a second major rain event in March 2005.

1.3.2 Sediment

Sediment samples were collected as dry soil samples from the Ephemeral Pond in December 2004, before the winter rains had begun. Nineteen samples (plus two duplicates) were collected from a grid pattern established across the Ephemeral Pond bottom. The samples were collected to determine if chemicals were present as a result of site activities, and, if present, were present at concentrations high enough to adversely affect the dormant vernal pool community. One member of the vernal pool community is the Riverside fairy shrimp, an endangered species.

1.3.3 Surface Soil

Prior to the Phase II RI field activities, soil investigations were conducted at Site 1 as a part of the Phase I RI, as part of the *Verification of Perchlorate* study (Earth Tech 2001b), and as part of an

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MCAS EL TORO
SSIC NO. 5090.3.A

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURE 1-1 – PROJECT LOCATION MAP

FOR ADDITIONAL INFORMATION, CONTACT:

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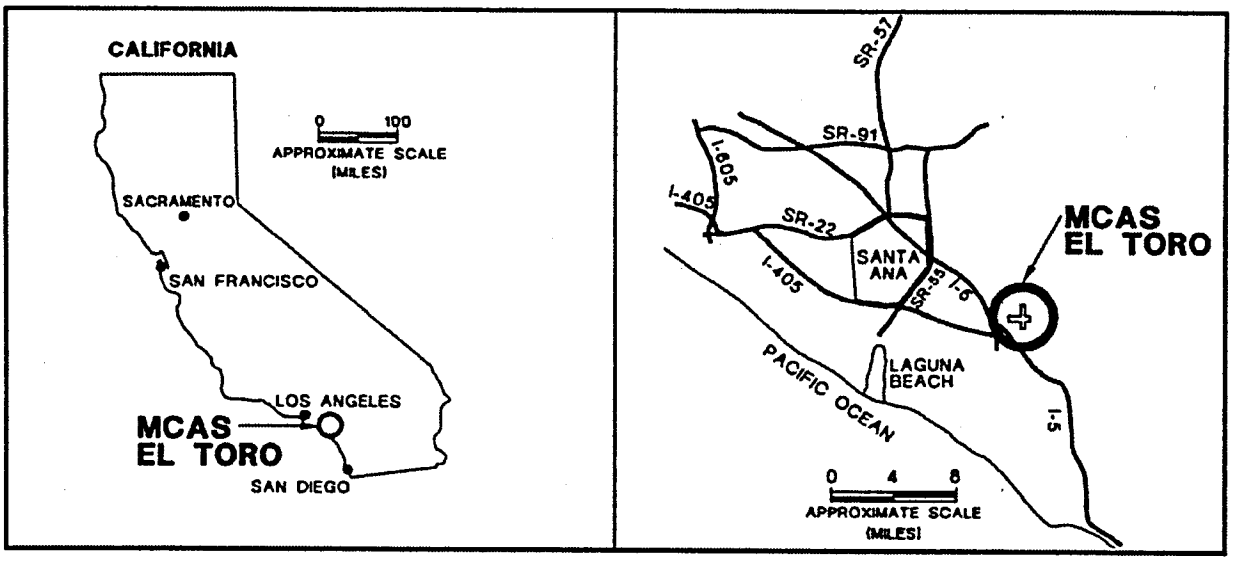

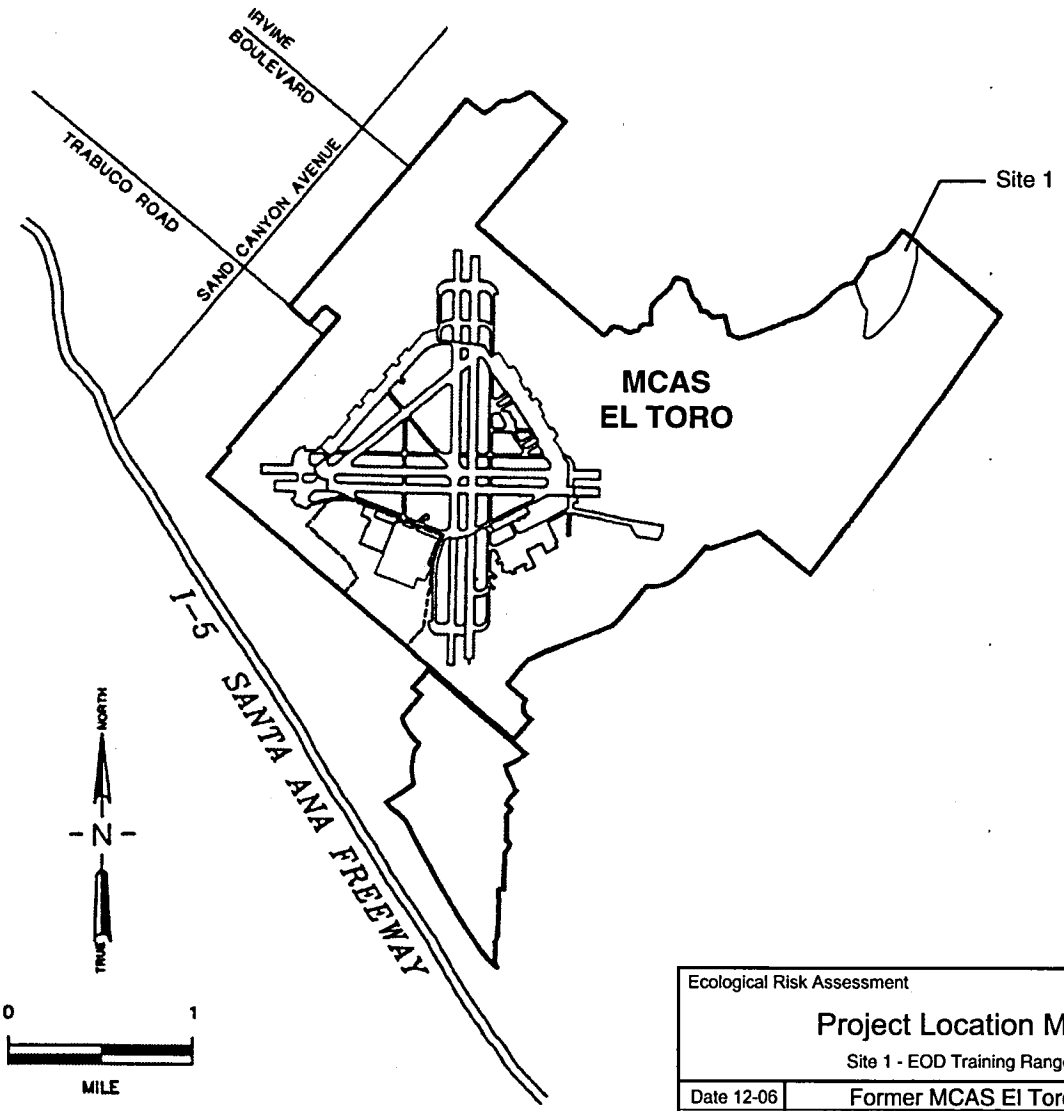

Ecological Risk Assessment		
Project Location Map Site 1 - EOD Training Range		
Date 12-06	Former MCAS El Toro	Figure 1-1
Project No. 36097	E	

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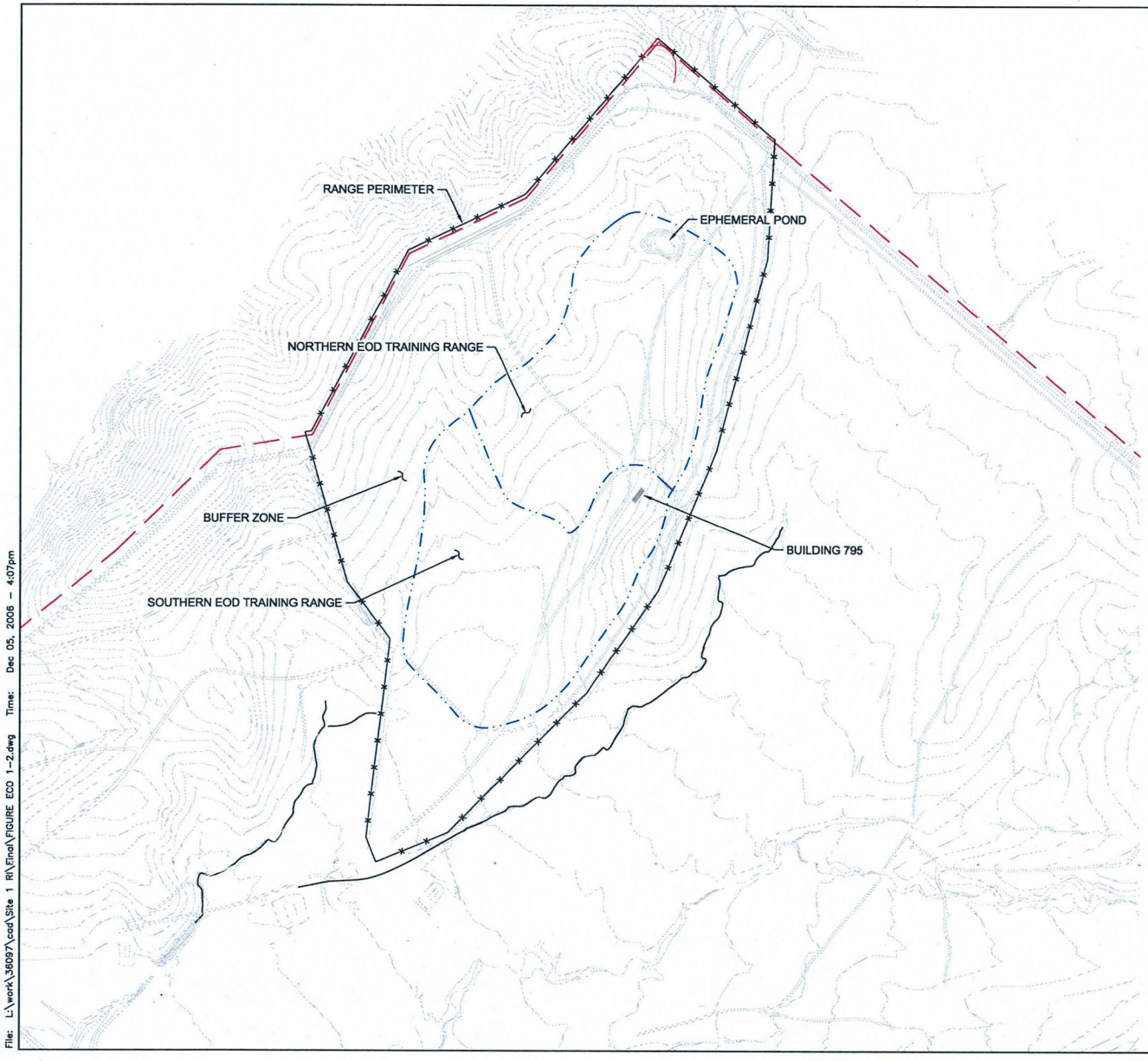

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- STREAM OR WASH

NORTH

0 200' 400'

SCALE: 1"= 400'

Phase II Remedial Investigation — Final

Site Plan

Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	1-2

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investigation of the 3.3-acre area located in the southern portion of the site in support of the *Site-Specific Environmental Baseline Survey* (Earth Tech 2001c). During the Phase II RI field activities, soil samples were collected throughout the Northern and Southern EOD ranges. Finally, during the *Ordnance and Explosives Range Evaluation* study (Earth Tech 2001d), soil samples were collected from trenches advanced at the locations of Munitions and Explosives of Concern (MEC)-related materials.

In total, 211 soil samples were collected from depths between 0 and 35 feet below ground surface (bgs). Figure 1-2 presents the soil sampling locations for the entire site. Analytical results for all soil samples collected at Site 1 are presented in Appendix E. The results are separated by depth distribution: 0 feet to 6 feet bgs, greater than 6 feet to 10 feet bgs, and greater than 10 feet to 35 feet bgs.

The samples collected during the Phase II RI were to be used to characterize the nature and extent of contamination, as well as to quantify any risk to human health and ecological receptors at Site 1. Because Site 1 has historically been tilled twice per year (USACE 1998), the surface soil is of a very loose consistency, which in turn causes poor recovery in surface soil samples. The *Phase II RI Work Plan* (Earth Tech 2001a) proposed sampling at 1.5 feet bgs and 5 feet bgs. The shallow samples were collected from 6 inches to 2 feet bgs, using a direct-push sampling system; however, the sleeve collected from 6 inches to 1 foot bgs, and the sleeve collected from 1 foot to 1.5 feet bgs were sent to the analytical laboratory. Samples between 1.5 feet and 6 feet bgs were also collected using the direct push sampling system. These 1.5-foot-deep samples, combined with previously collected samples at depths of 5 feet and 2 feet bgs and shallower (and appropriate samples collected during the *Munitions and Explosives of Concern Range Evaluation*), constitute the dataset for the ecological risk assessment included in this document. Of the 211 soil samples collected at Site 1, 93 were collected between 0 and 6 feet bgs.

1.4 SIGNIFICANT CHANGES FROM DRAFT SRA IN RESPONSE TO SMDP

Due to discussions with regulators and comments received on the Draft Screening Ecological Risk Assessment (Earth Tech 2003), four additional terrestrial species were added to more thoroughly represent the bird and mammal feeding guilds present at the site. This evaluation now uses the ornate shrew, deer mouse, and long-tailed weasel as representative mammals, and the western meadowlark, mourning dove, and loggerhead shrike as representative birds.

In addition, the definition of surface soil has been changed from zero to two feet to zero to six feet below the ground surface. This was done to more conservatively represent incidental ingestion of soil by burrowing mammals and the exposure of plants and soil invertebrates to deeper soils that may be brought to the surface by burrowing animals. Regulatory comments and Navy responses are included as Attachment H-14.

2. ECOLOGICAL SCREENING RISK ASSESSMENT

This ecological SRA was conducted according to the screening-level guidance presented in U.S. EPA *Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (EPA 1997). A full ERA is an eight-step process. It is organized around the framework suggested by the EPA Risk Assessment Forum (EPA 1998). The presentation of this ecological SRA has been structured according to U.S. Navy policy (DON 1999) so that it fulfills both the requirements of an EPA ecological SRA (Figure 2-1) and a U.S. Navy Tier 1 ecological SRA (Figure 2-2).

The Navy Tier 1 ecological SRA process can be described in two steps (see Figure 2-2). Step 1, equivalent to Step 1 of the EPA ecological SRA process, is the Screening Level Problem Formulation and Ecological Effects Evaluation (see Figure 2-1). This includes a habitat assessment, contaminant identification, receptor and pathway identification, and toxicity evaluation. The goal of this step is to describe the ecological setting of the site and to determine whether complete ecological exposure pathways are present, determine what chemicals may be present and characterize their toxicity.

Step 2 of the Navy Tier 1 ecological SRA process is equivalent to Step 2 of the EPA ecological SRA process. First, exposure is estimated based on conservative assumptions. Then, risk is estimated by comparing the media-specific exposure point concentrations to conservative, screening-level, media-specific benchmark values. At this point, a scientific management decision point is made to determine if the exit criteria for Tier 1, Step 2 have been met. These criteria are as follows:

1. There is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk;
2. The information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3; or
3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

2.1 TIER 1, STEP 1 – SCREENING-LEVEL PROBLEM FORMULATION

Step 1 of the ecological SRA is divided into several sections that help define the problem at the screening level. An abbreviated site history and description is given in Section 2.1.1. Assessment endpoints, measurement endpoints, representative species, exposure pathway analysis, the development of a conceptual site model, toxicity evaluation, and a description of affected media and chemicals of potential ecological concern (COPCs) are identified in Sections 2.1.2 through 2.1.8, respectively.

2.1.1 Ecological Setting

Former MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (see Figure 1-1). MCAS El Toro covers approximately 4,738 acres. Land use around Former MCAS El Toro includes commercial, light industrial, and residential. Former MCAS El Toro closed on 2 July 1999, as part of the BRAC Act.

IRP Site 1 is located in the northeast portion of Former MCAS El Toro in the foothills of the Santa Ana Mountains (see Figure 1-2). Site 1 is situated within a tributary canyon of Borrego Canyon Wash at elevations ranging from approximately 610 to 760 feet above MSL. Site 1 includes the Northern EOD Range (approximately 16.9 acres) and the Southern EOD Range (approximately 16.6 acres) (BNI 1995).

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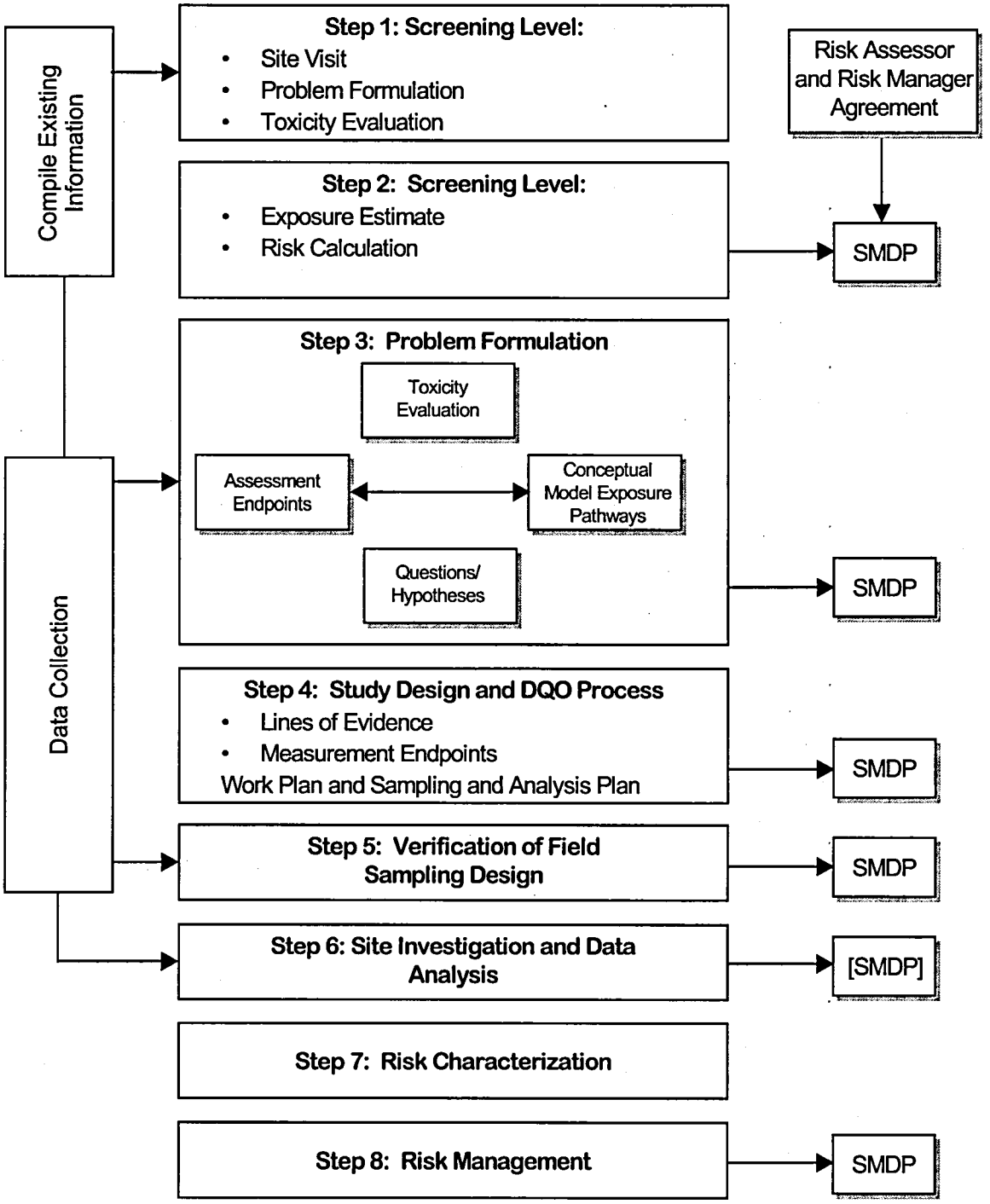

Note: SMDP = scientific management decision point

Figure 2-1: Eight-Step Ecological Risk Assessment Process Superfund

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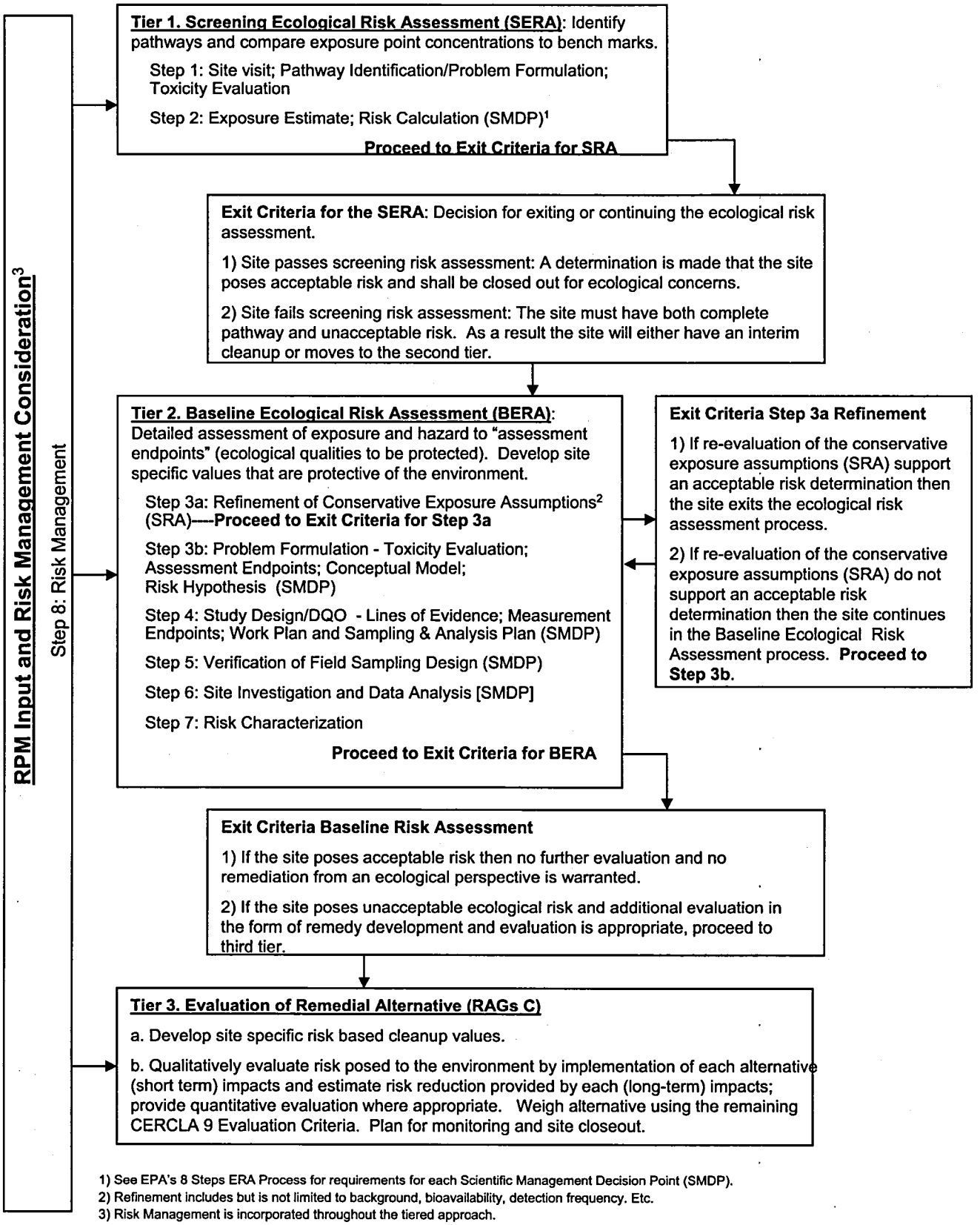
Figure 2-2: 3-Tiered Navy Approach to Ecological Risk Assessment



1) See EPA's 8 Steps ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, detection frequency. Etc.
3) Risk Management is incorporated throughout the tiered approach.

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An Ephemeral Pond is present in the northern portion of the site to reduce sheet flow across the site during rare torrential rainfall events. Seasonal accumulations of rainwater were observed in the Ephemeral Pond in 1998 and 2005. However, no ponding or accumulation contributing to surface water flow was observed from June 1999 to November 2004. The site has been characterized by fairly rapid groundwater recharge in response to storm events (JEG 1993). Results from the habitat assessment conducted as part of the Phase II RI are presented below.

2.1.1.1 VEGETATION

The dominant vegetation types at Site 1 consist of non-native grassland coastal sage scrub (CSS), and toyon-sumac chapparral. Plants found on the site are listed in Table 2-1.

- **CSS.** CSS occurs in patches on the slopes in the northern part of the property. It is typically dominated by California sagebrush (*Artemisia californica*), California encelia (*Encelia californica*), and California buckwheat (*Eriogonum fasciculatum*). Other common elements of this habitat type are prickly pear (*Opuntia littoralis*), black sage (*Salvia mellifera*), and goldenbush (*Isocoma menziesii*). The structure and composition of this habitat also appears to be a function of how long since it was disturbed. In some locations such as the west-facing slope above the main valley, the valley contains more succulents (e.g., prickly pear) than the other stands of sage scrub. The number and cover of annual species observed were limited, however, partly because of the dense canopy in some stands and partly due to the timing of the survey. There are approximately 9.74 acres of sage scrub at Site 1.

- **Toyon-sumac chapparral.** Toyon-sumac chaparral occurs primarily on the east-facing slopes above the main valley. On site, it is dominated by lemonadeberry. Subdominant elements of this vegetation type include toyon (*Heteromeles arbutifolia*) and laural sumac (*Malosma laurina*), and other CSS elements. It is a relatively tall (up to eight feet) and dense vegetation type and does not appear to have been disturbed or burned in recent times. There are approximately 2.63 acres of chaparral at Site 1.

There are also small areas of mulefat scrub, southern willow scrub, disturbed wetland, and ornamental plantings.

Mulefat scrub is dominated by its namesake (*Baccharis salicifolia*) and occurs in two locations. One is in the vicinity of the Ephemeral Pond in the northern portion of the site. The other is along a flat graded section of a hillside, north of the main valley. This latter stand also supports an understory of exotic grasses. Mulefat scrub on Site 1 ranges up to 8 feet tall and covers an area of approximately 0.03 acres.

Southern willow scrub stands consist of a few individuals of black willow (*Salix gooddingii*) up to 25 feet tall. There is approximately 0.01 acres of southern willow scrub at Site 1.

Disturbed wetland occurs in the bottom of the Ephemeral Pond (perhaps a previous stockpond). It consists of a sparse cover of a variety of weedy and wetland species including mulefat, black willow, mustard, tocalote (*Centauria melitensis*), and soft chess (*Bromus hordeaceus*). There is approximately 0.29 acres of disturbed wetland at Site 1.

The berm, which is partly responsible for the creation of the above basin, is planted with fan palms (*Washingtonia robusta*) and pines (*Pinus* sp.). These are mature specimens with an understory of CSS and annual grassland species. There is approximately 0.18 acres of ornamental plantings at Site 1.

Table 2-1: Flora Observed at Site 1

Scientific Name	Common Name
*Amaranthus albus**	tumbleweed
Malosma laurina	laurel sumac
Rhus integrifolia	lemonadeberry
*Daucus carota**	Wild carrot
Ambrosia acanthicarpa	annual burweed
Artemisia californica	California sagebrush
Artemisia dracunculcus	taragon
Baccharis salicifolia	mule fat
Baccharis pilularis ssp. consanguinea	coyote bush
Centaurea melitensis	tocalote
*Conyza sp.**	horseweed
*Cynara cardunculus**	artichoke
Encelia californica	California encelia
Euthamia occidentalis	western goldenrod
Ericameria ericoides	goldenbush
Hemizonia sp.	tarplant
Heterotheca grandiflora	telegraph weed
Isocoma menziesii	goldenbush
Lessingia filaginifolia var. *virgata*	sand-aster
Stephanomeria virgata	virgate wreath-plant
Xanthium strumarium	cocklebur
Cryptantha sp.	Cryptantha
Heliotorpium curassavicum	Helioitrope
*Brassica sp.**	mustard
*Hirschfeldia incana**	perrenial mustard
*Raphanus sativus**	wild radish
Opuntia littoralis	prickly pear
Opuntia parryi	cholla
Sambucus mexicana	blue elderberry
*Atriplex semibaccata**	Australian saltbush
*Salsola tragus**	Russian-thistle
Calystegia macrostegia	morning glory
*Convolvulus arvensis**	bindweed
Marah macrocarpus	wild cucumber
Cuscuta sp., on *Eriogonum fasciculatum*	dodder

Table 2-1: Flora Observed at Site 1 (Continued)

Scientific Name	Common Name
Chamaesyce polycarpa	fairy mats
Eremocarpus setigerus	dove weed
*Ricinus communis**	castor bean
Lotus scoparius	Deerweed
Lupinus bicolor	miniature lupine
Lupinus succulentus	arroyo lupine
*Medicago polymorpha**	bur clover
*Melilotus alba**	white sweetclover
*Erodium botrys**	filaree
*Erodium cicutarium**	red-stem filaree
*Erodium moshcatum**	green-stem filaree
*Marrubium vulgare**	horehound
Salvia apiana	white sage
Salvia mellifera	black sage
Malacothamnus fasciculatus	bush mallow
Mirabilis californica	wishbone bush
Eriogonum fasciculatum ssp. Fasciculatum	California buckwheat
*Polygonum aviculare**	yard knotweed
*Anagalus arvensis**	pimpernel
Heteromeles arbutifolia	toyon
Salix gooddingii	Godding's black willow
Mimulus aurantiacus	bush monkey-flower
*Nicotiana glauca**	tree tobacco
Solanum xantii	nightshade
Calochortus sp.	mariposa lily
Yucca whipplei	Our Lord's Candle
*Avena barbata**	slender wild oat
*Bromus diandrus**	ripgut grass
*Bromus hordeaceus**	soft chess
Bromus madritensis ssp. *rubens**	foxtail chess
Elymus condesatus	giant rye
Nasella lepida	needlegrass
Vulpia myuros var. *hirsute**	foxtail fescue

Note:
* indicates exotic species

2.1.1.2 FAUNA

A total of one reptile, 1 amphibian, 36 avian, and six mammalian species were documented on the site. The limited number of reptiles and amphibians reflects a single midwinter survey (December 2000).

Sampling for vernal pool fairy shrimp on the MCAS El Toro Conservation Area was conducted between February and March of 1998 and again at the Site 1 Ephemeral Pond in February and March of 2005. The Conservation Area is bordered by the airstation on the southwest, the foothill transportation corridor on the northeast, an arroyo and nursery on the northwest, and an arroyo and an orange grove to the southeast.

No fairy shrimp cysts were detected in any of the dry sediment samples taken in the 1998 samples (KEA 1998). Fairy shrimp were found in the Ephemeral Pond at Site 1 during both sampling periods. These were identified as Riverside fairy shrimp (*Streptocephalus woottoni*). The 1998 sampling recovered 2 males and 2 females, both without cysts. Thousands of Riverside fairy shrimp were observed in the Site 1 Ephemeral Pond in 2005.

The Site 1 Ephemeral Pond is seasonal, and its dike has been breeched, although it is currently partially plugged. It is relatively shallow, not exceeding 4.5 feet at the deepest point. The Site 1 Ephemeral Pond was cloudy to clear in 2005 and had a vigorous and diverse aquatic invertebrate community.

The pond near the Magazine Area was extensively sampled in 1998 and no fairy shrimp were found (KEA 1998)

Animals found at Site 1 are listed in Table 2-2.

Table 2-2: Fauna Observed at Site 1

Scientific Name	Common Name
Reptiles	
Sceloporus occidentalis	Western fence lizard
Amphibians	
Batrachoseps pacificus major	Garden slender salamander
Birds	
Cathartes aura	Turkey vulture
Buteo jamaicensis	Red-tailed hawk
Buteo lineatus elagans	Red-shouldered hawk
*Accipiter cooperii**	Cooper's hawk
Falco sparverius	American kestrel
Callipepla calfiornica	California quail
Zenaida macroura	Mourning dove
Otus kennicottii	Western screech owl
Calypte anna	Anna's hummingbird
Tyrannus vociferans	Cassin's kingbird
Sayornis nigricans	Black phoebe

Table 2-2: Fauna Observed at Site 1

Scientific Name	Common Name
Sayornis saya	Say's Phoebe
Corvus brachyrhynchos	Common crow
Aphelocoma coerulescens	Scrub jay
Corvus corax	Common raven
Psaltriparus minimus	Bushtit
Thryomanes bewickii	Bewick's wren
*Campylorhynchus brunneicapillus**	Cactus wren
*Polioptila californica californica**	Coastal California gnatcather
Chamaea fasciata	Wrentit
Mimus polyglottos	Northern mockingbird
Toxostoma redivivum	California thrasher
Dendroica coronata	Yellow-rumped Warbler
Pipilo crissalis	California towhee
Pipilo maculatus	Spotted towhee
*Aimophila ruficeps canescens**	Southern California rufous-crowned sparrow
Ammodramus savannarum perpallidus	Grasshopper sparrow*
Melospiza melodia	Song sparrow
Ammodramus sandwichensis	Savannah Sparrow
Zonotrichia leucophrys	White-crowned sparrow
Chondestes grammacus	Lark sparrow
Sturnella neglecta	Western meadowlark
Agelaius phoeniceus	Red-winged blackbird
Euphagus cyanocephalus	Brewer's blackbird
Carpodacus mexicanus	House finch
Carduelus psaltria	Lesser goldfinch
Mammals	
Canis latrans	Coyote
Lynx rufus	Bobcat
Spermophilus beecheyi	California ground squirrel
Thomomys bottae	Botta's pocket gopher
Sylvilagus auduboni	Desert cottaintail
*Lepus californicus bennettii**	San Diego black-tailed jackrabbit

Note:
* indicates sensitive species

2.1.1.3 SENSITIVE RESOURCES

Vegetation. CSS is considered a sensitive vegetation type by several resource agencies because it supports a number of state and federally endangered, threatened, and rare vascular plants as well as several bird and reptile species that are federally listed or are candidate species for federal listing.

Wetland resources are also considered sensitive because of their scarcity in semi-arid southern California, their value to wildlife, and recent loss of this habitat from urbanization, agriculture, and flood control projects. The mulefat and southern willow scrubs and disturbed wetland are considered sensitive wetland habitats. Mulefat scrub is only considered sensitive where it occurs in a wetland landscape position (i.e., along drainages and not on level pads). There are very limited areas of these habitats on site, which limit their significance.

Potential Wetlands and Waters of the United States. The disturbed wetland and portions of the mulefat scrub and southern willow scrub may be subject to regulation under the Clean Water Act, as administered by the United States Army Corps of Engineers (USACE). Portions of the mulefat scrub and southern willow scrub may not be jurisdictional because they no longer occur in areas subject to wetland hydrology, and they were created in uplands. All areas of these habitats that could be disturbed during remedial activities would be delineated during the Feasibility Study or Remedial Site Investigation, following USACE methods to determine their jurisdictional status.

Wildlife. Special status species include those listed by state and federal agencies (CDFG 1994; USFWS 1989, 1990, 1992, 1993) as endangered, threatened, rare, or of special concern. They also include species listed by Everett (1979).

Previous dry and wet sampling that was conducted during 1998 and 2005 in the Ephemeral Pond revealed the presence of the Riverside fairy shrimp (*Streptocephalus woottoni*), which is a federally threatened species (KEA 1998). The presence of this species confers a high degree of sensitivity on this basin and its watershed.

During the generalized biological survey that was conducted during December 2000, the entire Site 1 was covered by foot using meandering transects. Each habitat type was examined for sign (i.e., tracks and scat) and regular five-minute stops were made to look and listen for birds and other wildlife. All observed species, either listed or considered sensitive, were noted.

Four coastal California gnatcatchers (*Polioptila californica californica*), which are a federally threatened species were documented on site. They consisted of one pair and two separate individuals of unknown gender.

Three individual cactus wren (*Campylorhynchus brunneicapillus*) were documented in a cactus patch within CSS in the northwestern quadrant of the site. This bird is a federally regionally sensitive species.

One non-vocalizing grasshopper sparrow (*Ammodramus savannarum*) was documented in non-native grassland in the north-central portion of the site.

Two southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*) were documented in CSS in the north-central portion of the site (federally regionally sensitive).

Evidence (scat or feces) of San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) was found in non-native grassland in the western portion of site between two patches of CSS.

2.1.2 Assessment Endpoints

Assessment endpoints are "explicit expressions of the actual environmental value that is to be protected" (EPA 1992). Assessment endpoints are critical to problem formulation, because they link the risk assessment to management concerns and are central to developing the conceptual site model (EPA 1997).

According to EPA guidance (EPA 1997), the assessment endpoint for any ecological SRA is an adverse effect on an ecological receptor. Ecological receptors are defined as plant and animal populations, communities, habitats, or sensitive environments. More specifically, the assessment endpoints for this ecological SRA include the following:

- Protection and maintenance (survival, growth, and reproduction) of aquatic life in the Ephemeral Pond and surface water habitats supplied by runoff from Site 1.
- Protection and maintenance (survival, growth, and reproduction) of benthic life in the Ephemeral Pond.
- Protection and maintenance (survival, growth, and reproduction) of terrestrial plants.
- Protection and maintenance (survival, growth, and reproduction) of soil invertebrates.
- Protection and maintenance (survival, growth, and reproduction) of local birds
- Protection and maintenance (survival, growth, and reproduction) of local mammals

2.1.3 Measurement Endpoints

Measurement endpoints (measures of effects) corresponding to the survival and reproductive assessment endpoints were identified for the representative species or their surrogates.

Surface water screening values were selected first from the California Toxics Rule (EPA 2000a) and then from EPA's National Recommended Water Quality Criteria (EPA 2002). If those sources provided no data, the Great Lakes Tier II values calculated by Oak Ridge National Laboratory (ORNL) (Suter and Tsao 1996) were used, and several values for nitroaromatic compounds were obtained from Talmage et al. (1999).

Sediment screening values were selected first from published values from Smith et al. 1996, Long et al. 1995, and Long and Morgan 1990. For other chemicals, published values from EPA 1977, Sullivan et al. 1985, Fitchko 1989, Jaagumagi 1993, British Columbia Ministry of Environment Lands and Parks (BCMOELP) 1994, MacDonald et al. 1996, Talmage et al. 1999, and MacDonald et al. 2000 were used.

Surface soil screening values for exposure of lower trophic level species by direct contact with chemicals in soil included Eco-soil screening levels (SSLs) (EPA 2005), ORNL plant toxicological benchmarks (Efroymson et al. 1997a) and soil invertebrate toxicological benchmarks (Efroymson et al. 1997b).

Food-chain based chronic ingested doses were also developed for birds and mammals. Adverse effects of exposure to COPCs on the survival and reproduction/development of the representative bird and mammal species or their surrogates were obtained from peer-reviewed publications. Measurement endpoints were no-observed-adverse-effect levels (NOAELs) for ingestion of each COPC in chronic feeding studies conducted on the same representative species or a related species. This information was used to develop an exposure below which adverse effects are not expected to occur (Toxicity Reference Value or TRV). When no toxicity test data were available for a particular representative animal, surrogate animal data were used to generate the TRVs. The potential for

adverse effects was estimated by comparing the calculated chronic daily intake (CDI) of a chemical for representative birds and mammals to their respective NOAEL-based TRVs.

Measurement endpoints provide the actual measurements used to evaluate ecological risk and are selected to represent mechanisms of toxicity and exposure pathways. Measurement endpoints generally include measured or modeled concentrations of chemicals in water, sediment, soil, birds, and/or mammals; laboratory toxicity studies; and field observations. The measurement endpoints identified for this SRA are the following:

- Exceedance of risk-based benchmark concentrations by COPC concentrations measured in surface water, sediment, and surface soils
- Exceedance of NOAEL-based TRVs for each COPC CDI calculated for each representative bird and mammal

Final assessment and measurement endpoints are summarized in Table 2-3.

2.1.4 Selection of Representative Terrestrial Species

A variety of terrestrial species have been identified from the affected area. Several species must be selected to represent exposure characteristics of the fauna of the area. In selecting representative species, ecological and species-specific factors must be considered. These factors include the following:

Ecological Importance. This includes those species that affect the structure and function of existing habitats, communities, or ecosystems (e.g., key members of the local food web). The representative species are major intermediate components in the food web; if a population of a pivotal species is disrupted, there could be consequences throughout the food web, resulting in an ecosystem balance disruption.

Body Size. Species of small body size are preferred, because they are likely to be more affected by a given exposure. Due to their higher metabolic demands, small species tend to eat more food per unit body weight per day than larger animals.

Active Area. Species with small site use areas or home ranges are likely to be more affected by contamination at the site, because a higher percentage of their foraging may occur in contaminated areas.

Feeding Guild. Certain methods of finding, processing, and consuming food present a higher risk of exposure than others. For example, the ash-throated flycatcher forages by swooping from a hunting perch to catch insects of the air, whereas the western meadow lark forages on the ground, where it is more likely to contact soil contaminants (Ehrlich et al. 1988).

Diet. Species with a specialized diet are likely to be more affected by a given contaminant exposure pathway and changes in food species density, because they have fewer food alternatives.

Fecundity. Species having small litter or egg clutch sizes and fewer litters or clutches per year are likely to be more impacted by adverse effects on reproductive success.

Resident or Nesting Species. Resident or nesting species are likely to be more affected by contamination at the site because they may spend more time in the contaminated area per year.

Table 2-3: Summary of Assessment and Measurement Endpoints

Receptor of Concern	Exposure Pathway	Assessment Endpoint *	Testable Hypothesis	Measurement Endpoint	Data Available
Aquatic Life	Direct Contact with chemicals in Surface Water.	Protection and maintenance (survival, growth, and reproduction) of aquatic life.	The concentration of chemicals in surface water does not exceed a level known to be toxic to aquatic life.	Compare concentration of chemicals in surface water to risk-based water benchmark concentrations developed to protect survival and growth of aquatic life.	Site-specific chemical data for surface water from the Ephemeral Pond and site runoff.
Benthic Organisms	Direct Contact with chemicals in Sediment.	Protection and maintenance (survival, growth, and reproduction) of benthic life.	The concentration of chemicals in sediment does not exceed a level known to be toxic to benthic invertebrates.	Compare concentration of chemicals in sediment to effects-based sediment benchmark concentrations developed to protect survival and growth of benthic invertebrates.	Site-specific chemical data for sediment from the Ephemeral Pond.
Plants	Root uptake of chemicals in soil.	Protection and maintenance (survival, growth, and reproduction) of plants.	The concentration of chemicals in surface soil does not exceed a level known to be toxic to plants.	Compare concentration of chemicals in soil to risk-based soil benchmark concentrations developed to protect plant growth and reproduction.	Site-specific chemical data for surface soil from potentially impacted locations.
Soil invertebrates	Uptake of chemicals in soil.	Protection and maintenance (survival, growth, and reproduction) of soil invertebrates	The concentration of chemicals in surface soil does not exceed a level known to be toxic to soil invertebrates.	Compare concentration of chemicals in soil to risk-based soil benchmark concentrations developed to protect growth and reproduction of soil invertebrates	Site-specific chemical data for surface soil from potentially impacted locations.
Small herbivorous mammals (represented by deer mouse)	Ingestion of chemicals accumulated in plants, soil invertebrates and from soil.	Protection and maintenance (survival, growth, and reproduction) of small herbivorous mammals.	The ingestion of bioaccumulative chemicals in surface soil invertebrates does not exceed a level known to be toxic to mice.	Compare modeled COPC chronic daily intake concentrations in representative herbivorous mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.
Small insectivorous mammals (represented by ornate shrew)	Ingestion of chemicals accumulated in soil invertebrate, insects, and from soil.	Protection and maintenance (survival, growth, and reproduction) of small insectivorous mammals.	The ingestion of bioaccumulative chemicals in surface soil and soil invertebrates does not exceed a level known to be toxic to ornate shrews.	Compare modeled COPC chronic daily intake concentrations in representative insectivorous mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.
Carnivorous mammals (represented by long-tailed weasel)	Ingestion of chemicals accumulated in small mammals, birds, and from soil.	Protection and maintenance (survival, growth, and reproduction) of carnivorous mammals.	The ingestion of bioaccumulative chemicals in small mammals, birds, and soil does not exceed a level known to be toxic to the long-tailed weasel.	Compare modeled COPC chronic daily intake concentrations in representative predatory mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.

Table 2-3: Summary of Assessment and Measurement Endpoints

Receptor of Concern	Exposure Pathway	Assessment Endpoint *	Testable Hypothesis	Measurement Endpoint	Data Available
Small herbivorous birds (represented by mourning dove)	Ingestion of chemicals accumulated in plants and from soil.	Protection and maintenance (survival, growth, and reproduction) of small herbivorous birds.	The ingestion of bioaccumulative chemicals in plants and surface soil does not exceed a level known to be toxic to birds.	Compare modeled COPC chronic daily intake concentrations in representative herbivorous bird species to determine exceedance of No-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.
Small insectivorous birds (represented by western meadow lark)	Ingestion of chemicals accumulated in soil invertebrates, insects, and from soil.	Protection and maintenance (survival, growth, and reproduction) of small insectivorous birds.	The ingestion of bioaccumulative chemicals in surface soil and soil invertebrates does not exceed a level known to be toxic to western meadowlarks	Compare modeled COPC chronic daily intake concentrations in representative insectivorous bird species to determine exceedance of No-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.
Carnivorous birds (represented by loggerhead shrike	Ingestion of chemicals accumulated in small mammals, birds, and from soil.	Protection and maintenance (survival, growth, and reproduction) of carnivorous birds.	The ingestion of bioaccumulative chemicals in birds, small mammals, and surface soil does not exceed a level known to be toxic to birds.	Compare modeled COPC chronic daily intake concentrations in representative predatory bird species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations.

Notes:

* Assessment endpoints identified for evaluation in this SRA are based on the parameters used to derive toxicity benchmarks (see Measurement Endpoint column) and are not intended to imply measurement of these parameters in the field.

COPC = chemical of potential ecological concern

TRV = toxicity reference value

Using the selection criteria discussed above, the animals listed in Table 2-2 were examined to identify appropriate terrestrial species to represent the major feeding guilds found on the site.

In consideration of all of the exposure-related factors and species identified in the previous subsections, six species were selected as representative terrestrial species (Table 2-4). Selection was based largely on the species' ecological importance and their habits that tend to lead to maximum exposure to soil pathways (i.e., small size and small foraging area). It is assumed that the evaluation of risk to these maximally exposed species will adequately characterize risk to the entire ecosystem, thus protecting all species.

Table 2-4: Summary of Selected Representative Terrestrial Species in this Risk Characterization

Common Name	Scientific Name	Justification (Critical Ecosystem Role)
Ornate shrew	*Sorex ornatus*	Insectivorous mammal
Deer mouse	*Peromyscus manicalatus*	Herbivorous mammal
Long-tailed weasel	*Mustela frenata*	Carnivorous mammalian predator
Mourning dove	*Zenaida macroura*	Granivorous bird
Western meadowlark	*Sturnella neglecta*	Insectivorous bird
Loggerhead shrike	*Lanius ludovicianus*	Carnivorous bird predator

The selected representative species at the site include the following:

The **ornate shrew** (*Sorex ornatus*) is a small (5.85 grams), insectivorous mammal (Brown et al. 1996). Because of its small size and high metabolism, it consumes a large amount of food for its size (maximum intake of 1.317 grams/day) thus, maximizing its exposure to site chemicals. Several subspecies of the ornate shrew are considered threatened or endangered in parts of its range, although no threatened or endangered populations are found in the area of the site. Ornate shrews prefer mesophytic communities with dense cover and an abundant litter layer. They build dome-shaped nests made of dead plant material and paper scraps, usually on top of the soil surface below driftwood or planks situated above the high tide line (WESCO 1986). The ornate shrew is assumed to forage in all habitats at the site. An ecological profile of this species is presented in Attachment H-10. For the SRA, the ornate shrew is assumed to be completely insectivorous.

The **deer mouse** (*Peromyscus maniculatus)* ranges in length from 7.1 to 10.2 cm (Burt and Grossenheider 1980) with weights ranging from 18.3 to 20.9 grams (Schlessinger and Potter 1974). The deer mouse (*Peromyscus maniculatus)* nests in burrows in the ground, in trees, stumps, and buildings. They inhabit nearly all types of dry-land habitats within their range: short grass prairies, grass-sage communities, CSS, sand dunes, wet prairies, upland mixed and cedar forests, deciduous forests, and ponderosa pine forests (Holbrook 1979; Kaufman and Kaufman 1989; Ribble and Samson 1987; Wolff and Hurlbutt 1982).

Deer mice eat seeds, arthropods, some green vegetation, roots, fruits, and fungi as available (Johnson 1961; Menhusen 1963; Whitaker 1966). An ecological profile of this species is presented in Attachment H-10. The deer mouse is assumed to forage in all habitats at the site. For the SRA, the deer mouse is assumed to be completely herbivorous.

The **long-tailed weasel's** (*Mustela frenata*) cited range of adult weights is 80 to 450 grams (Baker 1983). For risk assessment purposes a mean weight of 265 grams is used. Weasels are found in

temperate and tropical habitats in North and Central America. They inhabit crop fields and small wooded areas and will burrow and nest in hollow logs, rock piles, and under barns. Weasels sometimes take over the burrow of one of their prey (Baker 1983).

Weasels are strictly carnivorous but may ingest some soil while feeding. They prey on mammals up to rabbit size, and also take a few birds and other animals by piercing the prey's skull with its canines and killing it (Burt and Grossenheider 1976). An ecological profile of this species is presented in Attachment H-10. For the ecological SRA, the long-tailed weasel is assumed to be completely predatory and forage in all habitats at the site.

The **Mourning dove** (*Zenaida macroura*) has a weight that ranges from 115-140 grams with a mean weight of 119 grams (Dunning 1993). Mourning doves can be found in the desert (near water) to open woodland, agricultural areas with scattered trees, and suburbs. They will nest in the fork of a horizontal tree branch, on ground, on deserted nest of other species, or anywhere else providing solid support (Ehrlich et al. 1988). Since the mourning dove's diet consists of seeds, including waste grain from cultivated fields (Ehrlich et al. 1988), incidental ingestion of soil will occur. An ecological profile of this species is presented in Attachment H-10. For the ecological SRA, the mourning dove is assumed to be completely herbivorous and forage in all habitats at the site.

The **western meadowlark** (*Sturnella neglecta)* is a medium-sized (94 grams) bird found at the site that measures about 28 centimeters long and has a 13 centimeter tail (Dunn 1998). The western meadowlark's feeding habits are marked by seasonal differences in their main staples. They eat grain during winter and early spring, insects late spring and summer, and weed seeds in fall. (Lanyon 1994). Its feeding habits allow for an assumption of maximal exposure to COPCs at the site. An ecological profile of this species is presented in Attachment H-10. For the ecological SRA, the western meadowlark is assumed to be completely insectivorous and represents birds that feed in the open areas of the site.

The **loggerhead shrike** (*Lanius ludovicianus*) is approximately 21 centimeters in length (Campbell 1998). Minimum and maximum body weights of 44 to 61.10 grams have been reported by Graber et al. 1973 and Terres 1980.

Chief habitat requirements for the loggerhead shrike are open terrain with well-spaced lookout posts, that are at least two feet high, from which moving animals, like insects or small vertebrates may be seen on the bare ground below or in short, sparse grasses (Grinnell and Miller 1944).

The majority of their diet in all or nearly all areas is invertebrates. The loggerhead shrike is known to occasionally forage on carrion, including road kills (Anderson 1976; Hayes and Baker 1987). An ecological profile of this species is presented in Attachment H-10. For the ecological SRA, the loggerhead shrike is assumed to be completely predatory and forage in all habitats at the site.

A summary of the exposure assumptions used in the ecological SRA for the six representative species are presented in Table 2-5.

The **earthworm** (*Eisenia fetida*) was chosen to represent terrestrial invertebrates for purposes of food chain modeling because of its small size and range, its position as a decomposer in the food web, and its soil contact and diet. It is also a prey species for many small carnivorous animals, such as the house mouse. In addition, the earthworm serves as a conservative surrogate for other terrestrial invertebrate food species, such as insects. It is assumed that the earthworm is maximally exposed to soil contaminants because of its burrowing habit and ingestion of soil. Other invertebrates would be less exposed to site soil contaminants than the earthworm. Earthworm bioconcentration factor values are used to model food chain exposure concentrations.

Table 2-5: Summary of Species-Specific Exposure Assumptions used for SRA

Factor	Value	Reference
Deer mouse		
Minimum body weight (BW) (kg)	0.0183	Derived from Schlesinger and Potter (1974)
Maximum food intake (mg/day, dry weight)	3,491 [a]	Nagy (2001)
Water Intake (mL/day)	3[b]	EPA (1993)
Diet partition factor	3.2% (soil)	EPA (2005) using vole as surrogate [d]
	0% (plants) 100% (animals)	SRA Assumption[c]
Ornate Shrew		
Minimum body weight (BW) (kg)	0.0041	Brown et al. (1996)
Maximum food intake (mg/day, dry weight)	1,317	Deavers and Hudson (1981); Nagy (2001)
Water Intake (mL/day)	1.0	EPA (1993)
Diet Partition Factor	3% (soil)	EPA (2005) [d]
	0% (plants) 100% (invertebrates)	Derived from DOI (2002)
Long-Tailed weasel		
Minimum body weight (BW) (kg)	0.080	Baker (1983)
Maximum food intake (mg/day, dry weight)	24973 [a]	Nagy (2001)
Water Intake (mL/day)	30 [b]	EPA (1993)
Diet Partition Factor	4.3% (soil) 0% (plants) 100% (animals)	EPA (2005) [d] Derived from Burt and Grossenheider (1976)
Mourning dove		
Minimum body weight (BW) (kg)	0.115	Dunning (1993)
Maximum food intake (mg/day, dry weight)	18,414 [a]	Nagy (2001)
Water Intake (mL/day)	14.2 [b]	EPA (1993)
Diet Partition Factor	13.9% (soil)	EPA (2005) [d]
	100% (plants) 0% (animals)	Derived from Erlich et al. (1988)
Western Meadowlark		
Minimum body weight (BW) (kg)	0.0741	Lanyon (1994)
Maximum food intake (mg/day, dry weight)	16,003 [a]	Nagy (2001)
Water Intake (mL/day)	12 [b]	EPA (1993)
Diet partition factor	16.4% (soil)	EPA (2005) using woodcock as surrogate [d]
	0% (plants) 100% (invertebrates)	SRA Assumption [c]
Loggerhead shrike		
Minimum body weight (BW) (kg)	0.044	Graber et al. (1973) and Terres (1980)
Maximum food intake (mg/day, dry weight)	10,452[a]	Nagy (2001)
Water Intake (mL/day)	8.2 [b]	EPA (1993)
Diet partition factor	5.7% (soil)	EPA (2005) using hawk as surrogate [d]

Table 2-5: Summary of Species-Specific Exposure Assumptions used for SRA

Factor	Value	Reference
	0% (plants) 100% (animals)	SRA Assumption [c]

Notes:
[a] Dry-weight food intake estimated based on algorithm given in Nagy (2001).
[b] Water intake estimated based on algorithm given in EPA (1993).
[c] Conservative Tier I assumption of maximum food intake of the one food item with the highest contamination.
[d] From 90th Percentile of: Table 3. Estimated Distribution of P_s Values (EPA 2005).
% = percent
BW = body weight
DOI = Department of Interior
EPA = Environmental Protection Agency
kg = kilograms
mg/day = milligrams per day
mL/day = milliliters per day
SRA = screening ecological risk assessment

2.1.5 Exposure Pathway Analysis

The source of chemicals at Site 1 is former activity related to training for EOD and detonation of munitions, Additionally, there have been reports of burning of certain chemicals (e.g., sulfur trioxide chlorosulfonic acid) and petroleum fuels, all of which potentially led to the contamination of soil with MEC items, explosives, fuel hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and dioxins. Potential contamination of groundwater is also expected due to leaching of contaminants from the soil; however, ecological receptors are not expected to come into contact with groundwater.

Plants may take chemicals up from soil through root absorption and adsorption. Soil invertebrates such as earthworms, insects, or other arthropods may also ingest soil and absorb chemicals from the soil while feeding. Animals, such as mammals and birds, may eat contaminated vegetation and soil invertebrates as well as incidentally ingest chemicals in soil while feeding on seeds, berries, roots, and other vegetative parts. They may also incidentally ingest soil while grooming their fur or feathers. Precipitation may leach chemicals to subsurface soil, where they are beyond the normal reach of representative species. Compared to surface soil, subsurface soil is not considered a significant exposure medium for representative species.

Precipitation may run off into the Site 1 Ephemeral Pond, picking up soil from the ground surface and transport it to the Ephemeral Pond, where it is deposited as sediment. During atypical wet seasons, water may accumulate in the Ephemeral Pond and chemicals in the sediment may partition into the water column. Benthic organisms may uptake chemicals from the sediment and aquatic organisms may uptake chemicals from the water.

Several exposure pathways therefore exist for ecological receptors at Site 1, and descriptions of these pathways follow.

2.1.5.1 SURFACE WATER PATHWAYS

The Ephemeral Pond at Site 1 typically receives little surface water runoff from rainfall and is normally dry for extended periods of time. During the wet season (late winter), unusually heavy rainfalls can saturate the Ephemeral Pond soil and the Ephemeral Pond will collect and hold surface water runoff. Runoff from the discharge of the Ephemeral Pond may eventually enter an unnamed wash to the south. These conditions may persist for a length of time sufficient for aquatic invertebrate organisms especially adapted for ephemeral habitats to complete one or more life cycles

in the Ephemeral Pond. Such organisms include the taxonomic orders Cladocera (water fleas) and Anostraca (fairy shrimps), which produce resting eggs (cysts) that can persist in or on the Ephemeral Pond soil during extended periods (even years) of desiccation. During the active stages of their life cycles, these organisms live in the water column and can be exposed to COPCs through direct contact as follows:

- Uptake of chemicals in water through sorption
- Incidental ingestion of chemicals in or on food items

There is insufficient information in the literature to discern uptake of chemicals from ingestion of chemicals by aquatic organisms, and these exposure routes are simply treated as total direct contact.

2.1.5.2 SEDIMENT PATHWAYS

Benthic organisms adapted to ephemeral habitats may exist in the Site 1 pond soil during periods of desiccation as resting eggs or cysts. During periods when the Ephemeral Pond holds water, these organisms spend the active stages of their life cycles in or on the Ephemeral Pond sediment. Therefore, they can be exposed to COPCs through direct contact as follows:

- Uptake of chemicals in sediment (including pore water) through sorption
- Incidental ingestion of chemicals in or on sediment or food items

As with aquatic organisms, insufficient information exists to discern uptake of chemicals from ingestion of chemicals by benthic organisms, and these exposure routes are simply treated as total direct contact.

2.1.5.3 SURFACE SOIL PATHWAYS

Surface soil (0 to 6 feet bgs) has been chosen as the terrestrial medium of concern for Site 1. Exposure pathways differ in importance from species to species and from site to site. For example, sites with minimum habitat value may be used by species that tolerate human disturbance of natural habitats. The representative species that were selected for assessment endpoints are the deer mouse, ornate shrew, long-tailed weasel, mourning dove, western meadowlark, and loggerhead shrike. The major terrestrial pathways chosen for analysis in this ecological risk assessment are as follows:

- Uptake of chemicals in surface soil by plants (via roots) and soil invertebrates
- Ingestion of contaminated surface soil by animals (mammals and birds)
- Ingestion of contaminated plants by animals (deer mouse and mourning dove)
- Ingestion of contaminated soil invertebrates by animals (ornate shrew and western meadowlark)
- Ingestion of vertebrate prey by predators (long-tailed weasel and loggerhead shrike)

2.1.5.4 SPECIES-SPECIFIC EXPOSURE FACTORS.

Factors used to estimate COPC intake values for terrestrial animal receptors are referred to as exposure factors. Defining exposure factors is essential to estimating COPC intake values. Factors such as species morphology, physiology, and behavior influence how individuals are exposed to COPCs and how much of a given COPC in a given medium is taken in by an individual representative species. Characteristics of representative species that are used to estimate exposure are presented in Attachment H-10 and summarized in Table 2-5. Uncertainties associated in applying these exposure factors in equations to calculate intake values are a complex issue; uncertainties are discussed in Section 2.2.3.

The most conservative species-specific exposure factors are used to estimate Tier 1 terrestrial exposure:

- Assume weight is low end of range and food intake is the high end of the range
- Assume 100 percent bioavailability of COPCs
- Assume the most sensitive life stage is present on the site
- Assume species is present year-round
- Use maximum concentration of contaminant in exposure media
- Assume incidental soil ingestion is 90th percentile for each feeding guild
- Assume site-use factor (SUF) is 1

Body Weight (BW). The lowest of the adult male and female body weights is used to estimate exposure because it is the most conservative assumption.

Food Intake/Day. The daily diet, in milligram of organic matter eaten per day, determined on a dry-weight basis, for an individual of maximum size.

SUF. The site use factor is defined as

$$SUF = \frac{Area\ of\ Surface\ Soil\ Contamination}{Site\ Use\ Area\ of\ Animal}$$

This factor permits consideration of less than full-time exposure for animals with site use areas exceeding the area of contamination. When the site use area of the receptor is less than the size of the site, it is assumed that the animal occupies the site 100 percent of the time, and the SUF is equal to 1. It is assumed that these receptors are continuously exposed to site contaminants.

Diet Partitioning Factor. The diet of animal receptors may be defined by three major exposure pathways:

- Direct ingestion of soil—soil ingestion
- Ingestion of contaminated plant materials—plant ingestion
- Ingestion of contaminated animal prey—animal ingestion

For Tier 1 screening assessment, the conservative assumption is that the diet consists entirely of the most contaminated diet fraction. This is assumed to be soil invertebrates for the ornate shrew and western meadowlark, plants (i.e., leaves and seeds) for the deer mouse and mourning dove, and small mammals for the long-tailed weasel and loggerhead shrike. Incidental soil ingestion is assumed to be the 90th percentile for each feeding guild (EPA, 2005; Attachment 4-1, Table 3).

2.1.5.5 CHEMICAL-SPECIFIC EXPOSURE FACTORS.

Exposure of representative species also depends, to some extent, on chemical-specific factors, such as solubility or tendency to bioaccumulate (Attachment H-4).

Soil-to-Plant Bioconcentration Factor (BCF_p). BCF_p values are used to convert chemical concentrations in soil to concentrations in plant biomass resulting from plant root uptake. This factor is used to estimate the concentration of a COPC that bioaccumulates in plants grown in contaminated

soil over one growing season. This factor is also used to model concentrations of COPCs through plants to herbivores. Use of this factor assumes that plant root uptake for a specific chemical is equal for all plants.

BCF_p values are obtained from the literature or derived from a chemical-specific regression relationships. For organic chemicals the BCF_p is derived from the octanol/water partition coefficient (K_{ow}) by the method of Travis and Arms (1988) as refined by EPA (2003). Some degree of uncertainty is associated with the use of this factor, especially for perennial plants. For the most part, however, animals feed on portions of the plants that are renewed annually (i.e., foliage, seeds, and fruit). The EPA algorithm is: $\log BCF_p = -(0.4965 \times \log K_{ow}) + 2.653$. For several inorganic chemicals the BCF_p is derived from the chemical concentration (maximum for Tier 1 and 95 percent upper confidence limit [UCL] for Tier 2) using regression models developed by Bechtel Jacobs Company for Oak Ridge National Laboratories (Bechtel Jacobs, 1998).

Soil-to-Invertebrate Bioconcentration Factor (BCF_i). BCF_i values are derived from studies of earthworm uptake and are used to convert chemical concentrations in soil to concentrations in invertebrate biomass resulting from both ingestion and integument sorption. This factor is used to estimate the concentration of a COPC that bioaccumulates in invertebrates living in contaminated soil. If a direct measurement was not available for an organic chemical, the BCF_i was estimated from the K_{ow} and organic carbon partition coefficient (K_{oc}) using the method from EPA 2003. For several inorganic chemicals the BCF_p is derived from the chemical concentration (maximum for Tier 1 and 95 percent UCL for Tier 2) using regression models developed by Sample and others for Oak Ridge National Laboratories (Sample et al., 1998).

The primary terrestrial exposure pathways potentially present at the site for both plant and animal receptors are contaminated soil pathways, including uptake from soil by plants and invertebrates and ingestion of soil and contaminated food by higher trophic level organisms such as birds and mammals.

Prey-to-Predator Bioconcentration Factor (BTF_a). BTF_a values were used to estimate chemical concentrations in predators that eat prey living on potentially contaminated areas of the site. The factor was used to model concentrations of COPCs through prey to their predators. BTF_a values are obtained from the literature or derived from chemical-specific K_{ow} by the method of Travis and Arms (1998) as refined by Birak et al. (2001). The Birack equation is: $\text{Log } BTF_a = (0.53 \times \log K_{ow}) - 5.8$.

2.1.6 Development of Conceptual Site Model

Potential pathways exist for both sediment-dwelling and aquatic receptors at the Site 1 Ephemeral Pond. While the endangered fairy shrimp species, *Streptocephalus woottoni*, is the primary receptor of concern, this ecological SRA addressed potential exposures to all benthic and aquatic life. Aquatic life in the Site 1 Ephemeral Pond will spend the active stages of their life cycles within the water column. Chemicals associated with the Ephemeral Pond soil (or sediment) may partition to the water and aquatic organisms may be exposed to these chemicals through direct contact (i.e., sorption across body surfaces and incidental ingestion). In a similar manner, benthic organisms may be exposed to chemicals within or upon the sediment.

Three potential pathways exist for terrestrial receptors to come into contact with surface soil chemicals. Terrestrial wildlife are expected to incidentally ingest surface soil as part of normal feeding activities, therefore, this pathway is considered complete and is evaluated quantitatively. Terrestrial wildlife ingest plant parts (i.e., leaves, seeds, roots) and soil invertebrates that may have taken up COPCs from the soil into their body tissues, therefore, ingestion of contaminated food is considered a complete exposure pathway and is evaluated quantitatively. Mammal and bird predators

may eat contaminated prey. Burrowing mammals may contact subsurface soils, although the majority of exposure to COPCs is through ingestion of food.

Inhalation of contaminated dust is expected to be insignificant because the site is well vegetated and dust generation is minimal. Ecological receptors are not expected to come into contact with subsurface soils, therefore this exposure pathway is considered incomplete.

VOCs may volatilize into soil air spaces from soil and migrate to the soil surface where they may be emitted to the atmosphere, but scientific data to estimate exposure of wildlife is lacking, so the pathway is not evaluated quantitatively. Exposure to VOCs by breathing contaminated air is expected to be insignificant compared to exposure by ingestion pathways.

Groundwater is considered beyond the reach of ecological receptors unless it discharges to the surface. Because it does not reach the surface on the site or in the immediate area, the groundwater pathway is considered incomplete for ecological receptors at Site 1.

The relationships between analytes in the site media and potential exposure pathways to ecological receptors are summarized in the Conceptual Site Model presented in Figure 2-3.

2.1.7 Toxicity Evaluation

The toxicity evaluation consists of identification of screening benchmark concentrations for surface water, sediment, and surface soil.

Surface Water. Maximum detected concentrations of chemicals in surface water and reporting limits of undetected chemicals were compared to published screening values for all aquatic life from several sources. The primary source was Criterion Continuous Concentration (CCC) values for freshwater from the California Toxics Rule (EPA 2000a). For chemicals without values in those tables, CCC values from EPA's National Recommended Water Quality Criteria (EPA 2002) were used. If that source provided no data, the Great Lakes Tier II Secondary Chronic Values (SCVs) calculated by ORNL (Suter and Tsao 1996) were used. None of the aforementioned sources provided data for certain nitroaromatic compounds, but some SCVs for nitroaromatics were available in Talmage et al. (1999).

CCC values and SCVs are derived from acute and chronic aquatic toxicity data obtained in the literature. The derivation process has strict requirements for the types and amount of data that may be included in the calculations, and it is because of the intensive criteria that govern the derivations that these screening values tend to be very conservative.

Sediment. A number of published literature sources were used to obtain conservative sediment screening values to be compared to maximum concentrations or reporting limits of chemicals that were analyzed in the Ephemeral Pond sediment medium. Three of the primary sources were Threshold Effect Levels (TELs) in Smith et al. 1996, Effects Range Low (ERL) values in Long and Morgan 1990, and ERLs in Long et al. 1995.

Alternative sources were used for chemicals without sediment screening values in those three sources. Threshold Effect Concentration (TEC) values in MacDonald et al. 2000 provided the bulk of screening values used for metals. A TEL value for one organic was provided by MacDonald et al. 1996. Lowest Effect Level values in Jaagumagi (1993) were used as screening values for three of the polynuclear aromatic hydrocarbons (PAHs). For nitroaromatics, Sediment Quality Benchmarks when organic carbon content is 1% ($SQB_{1\%}$) in Talmage et al. (1999) were used.

Figure 2-3. Conceptual Site Model Summary Diagram for Site 1

Contributing Sources / Transport Mechanisms / Exposure Route	Current Use: Ecological Receptors	Future Use: Ecological Receptors[1]	Rationale
Surface Soil → Windborne Particulates → Inhalation of Fugitive Particulates	Insignificant	Insignificant	Inhalation of contaminated dust is expected to be insignificant because the site is well vegetated and dust generation is minimal.
Surface Soil → Volatilization → Inhalation of VOCs	Insignificant	Insignificant	VOCs may volatilize into soil air spaces from soil and migrate to the soil surface where they may be emitted to the atmosphere, but scientific data to estimate exposure of wildlife is lacking, so the pathway is not evaluated quantitatively. Exposure to VOCs by breathing contaminated air is expected to be insignificant compared to exposure by ingestion pathways.
Leaching to subsurface → Direct Contact → Dermal Absorption	Insignificant	Insignificant	Dermal absorption of surface soil contaminants is potentially complete for ecological receptors, but scientific data to estimate exposure of wildlife is lacking, so the pathway is not evaluated quantitatively. Soil invertebrates ingested as food by wildlife are assumed to take up soil COPECs through the skin. Exposure to COPECs by dermal absorption by wildlife is expected to be insignificant compared to exposure by ingestion pathways.
Leaching to subsurface → Direct Contact → Incidental Ingestion of Soil	**Complete**	**Complete**	Terrestrial wildlife are expected to incidentally ingest surface soil as part of normal feeding activities, therefore, this pathway is considered complete and is evaluated quantitatively.
Leaching to subsurface → Bio-uptake → Ingestion of Plants/Animals (bio-uptake)	**Complete**	**Complete**	Terrestrial wildlife ingest plant parts (i.e., leaves, seeds, roots) and soil invertebrates that may have taken up COPECs from the soil into their body tissues, therefore, ingestion of contaminated food is considered a complete exposure pathway and is evaluated quantitatively.
Subsurface Soil → Direct Contact → Dermal Absorption / Incidental Ingestion	Incomplete	Incomplete	Ecological receptors are not expected to come into contact with subsurface soils, therefore this exposure pathway is considered incomplete. The majority of bird and mammal exposure comes from ingestion of food (plants and soil invertebrates). The majority of plant and invertebrate chemical exposure is from uptake in the first 2 feet of soil. Less than 3 percent of exposure is from incidental soil ingestion.
Groundwater → Direct Contact → Ingestion of Groundwater / Dermal Absorption / Inhalations of VOCs	Incomplete	Incomplete	Terrestrial ecological receptors are not expected to be exposed to groundwater, therefore this exposure pathway is considered incomplete.
Surface Water Runoff to the Bermed Retention Pond and Unnamed South Wash → Direct Contact → Sorption / Incidental Ingestion	**Complete**	**Complete**	Terrestrial ecological receptors are not expected to be regularly exposed to ephemeral surface water, however, aquatic and benthic organisms that are adapted to ephemeral habitats may be exposed to constituents in surface water where it collects as temporary pools. Exposure to COPECs in surface water in temporary pools is considered a complete exposure pathway.
Surface Water Runoff to the Bermed Retention Pond and Unnamed South Wash → Direct Contact → Inhalation of VOCs	Incomplete	Incomplete	VOCs may volatilize into air from surface water, but scientific data to estimate exposure of wildlife is lacking, so the pathway is not evaluated quantitatively. Exposure to VOCs by breathing contaminated air is expected to be insignificant compared to exposure by other pathways.

(1) Future conditions are assumed to be similar to current conditions for ecological receptors. No future scenarios are run.

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Several other sources for screening values were also used, including EPA 1977, Sullivan et al. 1985, Fitchko 1989, and BCMOELP 1994.

Surface Soil. Maximum detected analytes in site surface soil were screened initially against Eco-SSLs (EPA 2005), ORNL soil screening values based on the protection of plants (Efroymson et al. 1997a) and soil invertebrates (Efroymson et al. 1997b), and park land soil screening values for benzene-toluene-ethylbenzene-xylenes, total (BTEX) (CCME, 1991). These are based on toxicity studies of plants and soil invertebrates and are used to predict adverse effects on lower trophic level ecological receptors from exposure by direct contact with chemicals in soil. However, lower trophic level soil screening values are not available for many chemicals that may be found at contaminated sites.

Exposure of wildlife (i.e., birds and mammals) indirectly by ingestion of food was also assessed. The details of CDI of chemicals in soil through ingestion of food and soil to ingestion-derived toxicity reference values are presented in Section 2.2.2. If CDI exceeds the TRV, then adverse effects may occur.

NOAEL toxicity values, developed in laboratory feeding studies of birds and mammals, were used to develop risk-based TRVs for the screening of surface soil ingestion pathways. A TRV is a dosage (for animals, in milligram of contaminant per kilogram of body weight per day [mg/kg-day]) of a chemical believed to have no effect on the long-term health of the representative species. TRVs are specific for each chemical, receptor, and exposure route (e.g., ingestion, inhalation). The TRV of a chemical is equivalent to the exposure-specific, literature-derived NOAEL of that chemical for a particular plant or animal species of concern as published in the peer-reviewed toxicology literature.

The potential for adverse effects to be caused by exposure to site chemicals was evaluated based on toxicity experiments conducted, for the most part, in the laboratory and reported in scientific literature. Acceptable TRVs were developed from NOAELs for ingestion of each COPC in chronic feeding studies conducted on the same representative species or a related species. The primary source of TRVs was the "TRV-low level" which was developed by the Navy as part of a regional approach for conducting ERAs (EFAW 1998), in cooperation with the EPA Region IX Biological Technical Assistance Group. The TRVs used by EPA (2005) to develop Eco-SSLs were used in this risk assessment for the few chemicals for which they are available. For chemicals lacking Eco-SSLs or not listed in the Navy document, NOAELs were taken from peer-reviewed toxicology literature. Perchlorate TRVs and physical/chemical characteristics are discussed in Attachment H-11.

Because the toxicity information sought was not always available in the literature, extrapolations were sometimes required. The three general categories of extrapolations were (1) taxonomic extrapolations, (2) endpoint extrapolations, and (3) chemical extrapolations. Use of these extrapolations sometimes required the application of uncertainty factors in generating TRVs, as described below.

2.1.7.1 TAXONOMIC EXTRAPOLATION

Taxonomic extrapolation assumes that toxicological effects reported for one species can be used to predict the toxicological effects in a taxonomically related species. These assumptions have proven valid in extrapolations used to estimate toxicity in aquatic species (EPA 1989). Although little is known about extrapolations to assess risk to terrestrial plant and animal species, the paucity of specific toxicity data mandates such extrapolations. As an example of the use of taxonomic extrapolation, an uncertainty factor of 10 is assigned to toxicity data derived from laboratory rats if the species of concern is a bird. This assumes that birds are always more sensitive to organic chemicals than mammals. This is considered conservative because among chemicals with measured

toxicity in both birds and mammals, birds are sometimes more sensitive and sometimes less sensitive than mammals. Bird toxicity data is never extrapolated to mammals.

2.1.7.2 ENDPOINT EXTRAPOLATION

If NOAEL endpoint values were not available, lowest-observed-adverse-effect level (LOAEL) values were divided by 10 to estimate a surrogate NOAEL, as specified by EPA (1997). If only a NOAEL was available, it was multiplied by 10 to estimate a surrogate LOAEL if needed. If chronic studies were not available, subchronic and lethal dose (LD_{50}) study results were divided by 5 and 500, respectively, to estimate chronic results. Additional adjustments of TRVs to account for other sources of uncertainty are not recommended in the EPA (1997) guidance.

2.1.7.3 CHEMICAL EXTRAPOLATION

Chemical extrapolation assumes that a chemical of similar physical and chemical properties to a COPC may serve as a surrogate for that COPC. For mammals, laboratory toxicity tests for naphthalene and benzo(a)pyrene were used to represent toxicity of the less toxic and more toxic PAHs respectively. For birds, the only toxicity data available is for phenanthrene. This LOAEL was used to develop a bird toxicity value for the low-toxicity PAHs by dividing the LOAEL by 10 to estimate a NOAEL. This NOAEL was divided by 10 again to estimate the TRV for high-toxicity PAHs such as benzo(a)pyrene. Thus, it is assumed that benzo(a)pyrene is at least 10 times more toxic than phenanthrene.

2.1.7.4 ALLOMETRIC CONVERSIONS OF TRVS

General TRVs for birds and mammals must be converted to TRVs specific to each regional, site-specific receptor of concern (EFAW 1998). This extrapolation of data based on body scaling is called allometric conversion. For example, when there are available toxicological data and dose levels for mice, but toxicity data and dose levels are needed for the fox, an allometric conversion estimates a similar dose level for the fox. The underlying assumption of allometric conversions is that a given effect on a species of small mammals is similar to the effect on a larger species of mammals, per unit body weight.

Although several allometric conversion equations are available in the literature, Sample and Arenal (1999) is used for conversion of mammalian TRVs:

$$\text{Dose}_{\text{receptor}} = \text{Dose}_{\text{test organism}} (\text{Body Weight}_{\text{test organism}} / \text{Body Weight}_{\text{receptor}})^{0.06}$$

The equation from Mineau, et al. 1996 is used for conversion of avian TRVs:

$$\text{Dose}_{\text{receptor}} = \text{Dose}_{\text{test organism}} (\text{Body Weight}_{\text{test organism}} / \text{Body Weight}_{\text{receptor}})^{-0.14}$$

Allometric equations generally follow the form:

$$Y = aM^b$$

Y is some variable of structure or function and is dependent (following a power law equation) on body mass, *M*, and *a* and *b* are taxon-specific empirical factors. Weight-specific metabolism in mammals scales with an exponent of 1/3, while biological rates (for example, respiratory rate) generally scale with an exponent of –1/4. In a review by Sample and Arenal (1999), the scaling factor for mammal toxicity was revised to 0.06 (1-0.94).

Mineau et al. (1996) showed that use of mammal derived scaling factors underestimated the toxicity of a COPC in birds, especially small birds. Based on empirical data from 10 species of birds and 37

chemicals, an average scaling factor of 1.14 is estimated for birds. However, scaling factors for the majority of chemicals evaluated (29 of 37) were not significantly different from 1. A scaling factor of 1 was therefore considered most appropriate for interspecies extrapolation among birds. Lindstedt (1987, in Mineau et al., 1996) notes that "throughout toxicology and the issues related to interspecies extrapolation, dose and exposure are nearly always 'fixed' and are independent of both body mass and physiological time." For this reason, the allometric conversion proposed in Sample and Arenal (1999), based on weight-specific metabolism, is recommended.

When interpolating bird toxicity from mammalian study results, only an uncertainty factor of 10 is applied and there is no adjustment for size.

Final TRVs used in this ecological SRA for mammals and birds are presented in Attachment H-5.

2.1.8 Identification of Chemicals of Potential Ecological Concern

The chemical groups of analytes for this ecological SRA include metals, explosives, VOCs, SVOCs, and dioxins. The analytical suite was limited to assess potential surface soil contamination from past training activities that took place on site. Up gradient surface water and sediment samples were collected in the Ephemeral Pond. Down gradient surface runoff was collected from the site drainage way where it leaves the site at the south boundary. Data from surface water, sediment, and surface soil samples were validated in accordance with U.S. Navy Installation Restoration Program guidance for data valuation (DON 1998). Any data assigned an R qualifier (data rejected) were eliminated from the dataset and not used for the preliminary risk evaluation.

Analytical results for all media samples at Site 1 are presented in Appendix E. A summary and statistical evaluation of the analytical data used for ecological risk assessment are presented as attachments to this Appendix as Attachments H-1, H-2 and H-3 for surface water, soil/sediment (from the Ephemeral Pond), and surface soil respectively.

COPCs for this ecological SRA were selected from chemicals detected in surface water, Ephemeral Pond soil/sediment, and surface soil (i.e., 0–6 feet bgs). Hydrocarbons were detected in surface soil and sediment, however, toxicity values do not exist to assess their potential for risk to the ecological receptors. Instead, hydrocarbons were assessed using their toxic components (BTEX, PAHs) because toxicity values do exist for these constituents.

Some inorganic chemicals are needed in relatively high concentrations for normal metabolism, growth, and reproduction. The amounts of these physiological electrolytes in tissue are regulated by most organisms. Metals that were eliminated as potential COPCs because they are essential nutrients include sodium, potassium, calcium, magnesium, and iron. Nitrate as N was also eliminated as a potential COPC because it is an essential nutrient for plant growth.

Chemicals detected in surface water, sediment, and surface soil samples were considered preliminary COPCs, provided that the analytical results were determined to be usable in the data validation process. Table 2-6 summarizes the maximum detected concentrations in each medium. Non-detected chemicals were analyzed further to identify COPCs. First the reporting limit range was compared to ecological screening values. All chemicals with a maximum reporting limit that exceeded a screening value were retained as COPCs for further evaluation. Second, the maximum chemical concentrations detected in each medium was compared to ecological direct contact screening values. Any chemical with a detected concentration that exceeded its respective direct contact screening value was retained as a COPC for further evaluation.

2.1.8.1 SURFACE WATER

An initial surface water screen compared the maximum reporting limits of undetected chemicals to selected surface water screening values to assess if there were any COPCs with reporting limits above screening concentrations In the first Ephemeral Pond surface water sample collected (LE524), fifteen COPCs in surface water had maximum reporting limits that were higher than their respective surface water screening values. In the second Ephemeral Pond surface water sample (LE619) and in the runoff water from the Ephemeral Pond (LE622), only five COPCs had maximum reporting limits that were higher than their respective surface water screening values (Attachment H 6-1).

A comparison of maximum detected chemical concentrations in three surface water samples to ecological screening values for aquatic life is presented in Attachment H 6-1. In the first surface water sample (LE524), four metals (including iron, a nutrient mineral not considered as a COPC) were present at concentrations that exceeded their screening values. Five metals (including iron) exceeded their screening values in the second Ephemeral Pond surface water sample (LE619), and three of the same metals exceeded their screening values in the runoff water from the Ephemeral Pond (LE622). None of the organics in the chemical suite were present at concentrations that exceeded their screening levels. Table 2-6 lists all chemicals detected in the Site 1 Ephemeral Pond surface water.

2.1.8.2 SEDIMENT

An initial surface soil/sediment screen compared the maximum reporting limits for the soil collected in the Ephemeral Pond (dry) to selected sediment screening values to assess if there were any undetected COPCs with reporting limits above screening concentrations. Seven COPCs in the Ephemeral Pond soil had maximum reporting limits that were higher than their respective sediment screening values (Attachment H 6-2).

A comparison of maximum detected chemical concentrations in the Ephemeral Pond soil to ecological screening values for benthic organisms is presented in (Attachment H 6-2). Only one chemical (mercury) exceeded its screening value and is considered a COPC in the SRA (Table 2-6).

2.1.8.3 SURFACE SOIL

An initial soil screen compared the maximum reporting limits to Eco SSLs, ORNL, and Canadian Council of Ministers of the Environment values for lower trophic level species to assess if there were any COPCs with reporting limits above screening concentrations. Twenty five COPCs in surface soil had maximum reporting limits that were higher than their respective ecological screening values (Attachment H 6-3). These 25 COPCs were evaluated in the same way as other COPCs in surface soil.

A comparison of maximum detected chemical concentrations in surface soil to ecological screening values for direct contact by plants and soil invertebrates is presented in Attachment H 6-4. Table 2-6 presents the list of all chemicals detected in surface soil. Surface soil chemicals with maximum concentrations that exceed screening values are indicated by asterisks and are considered COPCs in the ecological SRA. Other chemicals may have been detected at depths greater than 6 feet bgs at Site 1; however, any chemicals only detected at depths greater than 6 feet bgs were not included in the ecological SRA and therefore are not included in Table 2-6.

Table 2-6: Maximum COPC Concentrations Detected in Surface Water, Sediment, and Soil

COPC	Maximum Surface Water Concentration 01-Pond Sample LE524	Maximum Surface Water Concentration 01-Pond-Outfall Sample LE619	Maximum Surface Water Concentration 01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
VOCs (µg/L water, µg/kg sediment or soil)					
2-Butanone	nd	nd	nd	nd	9
2-Hexanone	nd	nd	nd	nd	50J
4-Methyl-2-Pentanone	nd	nd	nd	nd	2
Acetone	nd	6J	6J	nd	8,700J
Benzene	nd	nd	nd	nd	610*
Chloroform	nd	nd	nd	nd	2.2
Ethylbenzene	nd	nd	nd	nd	14,000*
Tetrachloroethene	nd	nd	nd	nd	2
Toluene	nd	nd	nd	0.8J	41,000*
Xylenes, Total	nd	nd	nd	nd	98,000*
SVOCs (µg/L water, µg/kg sediment or soil)					
2-Methylnaphthalene	nd	nd	nd	nd	270,000
Bis(2-ethyhexyl)phthalate	nd	nd	nd	nd	420
Diethyl Phthalate	nd	nd	nd	nd	250J
Di-n-butyl Phthalate	nd	nd	nd	nd	307,000 *
Fluoranthene	nd	nd	nd	nd	38
Hexachlorobenzene	nd	nd	nd	nd	220
Naphthalene	nd	nd	nd	nd	128,000
n-nitrosodiphenylamine	nd	nd	nd	nd	66,700 *
Phenol	nd	nd	nd	nd	1,200
Pyrene	nd	nd	nd	2	nd
Explosives Residues(µg/L water, µg/kg sediment or soil)					
1,3-Dinitrobenzene	nd	nd	nd	nd	630
2,4,6-Trinitrotoluene	nd	nd	nd	nd	7,860
2,4-Dinitrotoluene (also SVOC)	nd	nd	nd	nd	7,000
2,6-Dinitrotoluene (also SVOC)	nd	nd	nd	nd	44
2-Amino-4,6-Dinitrotoluene	nd	nd	nd	nd	310
4-Amino-2,6-Dinitrotoluene	nd	nd	nd	nd	228
HMX	nd	nd	nd	nd	1,400
RDX	nd	nd	1	nd	14,000
General Chemistry (µg/L water, µg/kg sediment or soil)					
Perchlorate	nd	nd	nd	nd	1,600
Metals (mg/L water, mg/kg sediment or soil)					
Aluminum	2,840 *	3,740 *	1,390 *	16,900	190,000 *
Antimony	nd	nd	4.7J	nd	103 *

Table 2-6: Maximum COPC Concentrations Detected in Surface Water, Sediment, and Soil

COPC	Maximum Surface Water Concentration 01-Pond Sample LE524	Maximum Surface Water Concentration 01-Pond-Outfall Sample LE619	Maximum Surface Water Concentration 01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
Arsenic	nd	1.2	0.8	1.5	12.4
Barium	50.2 *	39.3 *	45.9 *	81.7	537 *
Beryllium	nd	0.1	0.048J	0.98	1.1
Cadmium	0.24J	nd	nd	0.34	156 *
Chromium	7.9	3.3J	2.4J	7.1J	171 *
Cobalt	1.1J	1.1J	0.55J	2.7J	6.6
Copper	4.1J	5.3 *	9.6 *	6.4	16,700 *
Lead	3.1J *	0.93	0.95	12.1	1,580 *
Manganese	26.4	24.2	13.8	121	711 *
Mercury	0.21J	0.89 *	0.3J	0.32 *	7.1 *
Nickel	4.1J	3.5	2.6	4J	112 *
Selenium	nd	0.4J	0.37J	0.19J	4.7 *
Silver	nd	nd	nd	nd	5.8 *
Thallium	nd	nd	nd	nd	15.2 *
Vanadium	6.1J	3.8J	3.9J	14.4	60.9 *
Zinc	20.8	15.3	19.3	19.6J	29,100 *
Dioxins (ng/kg)					
2,3,7,8-TCDD TEQ (Mammal)	NA	NA	NA	NA	23.7
2,3,7,8-TCDD TEQ (Bird)	NA	NA	NA	NA	39.3

Notes:

* = Detected concentration exceeds screening level
µg/kg = micrograms per kilogram on a dry-weight basis
µg/L = micrograms per liter
COPC = chemical of potential ecological concern
J = indicates an estimated value
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg = milligrams per kilogram on a dry weight basis
mg/L = milligrams per liter
NA = not analyzed
nd = not detected
ng/kg = nanograms per kilogram on a dry-weight basis
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalence quotient
This table lists analytes detected in soil from 0 feet to 6 feet bgs. The table does not include analytes detected at depths greater than 6 feet bgs in soil.

2.2 TIER 1, STEP 2 – SCREENING

This section presents the methods and results of Step 2 of the ecological SRA process. This step comprises a quantitative risk analysis, with the potential for adverse effects to ecological receptors being estimated using very conservative assumptions. This section is divided into five subsections: exposure estimation (Section 2.2.1); risk calculations (Section 2.2.2); uncertainty analysis (Section 2.2.3); risk characterization (Section 2.2.4); and Tier 1, Step 2 exit criteria (Section 2.2.5).

2.2.1 Exposure Estimation

Exposure of representative species occurs in different ways depending on the physical and behavioral characteristics of the organism. Plants take up COPCs from the soil by absorption through the roots. Soil invertebrates can be exposed by absorption across the skin and through ingestion of soil. The two mechanisms cannot be conveniently separated; therefore, soil invertebrate exposure (represented by the earthworm) is considered the combined uptake. Some COPCs must be dissolved in pore water before they can cross cell membranes into a plant root or an invertebrate's body. Terrestrial organisms can be exposed through the skin, respiratory surface, or, more commonly, through ingestion of contaminated soil and food.

Exposure point concentrations (EPCs) are used in the exposure estimation and represent the maximum detected concentration in each affected medium at Site 1. The EPCs are summarized in Table 2-6.

2.2.2 Risk Calculations

The integration of toxicity and exposure information is used to predict possible adverse effects to ecological receptors. The hazard quotient (HQ) method is used to screen site COPCs for their potential to cause adverse effects to ecological receptors.

2.2.2.1 HAZARD QUOTIENTS

The HQ method is used to compare media COPC concentrations to media-specific, risk-based screening values. For aquatic or benthic receptors, the HQ value is calculated by dividing the maximum surface water or sediment COPC concentration by the surface water or sediment screening value, respectively.

For terrestrial plants and invertebrates, the HQ value is calculated by dividing the maximum surface soil COPC concentration by Eco-SSLs or the ORNL Soil Benchmark concentration or Canadian Council of Ministers of the Environment (CCME) screening value for BTEX.

Food chain intake equations are presented in Attachment H-12; the HQ value is calculated using Equation 1:

Equation 1: Hazard Quotient

$$HQ = \frac{Intake\ of\ COPC\ (mg/kg/day)}{TRV\ for\ COPC\ (mg/kg/day)}$$

Where:

HQ = The hazard quotient.

Intake = Sum of chronic daily intake from all ingestion pathways (i.e., soil, plants, and invertebrates): intake equations presented in Attachment H-12.

HQ values were determined for each COPC and receptor at the site. HQ values equal to or exceeding 1 indicate that the exposure level equals or exceeds the effects level and that the receptor being assessed has a potential for adverse effects resulting from exposure to site contaminants via a variety of pathways at a given site. HQ values exceeding 1 do not necessarily indicate that an effect will occur, only that a lower threshold has been exceeded based on the exposure assumptions used in the model. It should be noted that a single chemical or pathway may be responsible for the majority of the risk to a receptor at a site.

Note that the HQ calculated using NOAEL-based TRVs provides some insight into general effects on individual animal reproduction and/or survival in the local population. It is assumed that if risks are judged insignificant for the average individual receptor, they will be considered insignificant at the population level. However, if risks are present at the individual receptor level, risks may or may not be important at the population level.

HQ values calculated for soil COPCs at Site 1 evaluated in the SRA are presented in Attachment H-7 for each representative species. The COPCs include VOCs, SVOCs, PAHs, explosives, metals, dioxins, and one anion. The conservative exposure assumptions included use of maximum COPC concentrations, minimum body weight, maximum ingestion rate, and a SUF of 1 (see Table 2-5 and Attachment H-10).

2.2.2.2 Comparison of Surface Water COPC Concentrations with Aquatic Life Screening Concentrations

For the first surface water sample collected from the Ephemeral Pond (LE524), three metals (excluding iron, a nutrient mineral not considered as a COPC) exceeded their respective aquatic life screening values. These metals were aluminum, barium, and lead (Attachment H 6-1).

The second sample from the Ephemeral Pond (LE619) collected more than seven weeks after the first sample contained four metals that exceeded their respective aquatic life screening values. These metals included aluminum, barium, copper, and mercury (Attachment H 6-1).

In the Ephemeral Pond runoff water sample (LE622) three metals exceeded their respective aquatic life screening values. These metals were aluminum, barium, and copper (Attachment H 6-1).

2.2.2.3 Comparison of Sediment COPC Concentrations with Benthic Invertebrate Screening Concentrations

In the comparison of maximum detected concentrations of chemicals in sediment with risk-based sediment screening values, only mercury exceeded its screening value with HQ = 2 (Attachment H 6-2).

2.2.2.4 Comparison of Surface Soil COPC Concentrations with Plant and Invertebrate Screening Concentrations

The comparison of COPCs detected in surface soil at Site 1 with the plant and invertebrate screening concentrations developed for lower trophic level species in this assessment is presented in Attachment H 6-4 and summarized in Table 2-7. Maximum surface soil concentrations of di-n-butyl phthalate, naphthalene, n-nitrosodiphenylamine, BTEX, aluminum, antimony, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc exceed plant and invertebrate screening concentrations. These concentrations result in an HQ>1, which indicates a potential for adverse effects to lower trophic level ecological receptors from direct contact with soil COPCs.

Of the COPCs that were detected, six VOCs, four SVOCs, four explosives, perchlorate, and dioxins detected in surface soil did not have plant or invertebrate screening concentrations.

2.2.2.5 TIER 1 SURFACE SOIL RISK CALCULATION RESULTS

The HQ results of risk calculations based on food chain exposure and conservative exposure assumptions for surface soil COPCs are presented in Attachment H-7. Those receptors with elevated HQs (equal to or greater than 1) are presented in Table 2-8.

The HQs for acetone, ethylbenzene, toluene, total xylenes, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, hexachlorobenzene, naphthalene, N-nitrosodiphenylamine, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2 amino-4,6-dinitrotoluene HMX, RDX, perchlorate, aluminum, antimony, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc, and total 2,3,7,8-TCDD (mammal) and (bird) are 1 or greater, with respect to specific receptors, which indicates a potential for adverse effects to terrestrial ecological receptors.

Table 2-7: Comparison of Maximum Surface Soil EPCs at Site 1 with Plant and Invertebrate Screening Concentrations

COPC	Maximum Concentration (mg/kg)	ORNL Soil Benchmark[1] (mg/kg)	Hazard Quotient
VOCs			
2-Butanone	0.009	DG	-
2-Hexanone	0.050	DG	-
4-Methyl-2-Pentanone	0.002	DG	-
Acetone	8.7	DG	-
Benzene	0.610	0.5[3]	**1**
Chloroform	0.0022	DG	-
Ethylbenzene	14	1.2[3]	**12**
Tetrachloroethene	0.002	DG	-
Toluene	41	0.8[3]	**51**
Xylenes, Total	98	1[3]	**100**
SVOCs			
2-Methylnaphthalene	270	DG	-
Bis(2-ethyhexyl)phthalate	0.42	DG	-
Diethyl Phthalate	0.25	100	0.003
Di-n-butyl Phthalate	307	200	**2**
Fluoranthene	0.038	37	0.001
Hexachlorobenzene	0.220	DG	-
Naphthalene	128	20	**6**
n-nitrosodiphenylamine	66.7	20	**3**
Phenol	1.2	30	0.04
Explosives Residues			
1,3-Dinitrobenzene	0.630	DG	-
2,4,6-Trinitrotoluene	7.86	30[4]	0.26
2,4-Dinitrotoluene (also SVOC)	7	DG	-
2,6-Dinitrotoluene (also SVOC)	0.044	DG	-
2-Amino-4.6-Dinitrotoluene	0.31	80	0.004
4-Amino-2,6-Dinitrotoluene	0.228	DG	-

Table 2-7: Comparison of Maximum Surface Soil EPCs at Site 1 with Plant and Invertebrate Screening Concentrations

COPC	Maximum Concentration (mg/kg)	ORNL Soil Benchmark[1] (mg/kg)	Hazard Quotient
HMX	1.4	15.6	0.09
RDX	14	46.7	0.3
General Chemistry			
Perchlorate	1.6	DG	-
Metals			
Aluminum	190,000	50	**4,000**
Antimony	103	78[2]	**1**
Arsenic	12.4	18[2]	0.7
Barium	537	330[2]	**2**
Beryllium	1.1	40[2]	0.03
Cadmium	156	32[2]	**5**
Chromium	171	0.4	**430**
Cobalt	6.6	13[2]	0.5
Copper	16,700	50	**335**
Lead	1,580	110[2]	**15**
Manganese	711	500	**1**
Mercury	7.1	0.1	**70**
Nickel	112	30	**4**
Selenium	4.7	1	**5**
Silver	5.8	2	**3**
Thallium	15.2	1	**15**
Vanadium	60.9	2	**30**
Zinc	29,100	50	**600**
Dioxins			
2,3,7,8-TCDD TEQ (Mammal)[2]	0.0000237	DG	-
2,3,7,8-TCDD TEQ (Bird)[2]	0.000039	DG	-

Notes:

Bold = COPC concentration exceeds surface soil screening criteria for lower trophic level organisms; HQ exceeds 1.

[1] = The lesser of plant screening value (Efroymson et al. 1997a) or soil invertebrate screening value (Efroymson et al. 1997b). Eco-SSL used for antimony, arsenic, barium, beryllium, cadmium, cobalt, and lead.

[2] TEQ value calculated based on TEFs for birds and mammals respectively.

[3] Canadian Council of Ministers of the Environment (CCME), 1999.

[4] Talmage et al., 1999.

- = value does not exist
COPC = chemical of potential ecological concern
DG = data gap (Screening data were not available for these COPCs)
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg = milligrams per kilogram on a dry-weight basis
ORNL = Oak Ridge National Laboratory
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
2,3,7,8- TCDD TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalence quotient

Table 2-8: Elevated Hazard Quotient Values for Food Chain Exposure to Soil COPCs

COPC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Western Meadowlark	Loggerhead shrike
Volatile Organics						
Acetone	-	4	-	4	-	-
Ethylbenzene	-	-	-	-	3	-
Toluene	4	5	-	-	-	-
Xylenes, Total	100	80	-	700	1,000	5
Semivolatile Organics						
2-Methylnaphthalene	5	-	-	2	10	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	10	-
Di-n-butylphthalate	-	-	-	200	1,000	30
Hexachlorobenzene	-	-	-	-	2	
Naphthalene	3	5	-	10	6	-
N-Nitrosodiphenylamine	2	5	-	5	2	-
Explosives Residues						
1,3-Dintrobenzene	20	70	1	7	1	-
2,4-Dinitrotoluene	-	10	-	100	4	-
2,4,6-Trinitrotoluene	1	10	-	8	-	-
2 Amino 4,6-Dinitrotoluene	-	-	-	3	-	-
HMX	-	10	-	10	-	-
RDX	-	-	-	2	1	-
General Chemistry						
Perchlorate	-	100	1	60	-	2
Metals						
Aluminum	10,000	600	2,000	40	200	20
Antimony	600	20	20	500	4,000	200
Barium	-	-	-	1	1	-
Beryllium	-	-	-	6	-	-
Cadmium	200	4	3	3	70	1
Chromium	8	1	1	2	7	-
Copper	1,000	40	100	200	1,000	70
Lead	20	3	5	20	70	9
Manganese	1	1	-	-	-	-
Mercury	7	-	-	8	40	2
Nickel	200	9	10	2	20	-
Selenium	20	10	2	2	3	-
Silver	-	-	-	-	3	-
Thallium	4	2	-	4	8	-
Vanadium	-	-	-	4	8	2
Zinc	100	50	50	50	90	20
Dioxins						
Total 2,3,7,8-TCDD (Mammal)[1]	30	-	-	NA	NA	NA
Total 2,3,7,8-TCDD (Bird)[1]	NA	NA	NA	-	3	-

Notes:
(1) TEQ value calculated based on TEFs for birds and mammals respectively.

-	= HQ is less than 1 for this receptor
COPC	= chemical of potential ecological concern
HMX	= octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
NA	= analyte is not a COPC in this medium
RDX	= cyclotrimethylenetrinitramine
SVOCs	= semivolatile organic compounds
VOCss	= volatile organic compounds
2,3,7,8-TCDD	= 2,3,7,8- tetrachlorodibenzo-p-dioxin
TEF	= toxicity equivalency factor
TEQ	= toxicity equivalency quotient

2.2.3 Uncertainty Analysis

Ecological risk assessment results depend primarily on the weight of evidence supporting particular conclusions, and each line of evidence is subject to varying degrees of uncertainty. Due to the complexity of ecosystems and the associated mechanisms that cause ecological stress, uncertainty in environmental risk characterization is inevitable. Uncertainty stems from a number of sources. These include, but are not limited to, the following:

- Sampling and statistical variability
- Limitations of toxicity testing
- Difficulty of extrapolating from laboratory data to field data
- Problems in evaluating environmental responses to mixtures of contaminants
- Assumptions underlying the use of fate and transport models
- Range of conditions for which models or hazard indexes are applicable

Other uncertainty sources include unexpected weather conditions or sources of contamination. Uncertainty associated with each step of this ecological risk characterization is described below.

2.2.3.1 Uncertainties in the Ecological Exposure Estimation

Reporting Limits. In some cases, the reporting limit of an analyte exceeds the screening value for that analyte. If the analyte is not detected at any location at the site it is assumed to be absent from the site. When the "non-detect" exceeds the screening value, this may potentially underestimate risk for that analyte.

Toxicity Equivalence. Dioxin congeners were evaluated on the basis of toxicity equivalence (TEQ) relative to 2,3,7,8-tetrachlorodibenzo-n-dioxin (TCDD). The EPA has assigned toxicity equivalence factors (TEFs) relative to 2,3,7,8-TCDD for highly chlorinated dibenzo-n-dioxins and highly chlorinated dibenzo-n-furans. The maximum concentration of each detected dioxin congener and the full reporting limit of each non-detected dioxin congener was multiplied by the congener-specific TEF for birds to calculate 2,3,7,8-TCDD TEQs. Van den Berg et al. (1998) pointed out that the TEFs developed for birds are normally applied to bird tissue concentrations to estimate a tissue burden of 2,3,7,8 TCDD. However, they can also be used as a surrogate to estimate an ingested dose when applied to diet concentrations (EPA 2003b). This application adds a level of uncertainty to the estimation of bird dioxin exposure. Because mammal TEFs are based on diet exposure, the TEFs for mammals are applied directly to each diet fraction to estimate a diet-based TEQ for mammals. There is also uncertainty in the TEF values because they are estimated on the basis of structural similarity to 2,3,7,8-TCDD and are not measured directly.

To calculate the expected bioaccumulation of dioxins in the plant and earthworm, congeners were summed and a surrogate BCF, based on "2,3,7,8-TCDD", was used to estimate dioxin uptake. Since dioxins are comprised of several congeners, each of which may bioaccumulate at a unique rate, the use of the 2,3,7,8-TCDD BCF to represent all congeners may over- or under-estimate total dioxins in the diet.

Bioavailability and Chemical Mobility. Assumptions regarding chemical bioavailability and mobility add uncertainty to the risk assessment. Extraction methods used to determine chemical concentrations in sediment and soil are rigorous and destructive; chemicals are often sorbed to soil or sediment particles such that they may not be available to ecological receptors under normal environmental conditions. Soils with high organic carbon content can bind significant quantities of PAHs, polychlorinated biphenyls, pesticides, dioxins, and some inorganics, making them unavailable for absorption by plants or invertebrate organisms.

Bioconcentration/Bioaccumulation Factors (BCFs). The use of BCFs in exposure modeling also presents uncertainty. The BCF_p value for perchlorate is based on Ellington et al., (2001) data and the BCF was calculated from limited soil and plant concentration data. BCF_p values for organics were calculated based on K_{ow} values according to a regression relationship established by Travis and Arms (1988) and updated by EPA (2003). The relationship is far from perfectly linear and it is based largely on studies involving many chemicals including pesticides and polybrominated biphenyls. BCF_p values for organics in other chemical classes may not be accurately represented by this relationship.

Uncertainty associated with BCF_i values extends largely from the fact that they are based on a single study for each chemical and that because data are lacking for some chemicals, a surrogate value of 1 is used for modeling. The physical characteristics of the soil used in a study, which may affect BCF_i values, rarely match the site soil characteristics. Finally, for both BCF_p and BCF_i values, the potential for variation between species of plants and invertebrates, respectively, is unaccounted for.

Species-Specific Exposure Factors. The exposure models used to predict uptake of chemicals by the mammals and birds via various pathways depend on average species-specific exposure factors that are inherently uncertain. These factors include body weight, daily food intake, and the percentage of soil, plant, and prey material relative to overall contaminant intake.

Other Factors. Several other factors that the models do not account for may affect exposure of representative species. For example, any or all of the receptors may avoid contaminated areas as a response to the contamination; also, receptors may avoid contaminated areas if there is little to forage or prey on in the areas.

2.2.3.2 *Uncertainties in the Ecological Toxicity Assessment*

A variety of sources of uncertainty were not included above. For one, it has long been recognized that laboratory studies that are used as a basis for generating TRVs may not accurately represent the complexities of potential exposure under field conditions. For example, the dosing of test animals by use of highly soluble salts in drinking water may overestimate exposures compared with the same salt administered in food. The chemical form present at the site may be in a less soluble form than that used in the laboratory study (e.g., lead acetate in water compared to lead carbonate in food). Finally, toxicological studies on which TRVs are based deal with a single chemical; effects of simultaneous exposure to multiple contaminants are not addressed.

Uncertainty in the Toxicity of Perchlorate Ion to Wildlife Receptors. The primary target of the perchlorate anion (perchlorate) in vertebrates such as birds and mammals is the thyroid gland.

Perchlorate inhibits the transport of iodide (I^-) from the blood into the thyroid follicle cells. The inhibition is thought to be accomplished by perchlorate competitively blocking iodide binding to a carrier, or sodium/iodide symporter (NIS), which catalyzes the simultaneous transfer of Na^+ and I^- across the basolateral membrane of thyroid follicle cells. Perchlorate inhibition of the NIS can limit the availability of iodide needed for the production of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which in turn, may affect the circulating levels of T4 and T3. All toxic effects of perchlorate on the thyroid hormone system derive directly or secondarily from the inhibition of the NIS. The competitive inhibition is completely reversible. If perchlorate exposure is removed, the perchlorate is lost from the thyroid and the blocking effect on the iodine binding site is lost (ATSDR, 2005).

A problem in ecological risk assessment is translating effects on the thyroid and circulating thyroid hormones into ecologically relevant endpoints such as survival, growth, and reproduction. Measurable effects on thyroid function can be observed at relatively low levels of perchlorate in the blood. However, adverse effects on survival, growth or reproduction may not be measurable until perchlorate levels are much greater.

The ecotoxicologists for the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) have been reviewing the perchlorate toxicology literature to develop mammalian and avian TRVs for use in ecological risk assessments at Army sites (personal communication, Dr. Mark Johnson, Nov. 1, 2005). The following TRVs are based on their toxicity assessment presented in the draft USACHPPM document (USACHPPM, 2005) using ecologically relevant endpoints. External review of the Draft has been completed (as of June 2006) and USACHPPM is anticipated to publish the Final report in the fall of 2006.

Table 2-9 presents the selected ingestion TRVs for mammals. A medium level of confidence has been given by USACHPPM to these TRVs because, though much data are available, there is considerable uncertainty regarding the relevance of thyroid structural and functional changes in wildlife (USACHPPM, 2005).

Table 2-9. USACHPPM Ingestion TRVs for the Class Mammalia

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	0.64	Medium
LOAEL-based	6.4	Medium

Notes:
LOEAL = lowest-observed-adverse-effect-level
mg/kg/d = milligrams per kilogram per day
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value

Table 2-10 presents the selected ingestion TRVs for birds. A medium level of confidence has been given by USACHPPM to these TRVs because these studies were of high quality, but lacking in regards to data from other species and lack of other developmental and reproductive data.

Table 2-10. USACHPPM Ingestion TRVs for the Class Aves

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	1.3	Medium
LOAEL-based	2.6	Medium

Notes:
LOEAL = lowest-observed-adverse-effect-level
mg/kg/d = milligrams per kilogram per day
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value

If the reversible changes in thyroid metabolism and thyroxin production were to be considered ecologically relevant, USEPA has proposed a NOAEL for mammalian herbivores of 0.001 mg/kg-day based on perturbations in thyroid and pituitary hormones, thyroid histopathology, and changes in brain morphometry in mice (EPA 2002). For birds, the Navy reviewed existing toxicity data for perchlorate exposure in birds. Based on studies by McNabb et al. (2004) of the effects of perchlorate ion on thyroid function in bobwhite quail chicks, the Navy proposed an alternative NOAEL TRV for birds of 0.00162 mg/kg-day. Table 2-11 presents the ranges of the modeled exposure for the four representative species and their calculated hazard quotients based on the USACHPPM wildlife TRVs and the thyroid function TRVs. The model calculations are presented in Attachment H 13-1.

The HQ values are approximately three orders of magnitude higher if reversible thyroid disruption is considered an endpoint directly related to maintenance of wildlife populations.

Table 2-11: Tier 2, Step3a, Exposure Pathway Analysis and Hazard Quotients for Perchlorate in Soils at El Toro Site 1

Representative Species	Soil EPC [95% UCL] (mg/kg dw)	CDI Soil Ingestion (mg/kg-day)	CDI Plant Ingestion (mg/kg-day)	CDI Invertebrate Ingestion (mg/kg-day)	DCI Ingestion Sum (mg/kg-day)	NOAEL-based TRV (mg/kg-day)	Hazard Quotient
TRV Based on Survival, Growth and Reproduction Endpoints (USACHPPM, 2005)							
Deer Mouse	0.087	0.000177	2.05	0.00728	2.06	0.64	3
Ornate Shrew	0.087	0.00015	0.235	0.0157	0.25	0.64	0.4
Mourning Dove	0.087	0.000735	3.19	0	3.19	1.3	2
Western Meadowlark	0.087	0.000831	1.26	0.0077	1.27	1.3	1
TRV Based on Thyroid Disruption (Altered Thyroid Function) (EPA, 2002 for Mammals, McNabb et al., 2004 for Birds)							
Deer Mouse	0.087	0.000177	2.05	0.00728	2.06	0.00119	2000
Ornate Shrew	0.087	0.00015	0.235	0.0157	0.25	0.00128	200
Mourning Dove	0.087	0.000735	3.19	0	3.19	0.00162	2000
Western Meadowlark	0.087	0.000831	1.26	0.0077	1.27	0.00162	800

Notes:
% = percent
CDI = chronic daily intake
EPA = Environmental Protection Agency
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram on a dry weight basis per day
mg/kg dw = milligrams per kilogram on a dry weight basis
NOAEL = no-observed-adverse-effect-level
TRV = toxicity reference value
UCL = upper confidence limit
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

2.2.3.3 UNCERTAINTY IN THE HAZARD QUOTIENT METHOD

The use of HQs for the assessment of risk presents some level of uncertainty. Primarily, calculation of an HQ is based on exposure modeling and development of TRVs, two exercises that have uncertainty in and of themselves. Although the endpoints measured in most toxicological studies used to generate TRVs were the same (development/reproduction/survival), the effects of simultaneous exposure to multiple contaminants may be, for example, synergistic or antagonistic (i.e., not necessarily additive). Thus, HQ values for a specific chemical, receptor, and pathway combination are absent. This potentially contributes to underestimating the HQ values for the pathway and, consequently, the HQ for the receptor from all pathways.

2.2.4 Risk Characterization

2.2.4.1 SURFACE WATER

The results of the Tier 1, Step 2 surface water screening indicate that several metals may pose risks to aquatic life receptors. Surface water was first sampled on January 4, 2005 soon after a heavy and persistent rainfall event. The main focus of the risk assessment for the Ephemeral Pond was the endangered fairy shrimp species (*S. woottoni*) and risks posed by exposures to chemicals that partition from the sediment to the water column. Because the rains persisted and the Ephemeral Pond filled to discharge capacity, the second round of samples was not collected until over seven weeks later (February 27) at which time most chemical partitioning should have taken place.

In the first Ephemeral Pond sample (unfiltered), aluminum, barium, and lead were present at concentrations that potentially pose risks to aquatic life. In the second Ephemeral Pond sample (unfiltered), aluminum, barium, copper, and mercury exceeded aquatic life criteria.

The Ephemeral Pond water runoff combines with runoff from the rest of the site and flows downhill from the Ephemeral Pond. The runoff from the site was sampled from the swale just before it left the site at the property boundary, approximately 2,000 feet downgradient from the Ephemeral Pond. Because the runoff water flowed over soil that has also been contaminated, it is not possible to ascertain how much of any constituent might have originated from chemical partitioning within the Ephemeral Pond. The unfiltered sample results from the two surface water samples collected from the ephemeral pond indicate that aluminum, barium, copper, lead, and mercury exceeded aquatic life criteria.

2.2.4.2 SEDIMENT

The Ephemeral Pond sediment was evaluated to determine if chemicals are present at concentrations that might elicit effects to benthic organisms. The resting eggs (i.e., cysts) of *S. woottoni* and other aquatic organisms that are able to withstand long periods of drought are resilient to most environmental stressors including chemicals. Therefore, while the resting eggs are in or on the dried Ephemeral Pond sediment during dry conditions, they are not thought to be subject to adverse effects from exposures to chemicals while in the cyst form.

The results of the Tier 1, Step 2 sediment screening indicate that only mercury poses potential risks to benthic organisms in the Site 1 Ephemeral Pond.

2.2.4.3 SURFACE SOIL

The results of the Tier 1, Step 2 risk calculations indicate that five VOCs (acetone, benzene, ethylbenzene, toluene, an xylenes), six SVOCs (2-methylnaphthalene, BEPH, di-n-butyl phthalate, hexachlorobenzene, naphthalene, and n-nitrosodiphenylamine), six explosives (1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6-trinintrotoluene, 2-amino,4,6 dinitrotoluene, HMX, and RDX), 16 metals (aluminum, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel,

selenium, silver, thallium, vanadium, and zinc), perchlorate, and dioxins in the surface soil at IRP Site 1 may cause adverse effects to terrestrial ecological receptors (Table 2-12).

Surface soil concentrations of those risk drivers listed in Table 2-8 that exceeded ecological screening values were examined to determine their spatial distribution at Site 1. The results of that evaluation are shown on Figure 2-4. Exceedances of ecological screening values for metals are not shown on the figure. Soil screening values were calculated using Tier I exposure assumptions to back calculate a soil concentration equivalent to a hazard quotient of 1. The lowest value of all representative species was selected as the screening value for mapping purposes. Consult Appendix C, Tables C-1 through C-5 of the RI for detailed information concerning sample locations and chemical concentrations.

Eight of the maximum surface soil detections for analytes that drove risk were found at sample location 01-T33 (LE177) including dioxins, aluminum, antimony, barium, copper, lead, selenium and thallium. Nine of the maximum surface soil detections for analytes that drove risk were found at sample location 01-T23 (LE167 and LE176) including bis(2-ethylhexylphthalate), di-n-butylphthalate, N-nitrosodiphenylamine, 2,4-dinitrotoluene, cadmium, chromium, nickel, silver, and zinc. Maximum detections of acetone, naphthalene, 2-methylnaphthalene, ethylbenzene, toluene, total xylenes, and perchlorate were in sample 01-T34 (LE182). Maximum detections of beryllium, manganese, and vanadium were at sample locations 01-DP23 (LE076), 01-DP26 (LE096), and 01-DP09 (LE021), respectively. The maximum 1,3-dinitrobenzene detection was at sample location 01-T29A (LE171), while the maximum hexachlorobenzene detection was at location 01-HA09 (LD131). Soil at sample location 01-HA09 (LD129 and duplicate sample LD130) also had the maximum mercury concentrations. Maximum detections of RDX and HMX were in sample 01-BH01 (LE207) (see Appendix C of the RI).

None of the above risk drivers in surface soil for ecological receptors are located within or near the boundary of the Ephemeral Pond located in the northern portion of Site 1.

A summary of the Tier 1, Step 2 ecological SRA results is presented in Table 2-12.

Table 2-12: Summary of HQ Values Equal to or Greater than 1 for Ecological Receptors after Tier 1, Step 2 Screening

	COPCs with Hazard Quotient Values Equal to or Greater than 1					
	Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors	
COPC	01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Conc.	Lower Trophic Level	Higher Trophic Level
VOCs						
Acetone	-	-	-	DG	DG	x
Benzene	-	-	-	DG	x	-
Ethylbenzene	-	-	-	DG	x	x
Toluene	-	-	-	-	x	x
Xylenes, Total	-	-	-	DG	x	x
SVOCs						
2-Methylnaphthalene	DG	DG	DG	-	DG	x
Bis(2-ethylhexyl)phthalate	-	-	-	-	DG	x
Di-n-butyl Phthalate	-	-	-	DG	x	x

Table 2-12: Summary of HQ Values Equal to or Greater than 1 for Ecological Receptors after Tier 1, Step 2 Screening

	COPCs with Hazard Quotient Values Equal to or Greater than 1					
	Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors	
COPC	01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Conc.	Lower Trophic Level	Higher Trophic Level
Hexachlorobenzene	DG	DG	DG	DG	DG	x
Naphthalene	-	-	-	-	x	x
n-nitrosodiphenylamine	DG	DG	DG	DG	x	x
Explosives Residues (also SVOCs)						
1,3-Dinitrobenzene	-	-	-	-	DG	x
2,4-Dinitrotoluene	DG	DG	DG	DG	DG	x
2,4,6-Trinitrotoluene	-	-	-	-	-	x
2 Amino-4,6 Dinitrotoluene	-	-	-	-	-	x
HMX	-	-	-	-	-	x
RDX	-	-	-	-	-	x
General Chemistry						
Perchlorate	DG	DG	DG	DG	DG	x
Metals						
Aluminum	x	x	x	DG	x	x
Antimony	-	-	-	-	x	x
Barium	x	x	x	-	x	x
Beryllium	-	-	-	DG	-	x
Cadmium	-	-	-	-	x	x
Chromium	-	-	-	-	x	x
Copper	-	x	x	-	x	x
Lead	x	-	-	-	x	x
Manganese	-	-	-	-	x	x
Mercury	-	x	-	X	x	x
Nickel	-	-	-	-	x	x
Selenium	-	-	-	-	x	x
Silver	-	-	-	-	x	x
Thallium	-	-	-	DG	x	x
Vanadium	-	-	-	DG	x	x
Zinc	-	-	-	-	x	x
Dioxins						
Total 2,3,7,8-TCDD (Mammal)	NA	NA	NA	NA	DG	x
Total 2,3,7,8-TCDD (Bird)	NA	NA	NA	NA	DG	x

Notes:
- = HQ value did not exceed 1 for COPC
x = HQ is 1 or greater for noted COPC

COPC = chemical of potential ecological concern
DG = screening criteria not available for this trophic level
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
NA = not analyzed
RDX = cyclotrimethylenetrinitramine
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzodioxin

Also, COPCs that were not detected at any sample location in surface soil, but had screening criteria that exceeded their respective reporting limits, are also retained to Tier 2, Step 3a for further consideration (Table 2-13).

2.2.5 Tier 1, Step 2 Exit Criteria

Three outcomes are possible at this point in the ecological SRA:

1. There is adequate information to conclude that the ecological risks are negligible and therefore there is no need for remediation on the basis of ecological risk;
2. The information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3; or
3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

In the most recent surface water sample from the Site 1 Ephemeral Pond, three metals exceeded screening values for aquatic life receptors (Table 2-6). Also, two VOCs (cis-1,3-dichloropropene and total xylenes), two PAHs (benzo(a)anthracene and benzo(a)pyrene), and one metal (cadmium) had reporting limits that exceeded their respective screening criteria, which may lead to an underestimation of risks due to potential exposures to these chemicals (Attachment H 6-1 and Table 2-13).

For the Site 1 Ephemeral Pond sediment, the mercury concentration exceeded its screening value for benthic receptors (Table 2-6). In addition, one SVOC (bis(2-ethylhexyl)phthalate), five explosives (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine), and one metal (antimony) had reporting limits that exceeded their respective screening criteria, which may lead to an underestimation of risks due to potential exposures to these chemicals (Attachment H 6-2 and Table 2-13).

Concentrations of four VOCs, three SVOCs, and 16 metals in surface soil exceed screening values for terrestrial ecological receptors at EOD Site 1 (Table 2-6). Also, four VOCs, 12 SVOCs, three PAHs, and six metals had reporting limits that exceeded their respective screening values and could not be fully evaluated, so ecological risk may be underestimated for them (Table 2-13). Therefore, the site fails the ecological SRA and surface water, sediment, and soil pathways require further evaluation in a BERA.

2.2.6 Conclusions for the Ecological SRA

Based on the results of the ecological SRA risk calculations, it is recommended that those COPCs listed in Tables 2-8 be retained as COPCs to Tier 2, Step 3a for further consideration. Based on the most recent water sample (LE619), sediment and surface soil analyses several chemicals were not detected in any samples, but had reporting limits that exceeded their screening criteria and should therefore be retained for further consideration in a Tier 2, Step 3a evaluation (Attachment H 6-3 and Table 2-13).

Tier 2, Step 3a (BERA) will involve the refinement of the more conservative exposure characteristics used in the ecological SRA, including evaluation of the frequency of COPC detection, comparison of concentrations of inorganics in soil and sediment to background concentrations, use of 95 percent UCLs in place of maximum soil concentrations to represent exposure concentration, use of filtered water data for comparison to aquatic life criteria, use of mean body weights and food ingestion rates for wildlife receptors, and re-estimation of risk using HQs.

Table 2-13: Chemicals with Maximum Reporting Limits Exceeding Screening Levels

Aquatic Life Receptors			Benthic Receptors	Terrestrial Receptors
01-Pond Sample LE524	01-Pond-Outfall Sample LE619	01-STREAM Sample LE622	Maximum Sediment Concentration	Maximum Surface Soil Concentration
VOCs				
Carbon disulfide	Cis-1,3-Dichloropropene	Cis-1,3-Dichloropropene	-	Benzene
Cis-1,3-Dichloropropene	Total Xylenes	Total Xylenes	-	Ethylbenzene
Trans-1,3-Dichloropropene	-	-	-	Toluene
Total Xylenes	-	-	-	Total Xylenes
SVOCs				
4-Bromophenyl Phenyl Ether	-	-	Bis(2ethylhexyl) Phthalate	1,2,4-Trichlorobenzene
Bis(2ethylhexyl) Phthalate	-	-	-	1,4-Dichlorobenzene
Dibenzofuran	-	-	-	2,4,5-Trichlorophenol
Pentachlorophenol	-	-	-	2,4,6-Trichlorophenol
-	-	-	-	2,4-Dinitrophenol
-	-	-	-	4-Nitrophenol
-	-	-	-	Diethylphthalate
-	-	-	-	Hexachloro-cyclopentadiene
-	-	-	-	N-Nitroso-diphenylamine
-	-	-	-	Napthalene
-	-	-	-	Pentachlorophenol
-	-	-	-	Phenol
PAHs				
Anthracene	-	-	-	Acenaphthene
Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene	-	Fluorene
Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene	-	Fluoranthene
Fluorene	-	-	-	-
Explosives Residues (also SVOCs)				
-	-	-	1,3,5-Trinitrobenzene	-
-	-	-	1,3-Dinitrobenzene	-
-	-	-	2,4,6-Trinitrotoluene	-
-	-	-	RDX	-
-	-	-	HMX	-
Metals				
Beryllium	Cadmium	Cadmium	Antimony	Arsenic
Selenium	-	-	-	Cobalt
Silver	-	-	-	Selenium
-	-	-	-	Silver
-	-	-	-	Thallium
-	-	-	-	Mercury

Notes:
VOCs = volatile organic compounds - = maximum reporting limit did not exceed screening level for trophic level
SVOCs = semivolatile organic compounds x = HQ is 1 or greater for noted COPC PAHs= polycyclic aromatic hydrocarbons

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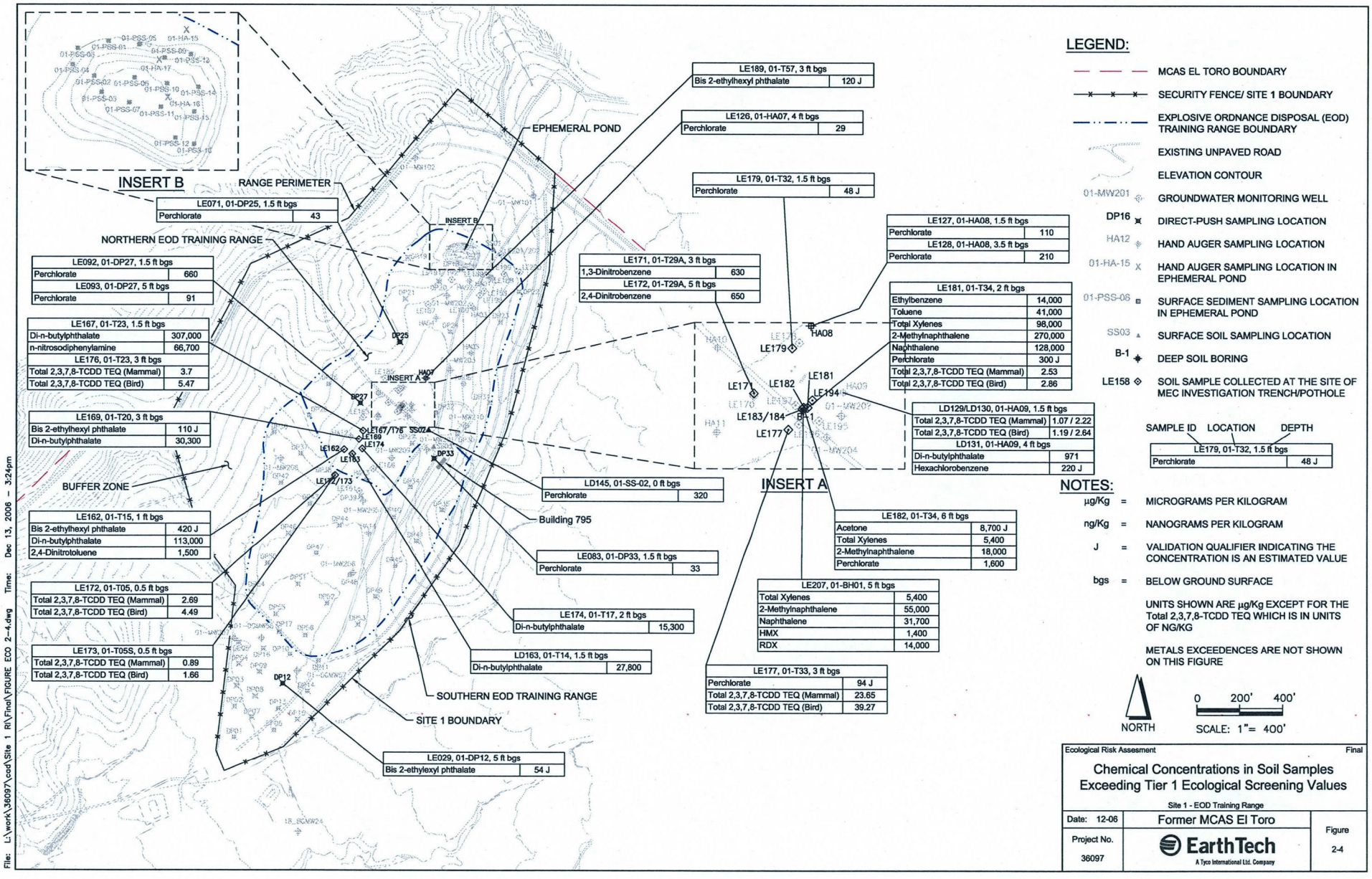
INSERT B
RANGE PERIMETER
EPHEMERAL POND
NORTHERN EOD TRAINING RANGE
BUFFER ZONE
Building 795
SOUTHERN EOD TRAINING RANGE
SITE 1 BOUNDARY
INSERT A
LE071, 01-DP25, 1.5 ft bgs
Perchlorate 43
LE092, 01-DP27, 1.5 ft bgs
Perchlorate 660
LE093, 01-DP27, 5 ft bgs
Perchlorate 91
LE167, 01-T23, 1.5 ft bgs
Di-n-butylphthalate 307,000
n-nitrosodiphenylamine 66,700
LE176, 01-T23, 3 ft bgs
Total 2,3,7,8-TCDD TEQ (Mammal) 3.7
Total 2,3,7,8-TCDD TEQ (Bird) 5.47
LE169, 01-T20, 3 ft bgs
Bis 2-ethylhexyl phthalate 110 J
Di-n-butylphthalate 30,300
LE162, 01-T15, 1 ft bgs
Bis 2-ethylhexyl phthalate 420 J
Di-n-butylphthalate 113,000
2,4-Dinitrotoluene 1,500
LE172, 01-T05, 0.5 ft bgs
Total 2,3,7,8-TCDD TEQ (Mammal) 2.69
Total 2,3,7,8-TCDD TEQ (Bird) 4.49
LE173, 01-T05S, 0.5 ft bgs
Total 2,3,7,8-TCDD TEQ (Mammal) 0.89
Total 2,3,7,8-TCDD TEQ (Bird) 1.66
LE029, 01-DP12, 5 ft bgs
Bis 2-ethylexyl phthalate 54 J
LD145, 01-SS-02, 0 ft bgs
Perchlorate 320
LE083, 01-DP33, 1.5 ft bgs
Perchlorate 33
LE174, 01-T17, 2 ft bgs
Di-n-butylphthalate 15,300
LD163, 01-T14, 1.5 ft bgs
Di-n-butylphthalate 27,800
LE189, 01-T57, 3 ft bgs
Bis 2-ethylhexyl phthalate 120 J
LE126, 01-HA07, 4 ft bgs
Perchlorate 29
LE179, 01-T32, 1.5 ft bgs
Perchlorate 48 J
LE171, 01-T29A, 3 ft bgs
1,3-Dinitrobenzene 630
LE172, 01-T29A, 5 ft bgs
2,4-Dinitrobenzene 650
LE127, 01-HA08, 1.5 ft bgs
Perchlorate 110
LE128, 01-HA08, 3.5 ft bgs
Perchlorate 210
LE181, 01-T34, 2 ft bgs
Ethylbenzene 14,000
Toluene 41,000
Total Xylenes 98,000
2-Methylnaphthalene 270,000
Naphthalene 128,000
Perchlorate 300 J
Total 2,3,7,8-TCDD TEQ (Mammal) 2.53
Total 2,3,7,8-TCDD TEQ (Bird) 2.86
LD129/LD130, 01-HA09, 1.5 ft bgs
Total 2,3,7,8-TCDD TEQ (Mammal) 1.07 / 2.22
Total 2,3,7,8-TCDD TEQ (Bird) 1.19 / 2.64
LD131, 01-HA09, 4 ft bgs
Di-n-butylphthalate 971
Hexachlorobenzene 220 J
LE182, 01-T34, 6 ft bgs
Acetone 8,700 J
Total Xylenes 5,400
2-Methylnaphthalene 18,000
Perchlorate 1,600
LE207, 01-BH01, 5 ft bgs
Total Xylenes 5,400
2-Methylnaphthalene 55,000
Naphthalene 31,700
HMX 1,400
RDX 14,000
LE177, 01-T33, 3 ft bgs
Perchlorate 94 J
Total 2,3,7,8-TCDD TEQ (Mammal) 23.65
Total 2,3,7,8-TCDD TEQ (Bird) 39.27
LEGEND:
MCAS EL TORO BOUNDARY
SECURITY FENCE/ SITE 1 BOUNDARY
EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
EXISTING UNPAVED ROAD
ELEVATION CONTOUR
01-MW201 GROUNDWATER MONITORING WELL
DP16 DIRECT-PUSH SAMPLING LOCATION
HA12 HAND AUGER SAMPLING LOCATION
01-HA-15 HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
01-PSS-06 SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
SS03 SURFACE SOIL SAMPLING LOCATION
B-1 DEEP SOIL BORING
LE158 SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE
SAMPLE ID LOCATION DEPTH
LE179, 01-T32, 1.5 ft bgs
Perchlorate 48 J
NOTES:
µg/Kg = MICROGRAMS PER KILOGRAM
ng/Kg = NANOGRAMS PER KILOGRAM
J = VALIDATION QUALIFIER INDICATING THE CONCENTRATION IS AN ESTIMATED VALUE
bgs = BELOW GROUND SURFACE
UNITS SHOWN ARE µg/Kg EXCEPT FOR THE Total 2,3,7,8-TCDD TEQ WHICH IS IN UNITS OF NG/KG
METALS EXCEEDENCES ARE NOT SHOWN ON THIS FIGURE
NORTH
0 200' 400'
SCALE: 1"= 400'
Ecological Risk Assesment
Final
Chemical Concentrations in Soil Samples Exceeding Tier 1 Ecological Screening Values
Site 1 - EOD Training Range
Date: 12-06
Former MCAS El Toro
Project No. 36097
EarthTech
A Tyco International Ltd. Company
Figure 2-4
File: L:\work\36097\cad\Site 1 RI\Final\FIGURE ECO 2-4.dwg Time: Dec 13, 2006 - 3:24pm

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3. BASELINE ECOLOGICAL RISK ASSESSMENT (BERA) TIER 2, STEP 3A

3.1 INTRODUCTION

The SRA for Site 1 is presented in Section 2, and includes Tier 1, Steps 1 and 2. These steps were conducted in accordance with the EPA guidance (EPA 1997), U.S. Navy ERA guidelines (DON 1999), and the Final Phase II RI Work Plan (Earth Tech 2001a).

Refer to the Step 1 procedures in Section 2.1 for the ecological site description, COPCs, as well as assessment endpoints, measurement endpoints, representative species, exposure pathway analysis, the development of a CSM, and toxicity evaluation. Refer to Step 2 procedures in Section 2.2 for exposure estimations and screening level risk characterization.

The BERA Tier 2, Step 3a uses the same representative species, exposure pathways, and TRVs, with refined exposure assumptions to more realistically estimate the potential risk to ecological receptors from COPCs that failed the conservative Tier 1 screening process. NOAEL-based TRVs are retained in this BERA because endangered birds may occasionally utilize part of the site for foraging, and NOAEL—based TRVs are protective at the individual level. However, use of NOAEL-based TRVs may overestimate risk to populations of non-endangered species.

3.2 OVERVIEW OF TIER 2, STEP 3A BERA PROCESS

The Tier 2 ERA represents the BERA and follows a five-step process to evaluate ecological risks and to determine if site remediation is warranted from an ecological perspective. The five steps that make up Tier 2 (Steps 3 through 7) are consistent with and analogous to Steps 3 through 7 of the EPA Superfund process for ERA. The Tier 2 BERA includes 2 sets of decision criteria (Step 3a and Step 7) for exiting from or proceeding with the ERA process.

The dual objectives of Tier 2, as specified in the Navy ERA policy, are to address risk management and decision-making considerations, and to identify assessment objectives to avoid multiple iterations of the BERA. The purpose of Tier 2, Step 3a is to re-evaluate COPCs that were retained from Tier 1 for further evaluation in a Tier 2 BERA and to identify and eliminate from further consideration those COPCs that were retained because of the use of very conservative exposure scenarios. Using less conservative (but more realistic) assumptions, the Tier 1 SRA risk estimates will be re-calculated. These re-calculated risk estimates will then be used to refine the list of COPCs identified in the Tier 1 SRA in order to remove some or all of the COPCs from further consideration. The Step 3a of Tier 2 questions that would help refine the Tier 1 SRA are:

- Do site contaminant concentrations exceed background levels (background risks)?
- Do any of the COPCs identified in Tier 1 occur infrequently at Site 1 (i.e., too few samples to calculate a 95 percent UCL EPC); if so, the estimated exposure of representative species is overestimated by using the maximum detection as the EPC.
- Are high concentrations and risks widespread across the site or limited to discrete locations (magnitude and extent of contamination and risk)?
- Could the COPC be in a chemical form that is less hazardous (bioavailability of the COPC)?
- Do more realistic exposure assumptions reduce potential risk to an acceptable level?

This Tier 2, Step 3a evaluation will involve the refinement of conservative exposure characteristics used in the SRA, including re-estimation of risk using HQs, use of 95 percent UCLs in place of maximum soil concentrations to represent exposure concentration, use of mean body weights and

food ingestion rates, use of diet fractions typical of each representative species as identified in the literature, and comparison of concentrations of inorganics to background concentrations.

The Step 3a re-evaluation/refinement process is the first step in the BERA problem formulation and will follow these steps (Navy ERA process):

- Revise exposure factor assumptions and calculate Tier 2, Step3a doses and HQ risk estimates. This step may also include usage of 95 percent UCL value in place of maximum detected concentration to represent an average exposure concentration.
- Identify COPCs with HQ less than 1.0 and eliminate from further evaluation.
- For inorganic COPCs with HQ greater than 1.0, compare maximum concentrations to background levels (for soil and sediment data only). Identify inorganic COPCs present at concentrations below background, and propose these for elimination from further evaluation.
- For COPCs with HQ greater than 1.0, consider bioavailability, identify COPCs likely to be biologically unavailable, and propose these for elimination from further evaluation.

After the re-evaluation/refinement, the decision criteria for Tier 2, Step 3a are

- If the re-evaluation of the conservative exposure assumptions used in the SRA supports an acceptable risk determination for all COPCs, then a no further action designation is warranted and the site exits the ERA process.
- If the re-evaluation of the conservative exposure assumptions does not support an acceptable risk, areas of the site may be proposed for remediation or the BERA process continues to Step 3b.

Similar to Tier 1 SRA process, Tier 2 Step 3a utilizes existing data with additional information obtained primarily from existing literature. Additionally, Step 3a employs the same dose models and risk characterization methods as those used in the Tier 1, with changes to the values of some input parameters.

3.3 TIER 2, STEP 3A – REFINEMENT OF EXPOSURE FACTORS

3.3.1 Refinement of the COPC List

All chemicals detected in Site 1 surface water, sediment, and surface soil (0 to 6 ft bgs), that had HQ values of 1 or greater for aquatic life, benthic organisms, or terrestrial ecological receptors respectively, were retained for further evaluation in Tier 2, Step 3a of the BERA. Also, those chemicals whose maximum reporting limit ranges were greater than their respective screening values and were not detected in any sample of that particular medium were also retained for discussion in Tier 2, Step 3a of the BERA.

The HQ exceedance of 1 for aluminum is based on an assumption of high bioavailability for birds and mammals. "EPA recognizes that due to the ubiquitous nature of aluminum, the natural variability of aluminum soil concentrations and the availability of conservative soil benchmarks..., aluminum is often identified as a contaminant of concern ... for ecological risk assessments" (EPA 2000b). The toxicity of aluminum is associated with soluble aluminum while the analytical results used in this risk assessment are based on total extractable aluminum. The EPA recommends that aluminum be identified as a COPC only for those soils with a pH less than 5.5. The technical basis for this is that the soluble and toxic forms of aluminum are only present in soil under soil pH values

of less than 5.5 (EPA 2000b). For the surface soil samples collected at Site 1, the pH value ranged between 5.89 and 8.97. Therefore, aluminum was eliminated as a soil COPC for Site 1.

See Tables 2-12 and 2-13 of the ecological SRA for the complete list of COPCs retained for further evaluation in Tier 2, Step 3a.

3.3.2 Refinement of Exposure Factors

The most conservative species-specific exposure factors were used to estimate Tier 1, Step 2 exposure. In Tier 2, Step 3a, more realistic exposure factors are substituted in the exposure equations and the resulting uptake or intake is divided by the TRV values to estimate the potential for adverse effects to ecological receptors expressed as HQs (Table 3-1).

More realistic exposure concentrations are used to calculate chemical-specific exposures based on the 95 percent UCL, if applicable. The chemical-specific exposure factors for certain inorganic chemicals may vary with concentration in the soil. Tier 2 chemical-specific exposure factors were re-calculated based on the 95 percent UCL of the soil concentration for use in the Tier 2, Step 3a BERA (Attachment H-4).

If the re-calculated HQ exceeds 1, then there is a potential for adverse effects. Because the representative species are meant to represent endangered species, NOAEL-based TRVs are retained. Because the HQs are based on NOAELs, an HQ of 1 means that no effect is expected and the COPC is dropped from further consideration.

3.3.3 Refinement of Terrestrial Wildlife TRVs

Generally in a BERA, LOAEL–based TRVs can be used to re-evaluate the potential for adverse effects to representative species. NOAEL based TRVs represent a no-effect level of exposure and protect species at the individual level. NOAEL-based TRVs are appropriate for assessing the risk to endangered species where every individual may contribute to the survival of the species and an adverse effect may result in death. LOAELs identify the lowest exposure at which an adverse effect may occur. It does not indicate that an adverse effect will occur, only that a lower threshold has been exceeded.

Individuals of a species do not exist in isolation from other members of the species, but instead exist as a member of a population that interacts with other plant and animal species in the area as a community. At the population level, an individual death is not important in maintenance of a healthy population (Odum 1971). A population is sustained by a balance between a death rate (mortality) and a birth rate (natality). When the mortality exceeds natality the population size decreases. When natality exceeds mortality the population size increases. Normally a population responds to increased mortality by increasing natality through density-dependent population regulation mechanisms mediated through the endocrine system. LOAELs are used to estimate the potential for adverse effects at the population level. The calculation of HQs based on both LOAELs and NOAELs gives risk managers a risk range to consider in making risk management decisions for a site.

Table 3-1: Summary of Species-Specific Exposure Assumptions Used for Tier 2, Step 3a

Factor	Value	Reference
Deer mouse		
Mean body weight (BW) (kg)	0.0196	Derived from Schlesinger and Potter (1974)
Mean food intake (mg/day, dry weight)	3,322 [a]	Nagy (2001)
Mean Water Intake (mL/day)	3 [b]	EPA (1993)
Diet partition factor	1.2% (soil)	EPA (2005) using vole as surrogate [d]
	49.4% (plant) 49.4% (invertebrates)	Whitaker, J.O. (1966)
Ornate Shrew		
Mean body weight (BW) (kg)	0.00585	Brown et al. (1996)
Mean food intake (mg/day, dry weight)	1,119	Deavers and Hudson (1981); Nagy (2001)
Mean Water Intake (mL/day)	1.0	EPA (1993)
Diet partition factor	0.9% (soil)	EPA (2005) [d]
	5% (plants) 94.1% (invertebrates)	Derived from DOI (2002)
Long-Tailed weasel		
Mean body weight (BW) (kg)	0.265	Baker (1983)
Mean food intake (mg/day, dry weight)	16,058 [a]	Nagy (2001)
Mean Water Intake (mL/day)	30 [b]	EPA (1993)
Diet partition factor	1.3% (soil) 0% (plants) 98.7% (animals)	EPA (2005) [d] Derived from Burt and Grossenheider (1976)
Mourning dove		
Mean body weight (BW) (kg)	0.119	Dunning (1993)
Mean food intake (mg/day, dry weight)	16,479 [a]	Nagy (2001)
Mean Water Intake (mL/day)	14.2 [b]	EPA (1993)
Diet partition factor	6.1% (soil)	EPA (2005) [d]
	93.9% (plants) 0% (animals)	Derived from Erlich et al. (1988)
Western Meadowlark		
Mean body weight (BW) (kg)	0.0941	Lanyon (1962)
Mean food intake (mg/day, dry weight)	14,038 [a]	Nagy (2001)
Mean Water Intake (mL/day)	12 [b]	EPA (1993)
Diet partition factor	6.4% (soil)	EPA (2005) using woodcock as surrogate [d]
	34.3% (plants) 59.3% (invertebrates)	Derived from Lanyon (1994)
Loggerhead shrike		
Mean body weight (BW) (kg)	0.05255	Graber et al. (1973) and Terres (1980)
Mean food intake (mg/day, dry weight)	9,430 [a]	Nagy (2001)

Table 3-1: Summary of Species-Specific Exposure Assumptions Used for Tier 2, Step 3a

Factor	Value	Reference
Mean Water Intake (mL/day)	8.2 [b]	EPA (1993)
Diet partition factor	2.4% (soil)	EPA (2005) using hawk as surrogate [d]
	0% (plants) 97.6% (animals)	Yosef et al. (1993)[c]

Notes:
[a] Dry-weight food intake estimated based on algorithm given in Nagy (2001).
[b] Water intake estimated based on algorithm given in EPA (1993).
[c] Conservative Tier I assumption of maximum food intake of the one food item with the highest contamination.
[d] From 50th Percentile of: Table 3. Estimated Distribution of P_s Values (EPA 2005).
% = percent
BW = body weight
DOI = Department of Interior
EPA = Environmental Protection Agency
kg = kilograms
mg/day = milligrams per day
mL/day = milliliters per day
SRA = screening ecological risk assessment

The proposed exposure refinements include the following:

- Assume filtered surface water data represent the bioavailable fraction of site COPCs.
- Assume SUF is the area of the contamination at the site divided by the species foraging area.
- Assume animal weight is the mean for the species.
- Assume food ingestion rate is the mean for the species.
- Assume incidental soil ingestion is the mean (50th percentile) for each feeding guild.
- Use literature-derived diet fraction for incidental soil, plant, and soil invertebrate ingestion.
- Use 95 percent UCL of the mean to represent the upper limit average COPC concentrations (if the 95 percent UCL is less than the maximum). This is the reasonable maximum exposure (RME) concentration. The maximum concentration is used as the RME for chemicals detected in less than 11 samples, because a 95 percent UCL should not be calculated.

3.4 RISK CALCULATIONS

3.4.1 Surface Water

Surface water risk calculations for Tier 2, Step 3a could not be refined because 95 percent UCL values were not calculated for the limited samples available and more realistic exposure assumptions are not available. However, with the second Ephemeral Pond sample collected more than seven weeks after the first, a filtered sample was also analyzed for dissolved metal determinations. The bioavailable form for metals in water is believed to be the dissolved form. In the filtered Ephemeral Pond sample (LE620), HQ values were considerably less for dissolved aluminum (HQ = 2), copper, and mercury (HQ < 1), but not for barium (HQ = 8) (Attachment H 6-1). Therefore, only aluminum and barium were at concentrations that potentially pose risks to aquatic life.

Based on the most recent Ephemeral Pond water sample analysis (LE619), cis-1,3-dichloropropene, total xylenes, benzo(a)anthracene, benzo(a)pyrene, and cadmium were not detected in any surface water samples, but had reporting limits that exceeded their aquatic life screening criteria (Attachment

H 6-1). However, these COPCs were not detected in surface water at the site; therefore, they cannot be further evaluated in Tier 2, Step 3a.

Based on the analysis of the discharge/runoff water from the Ephemeral Pond, in the filtered sample (LE623) only copper exceeded its screening value (HQ = 1) (Attachment H 6-1).

3.4.2 Sediment

For the sediment medium, only one chemical (mercury) was detected at a concentration that exceeded sediment quality criteria for benthic organisms. When comparing the 95 percent UCL for mercury (0.110 mg/kg) to the TEC (0.180 mg/kg), the HQ is estimated as less than one and the conclusion is drawn that mercury does not pose unacceptable risks to benthic receptors (Attachment H 6-2).

Also for the sediment, bis(2-ethylhexyl)phthalate), 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, and antimony reporting limits exceeded screening criteria (Attachment H 6-2). However, these COPCs were not detected in sediment at the site; therefore, they cannot be further evaluated in Tier 2, Step 3a.

3.4.3 Soil

3.4.3.1 FREQUENCY OF DETECTION

Chemicals that are detected infrequently in the surface soil are not generally available to contribute significantly to receptor exposure. The frequency of detection for each chemical is presented in Attachment H-3. Of the COPCs that were retained for further evaluation in Tier 2, Step 3a, the following were detected in less than 5 percent of surface soil samples: acetone, ethylbenzene, total xylenes, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, hexachlorobenzene, naphthalene, n-nitrosodiphenylamine, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, RDX, HMX, antimony, silver, and thallium. These 16 chemicals are detected at too few locations across the site to calculate a 95 percent UCL. In addition, their limited presence at the site reduces the potential exposure to ecological receptors and thus risk is overestimated for these chemicals.

3.4.3.2 HQ CALCULATION

The HQ results of risk calculations based on NOAEL-based TRVs and more realistic exposure assumptions for soil COPCs are presented in Attachment H-8 and summarized in Table 3-2.

Chemicals listed in Table 2-8 were further evaluated for potential risk because their HQ values were 1 or greater in Tier 1, Step 2 risk calculations.

For COPCs in surface soil, the HQ values for beryllium, cadmium, copper, lead, mercury, nickel, selenium, zinc, acetone, total xylenes, 1,3-dinitrobenzene, 2,4-dinitrotoluene, HMX, RDX, 2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-methylnaphthalene, naphthalene, bis (2-ethyl hexyl)phthalate, di-n-butylphthalate, n-nitrosodinphenylamine, perchlorate, and 2,3,7,8-TCDD (mammal) in soil are 1 or greater for at least one receptor. All other soil COPCs reevaluated in Tier 2, Step 3a have HQ values less than one with respect to all receptors and were eliminated as ecological COPCs.

Nineteen organic chemicals and six metals were also carried through to Tier 2, Step 3a because their respective maximum reporting limit ranges exceeded their respective soil screening values for ecological risk and potential risk could be underestimated. However, those COPCs that were not detected in surface soil at the site could not be further evaluated in Tier 2, Step 3a. Thus the potential risk to ecological receptors may be underestimated for these chemicals. All chemicals that were

detected at least once were evaluated quantitatively, whether a reporting limit exceeded a screening value or not.

Table 3-2: Tier 2, Step 3a, Hazard Quotient Values Equal 1 or Greater for Soil COPCs after Tier 2, Step 3a BERA Calculations Using NOAEL-based TRVs

COPC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Western Meadowlark	Loggerhead shrike
BTEX						
Total xylenes [1]	80	70	-	600	600	2
VOCs						
Acetone [1]	-	-	-	3	1	-
Explosives Residues						
1,3-Dinitrobenzene [1]	2	7	-	5	3	-
2,4-Dinitrotoluene	-	5	-	300	100	-
HMX [1]	-	4	-	9	3	-
RDX [1]	-	-	-	1	-	-
2,4,6-Trinitrotoluene [1]	-	-	-	6	3	-
2-Amino-4,6-Dinitrotoluene [1]	-	-	-	3	1	-
SVOCs						
2-Methylnaphthalene [1]	3	2	-		4	-
Naphthalene [1]	2	3	-	9	6	-
N-Nitrosodiphenylamine [1]	-	-	-	4	3	-
Bis (2-ethylhexyl)phthalate	-	-	-		5	-
Di-n-butylphthalate	-	-	-	10	40	-
General Chemistry						
Perchlorate	-	3	-	2	1	-
Metals						
Antimony [1]	400	200	2	300	2000	100
Beryllium	-	-	-	5	2	-
Cadmium	6	5	-	-	3	-
Copper	30	20	-	5	20	2
Lead	-	-	-	-	2	-
Mercury	-	-	-	1	2	-
Nickel	10	8	-	-	1	-
Selenium	5	5	-	-	1	-
Silver [1]	-	-	-	-	1	-
Thallium [1]	2	2		2	4	-
Zinc	3	10	-	3	7	-
Dioxins						
Total 2,3,7,8-TCDD (Mammal)[2]	5	2	-	NA	NA	NA
Total 2,3,7,8-TCDD (Bird)[2]	NA	NA	NA	-	-	-

Notes:

[1] EPC is maximum detected concentration, therefore, exposure and risk is overestimated

[2] TEQ value calculated based on TEFs for birds and mammals respectively.

- = HQ is less than 1 for this receptor

COPC = chemical of potential ecological concern
NA = analyte is not a COPC in this medium
SVOCs = semivolatile organic compounds
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient

3.4.3.3 BACKGROUND SCREENING

This step eliminates inorganic COPCs that were retained after Tier 2, Step 3a with HQs > 1, and that are detected at concentrations less than or equal to the 95th quantile of the background range of soil concentrations (BNI 1996) typical of uncontaminated soils. No organic preliminary COPCs in any medium, regardless of whether or not they may occur naturally, were screened out by this method; all were retained for further screening. Background screening was used only for inorganic COPCs in soil by first comparing each COPC maximum concentration from site soil to background concentrations. Eight inorganic chemicals in surface soil, including beryllium, cadmium, copper, lead, mercury, nickel, selenium, and zinc, have a maximum detected soil concentration that exceeds their respective Station background concentrations. The 95% UCL concentration for nickel does not exceed its background concentration at Site 1 (see Table 3-3) and nickel was eliminated as a COPC.

Table 3-3: Comparison of Maximum and 95% UCL COPC Concentrations in Soils to Background Concentrations – Inorganic COPCs only

Metals	Maximum Detected Concentration (mg/kg)	95% UCL of the Mean (mg/kg)	Surface Soil Background Concentration* (mg/kg)	Maximum Detected Soil Concentration Exceeds Background?	95% UCL Concentration Exceeds Background?
Beryllium	1.1	1.1[1]	0.669	**Yes**	**Yes** [1]
Cadmium	156	9.158	2.35	**Yes**	**Yes**
Copper	16,700	862	15.3	**Yes**	**Yes**
Lead	1,580	93.3	15.1	**Yes**	**Yes**
Mercury	7.1	0.507	0.22	**Yes**	**Yes**
Nickel	112	12.5	15.3	**Yes**	No
Selenium	4.7	2.12	0.32	**Yes**	**Yes**
Zinc	29,100	1,555	77.9	**Yes**	**Yes**

Notes:
% = percent
mg/kg = milligrams per kilogram on a dry-weight basis
UCL = upper confidence limit
* BNI 1996. Final Technical Memorandum, Background and Reference Levels, Remedial Investigations. San Diego, CA.
[1] The 95% UCL for beryllium (1.3) is greater than the maximum detected concentration. Therefore the value defaults to 1.1 and the comparison to the 95% UCL can not be made.

3.5 TIER 2 UNCERTAINTIES ANALYSIS

Tier 2, Step 3a of the EPA and Navy ecological risk assessment process is part of the first step in the problem formulation phase of the BERA. Exposure assumptions are modified to include scenarios that are less conservative and more closely match the exposure assumptions identified in the conceptual site model.

3.5.1 Uncertainties in the Definition of Surface Soil

For ecological risk assessment purposes, California DEQ considers all chemicals found in soil from the surface to a depth of 6 feet to be COPCs. This is designed to protect mammals that may burrow to 6 feet.

Although burrowing mammals may incidentally ingest soil from a depth of 6 feet, the majority of exposure for mammals (and birds) is through diet. The soil invertebrates and plants that comprise the diet take up the bulk of any COPCs from the absorptive root zone of the soil (approximately 0 to 2 feet). Including COPCs from below 2 feet may over-estimates risk to wildlife, especially those species that do not burrow below 2 feet.

3.5.2 Uncertainties in the Species Foraging Exposure

The SUF is used to adjust exposure estimates to account for the time a wildlife species spends foraging in the contaminated area as opposed to foraging in uncontaminated areas. For this risk assessment the entire site is assumed to be contaminated by COPCs at their exposure point concentrations. The Northern and Southern EOD Ranges cover approximately 33.5 acres. This is larger than the foraging area of all selected representative species (small foraging area was a criterion for species selection). Therefore the SUF is 1 for all species in both Tier 1 and Tier 2. The highest concentrations of the risk drivers are in the central portion of the site, and encompass an area of approximately 0.75 acres; therefore, the exposure in the risk assessment is overestimated for the predators because they hunt over an area larger than 0.75 acres.

The Federally threatened California coastal gnatcatcher has been documented on the site and as a result, the risk assessment has been developed using NOAEL-based TRVs to protect birds and mammals at the individual level. However, the California coastal gnatcatcher is specialized to forage in the CSS habitat. Soil COPCs at Site 1 are found in the central, grassy area of the site, and not in the Coastal Sage Scrub habitat found on the sides of the surrounding hills. As a result, Coastal California gnatcatchers are not likely to be exposed to Site 1 COPCs in normal feeding activities and NOAEL-based TRVs are likely over protective of non-threatened or endangered species populations.

3.5.3 Uncertainties in the Estimation of Soil Exposure Point Concentration

The exposure point concentration for each chemical should represent the level of a chemical in soil likely to be contacted by ecological receptors such as plants, soil invertebrates, birds, and mammals. In Tier 1 the maximum concentration is used as a conservative estimate. This is equivalent of assuming that the representative species at the site forages and lives only at the location where the maximum concentration of a chemical was detected during the sampling, or it assumes that the representative species exist and forage throughout the site and the average concentration is equal to the maximum detected concentration detected. These conditions are not representative of the way a species utilizes the site; therefore, the calculated HQs overestimate risk.

For Tier 2 COPCs, the 95 percent UCL of the surface soil concentration is used to estimate the average exposure concentration across the site. The 95 percent UCL was calculated using EPA's ProUCL program (EPA, 2001e) and represents an upper limit on the average concentration and is, thus, a conservative value. 16 chemicals were not detected frequently enough to calculate 95 percent UCL values, so maximum concentrations were used to estimate Tier 2 risk. Exposure and thus risk is overestimated for these 16 chemicals (identified in Table 3-2).

For large data sets, the mean is a good representative of the average exposure point concentration because the sample mean is expected to approach the parametric mean (Central Limit Theorem: EPA, 2000c; Singh et al., 1997). Because the maximum concentrations of the majority of the risk

Table 3-4: Summary of Risk Driver HQ Values for Ornate Shrew Based on Varied Assumed Exposure Point Concentrations

Chemical Name	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ	Mg/kg dw	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	**2**	9.15	**6**	1.17	<1	3.98	**3**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**4**	862	**30**	12.18	<1	45.4	**1**
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**7**	12.5	**10**	4.25	**5**	6.76	**8**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**3**	67.76	<1	213	<1
Perchlorate	0.0416	<1	0.087	<1	0.038	<1	0.66 *	**3**
Total 2,3,7,8-TCDD TEQ	0.00000289	<1	0.00000673	**5**	0.000000975	<1	0.0000027	**2**
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	<1	41	<1

Notes:
* Maximum
[1] – Not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
COPC = chemical of potential ecological concern
HQ = hazard quotient
mg/kg dw = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
COPC = chemical of potential ecological concern
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 3-5: Summary of Risk Driver HQ Values for Deer Mouse Based on Varied Assumed Exposure Point Concentrations

Chemical Name	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	1	9.15	**5**	1.17	<1	3.98	**2**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**2**	862	**20**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	NA	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**4**	12.5	**8**	4.25	**3**	6.76	**4**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**10**	67.76	<1	213	1
Perchlorate	0.0416	**2**	0.087	**3**	0.038	1	0.66 *	**20**
Total 2,3,7,8-TCDD TEQ	0.00000289	<1	0.00000673	**2**	0.000000975	<1	0.0000027	<1
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
Phenol	2.32	<1	1.2	<1	2.14	<1	NA	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	<1	41	<1

Notes:
* Maximum
[1] – Not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
COPC = chemical of potential ecological concern
HQ = hazard quotient
mg/kg dw = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
COPC = chemical of potential ecological concern
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 3-6: Summary of Risk Driver HQ Values for Western Meadowlark Based on Varied Assumed Exposure Point Concentrations

Chemical Name	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	1	1.1	**2**	0.4	<1	0.555	1
Cadmium	2.2	<1	9.15	**3**	1.17	<1	3.98	1
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**3**	862	**20**	12.18	<1	45.4	1
Lead	21.98	<1	93.3	**2**	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	**2**	0.22	<1	0.86	**3**
Nickel	5.81	<1	12.5	1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	1	1,560	**7**	67.76	<1	213	<1
Perchlorate	0.0416	<1	0.087	**2**	0.038	<1	0.66 *	**7**
Total 2,3,7,8-TCDD TEQ	0.00000452	<1	0.0000128	<1	0.00000132	<1	0.0000045	<1
Toluene	0.29	<1	1.83	1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**10**	22.1	**40**	9.12	**20**	22.1	**40**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	**2**	41	**40**

Notes:
* Maximum
[1] – Not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
COPC = chemical of potential ecological concern
HQ = hazard quotient
mg/kg dw = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
COPC = chemical of potential ecological concern
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Table 3-7: Summary of Risk Driver HQ Values for Mourning Dove Based on Varied Assumed Exposure Point Concentrations

Chemical Name	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ	mg/kg dw	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	**2**	1.1	**5**	0.4	**2**	0.555	**2**
Cadmium	2.2	<1	9.15	<1	1.17	<1	3.98	<1
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	<1	862	**5**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	1	0.22	<1	0.86	**2**
Nickel	5.81	<1	12.5	<1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	<1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	<1	1560	**3**	67.76	<1	213	<1
Perchlorate	0.0416	1	0.087	**2**	0.038	1	0.66 *	**20**
Total 2,3,7,8-TCDD TEQ	0.00000452	<1	0.0000128	<1	0.00000132	<1	0.0000045	<1
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**4**	22.1	**10**	9.12	**4**	22.1	**10**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC[1]		NA	NA	0.378	**5**	41	**90**

Notes:
* Maximum
[1] – Not a COPC due to low frequency of detection
Bold indicates HQ greater than 1
% = percent
COPC = chemical of potential ecological concern
HQ = hazard quotient
mg/kg dw = milligrams per kilogram on a dry-weight basis
NA = not analyzed
UCL = upper confidence limit
COPC = chemical of potential ecological concern
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

drivers represent outliers, the 95 percent UCL and exposure point concentrations are skewed upwards and overestimate potential risk to wildlife. Tables 3-4 through 3-7 compare the HQ values obtained for four different exposure point assumptions for four representative species. It is evident that overall risk decreases when the effect of outliers is minimized by using mean concentrations to represent average exposure instead of 95 percent UCL (or maximum).

3.5.4 Uncertainties in Bioaccumulation of Phthalate Esters

Bioaccumulation of bis (2-ethylhexyl)phthalate and di-n-butylphthalate in soil invertebrates in this ERA is estimated using established generalized relationships to the octanol-water partition coefficient (Log K_{ow}). However, there is recent evidence that this relationship does not accurately predict uptake of phthalates because they are quickly metabolically transformed and are not significantly accumulated (Gobas, MacIntosh, Webster, Blair, and Ikonomou, 2006). Therefore, exposure to phthalates through ingestion of soil invertebrates is overestimated in this ERA.

3.5.5 Uncertainties in the Toxicity Reference Values

This ERA uses NOAEL values from laboratory toxicity studies to estimate toxicity of COPCs to wildlife. This approach is protective of individual birds and mammals and is used in Tier 2 because a threatened species (California coastal gnatcatcher) is known to utilize the site. However, the gnatcatcher utilizes the CSS habitat found on the side slopes of the site. The highest levels of contamination are confined to the grassy area now covering the former disposal trenches. The gnatcatchers are not expected to spend any significant time foraging in this habitat, and thus are not likely to be exposed to the risk drivers. Other representative species are likely to use the area, but they are not endangered. Protection of non-endangered species using NOAEL may be overprotective, because, although a few individuals may suffer adverse effects from exposure to COPCs, the species population can respond to fluctuations in mortality by changing natality (birth rates). LOAEL-based TRVs represent the lowest concentrations at which an adverse effect may be observed. At the LOAEL exposure level some adverse effects to individuals may occur, but not enough to be detrimental to the species population. Thus LOAEL-based TRVs may better represent the protective wildlife exposure levels for chemicals found in surface soil at EOD Site 1. Perchlorate TRVs and physical/chemical characteristics are discussed in Attachment H-11.

Bird TRVs for total xylenes and antimony are not available in the literature, so bird TRVs were developed from mammalian TRVs using an uncertainty factor of 10. This conservative approach assumes that birds are at least 10 times more sensitive to xylenes and antimony than mammals. However, birds may actually be less sensitive or have the same sensitivity to these chemicals, in which case risk to birds from exposure to antimony and xylenes would be overestimated.

3.6 RISK CHARACTERIZATION

3.6.1 Surface Water

Potential risk to aquatic life in surface water at Site 1 is indicated for several COPCs in surface water. Aluminum and barium have HQs of 1 or greater in the Site 1 Ephemeral Pond water. Downgradient of the Ephemeral Pond, copper had a HQ of 1 in the discharge/runoff water.

3.6.2 Sediment

The Tier 2, Step 3a risk calculations for sediment using the 95 percent UCL for the only COPC remaining from the SRA (mercury) resulted in a HQ less than one. Therefore, no COPCs remain for the sediment medium of the Ephemeral Pond

3.6.3 Soil

The following eight metals in surface soil have HQ values greater than 1 after the Tier 2, Step 3a risk calculations using NOAEL-based TRVs and ProUCL-suggested 95 percent UCL EPCs: beryllium, cadmium, copper, lead, mercury, nickel, selenium, and zinc. This indicates that they have the potential to cause adverse effects to terrestrial wildlife individuals at Site 1. Di-n-butylphthalate, perchlorate, and dioxins also have HQ values that exceed 1 after the Tier 2, Step 3a evaluation. Because the EPC is based on a highly skewed data set, the EPC is likely overestimated. Antimony, total xylenes, and 2,4-dinitrotoluene also have HQs that exceed 1, but the HQs are based on using maximum reported concentrations as the EPCs, which overestimates exposure and risk.

The risk from exposure to mercury in soil is driven by high concentrations (3.6 and 10.6 [duplicate] mg/kg) found at sample location HA-09. The risk from exposure to cadmium, copper, lead, nickel, selenium, and zinc is driven by high concentrations found at a depth of 3 feet at sample locations T23 and T33. The highest concentration of di-n-butylphthalate was also detected at location T23 (at 1.5 feet). Beryllium was found at its maximum concentration at a depth of 5 feet at sample location DP23.The highest perchlorate concentration was identified at a depth of 6 feet at sample location T-34.

For 2,3,7,8-TCDD TEQ (mammal), the BERA risk calculations for the ornate shrew (HQ=5) and the deer mouse (HQ=2) are based on NOAEL-based TRVs. Since no endangered mammals are known from the area, a LOAEL-based TRV can be used to estimate a low-effect HQ to assess risk at the population level. The bioavailability of dioxins in soil may also be overestimated. Large organic molecules such as dioxins bind tightly with organic matter found in natural soils and may not be generally bioavailable. This may result in an over estimation of risk from dioxin exposure.

Also, the BERA risk calculations of dioxins for the ornate shrew (HQ=5) and the deer mouse (HQ=2) are based on the ProUCL-recommended 95% UCL (0.00000673 mg/kg) soil concentration. This value is driven by elevated concentrations detected in two out of 11 surface soil samples analyzed for dioxins (T23 and T33) located at a depth of 3 feet.

For small mammals, antimony, copper, nickel, zinc, and total xylenes HQ values equaled or exceeded 10 using NOAEL-based TRVs. For birds, antimony, copper, total xylenes, 2,4-dinitrotoluene, and di-n-butylphthalate HQ values equaled or exceeded 10 using NOAEL-based TRVs. The chronic daily intake of these soil chemicals may cause unacceptable adverse effects to individual birds and mammals , however, the HQs for antimony, and total xylenes are based on maximum detected concentrations (therefore ,the risk is overestimated).

3.6.3.1 Distribution of Tier 2 HQ Exceedances Across Site 1

Figure 3-1 shows the distribution of chemicals with surface soil HQ values that exceed 1 based on NOAEL-based TRVs (See calculation of soil concentrations with an HQ equal to 1 in Attachment H-12). The exceedances are centered around the former disposal trenches (characterized by sample locations T14, T15, T17, T20, T23, and T33). This area does not include the CSS habitat that is found on the sloped hillsides of the bowl-shaped Site 1 (Figure 3-1). The threatened California coastal gnatcatcher is specialized to forage in the CSS habitat. Typically, gnatcatchers glean insects and arthropods from the vegetation of the CSS. They are generally not ground feeders. The federally regionally sensitive cactus wren forages in a similar fashion in the CSS. As a result, Coastal California gnatcatchers are not likely to be exposed to Site 1 COPCs in normal feeding activities and LOAEL-based TRVs are more appropriate to assess the threat to non-threatened or endangered bird and mammal populations.

Tier II soil screening values were calculated using Tier II exposure assumptions and LOAEL-based TRVs to back calculate a soil concentration equivalent to a hazard quotient of 1. The lowest value of

all representative species was selected as the screening value for mapping purposes. Figure 3-2 shows the distribution of exceedances of LOAEL-based soil screening values.

3.6.3.2 ASSESSMENT OF NON-THREATENED OR –ENDANGERED BIRD AND MAMMAL POPULATIONS

Attachments H 5-5 through H 5-7 present the LOAEL-based bird and mammal TRVs for all soil COPCs in Tables 3-1 with HQ values exceeding 1. The potential risk (i.e., HQ) to wildlife from the Tier 2 COPCs was recalculated using LOAEL-based TRVs and reasonable maximum exposure soil concentrations (RME) (95 percent UCL EPCs or the maximum for those chemicals detected in less than 11 samples). Attachments H 8-7 through H 8-12 present exposure calculations and HQ values for those assessment endpoints and COPCs with NOAEL-based HQ values that exceed 1 in Tables 3-1. Table 3.8 summarizes the final HQ values using the 95 percent UCL EPCs (except as noted) and LOAEL-based TRVs.

Table 3-8: Table of Final HQ Values for Site 1 Using LOAEL-based TRVs for Protection of Representative Wildlife Populations

Chemical	95 Percent UCL (mg/kg)	Ornate Shrew HQ	Deer Mouse HQ	Western Meadowlark HQ	Mourning Dove HQ	Loggerhead Shrike HQ
2,3,7,8-TCDD TEQ - Mammal	0.00000673	<1	<1	NA	NA	NA
2,3,7,8-TCDD TEQ - Bird	0.0000128	NA	NA	<1	<1	<1
Total xylenes [1]	98 (max)	**8**	**7**	**50**	**30**	<1
Antimony [1]	130 (max)	**30**	**20**	**100**	**10**	<1
Beryllium	1.30	<1	<1	<1	<1	<1
Cadmium	9.16	<1	<1	<1	<1	<1
Copper	862	**3**	**2**	**2**	<1	<1
Mercury	0.507	<1	<1	<1	<1	<1
Nickel	12.5	1	<1	<1	<1	<1
Perchlorate	0.0876	<1	<1	<1	<1	<1
Selenium	2.12	<1	<1	<1	<1	<1
Zinc	1,560	<1	1	<1	<1	<1
2,4-Dinitrotoluene [1]	7	<1	<1	**8**	**10**	<1
Di-n-butylphthalate	22	<1	<1	**3**	1	<1

Notes:
[1] Maximum detected concentration used; due to low frequency of detection 95 percent UCLs not available
Bold indicates HQ greater than 1
NA = not applicable
UCL= upper confidence limit
mg/kg= milligrams per kilogram
HQ= hazard quotient
2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient

Tier 2 HQ values for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples for calculation of a 95 percent UCL): HQs for copper ranged from 2 to 3, and HQs for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPCs are overestimated, and, thus the HQs are overestimated for these two COPCs.

Additionally, HQs were calculated for COPCs that were detected in less than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only 3 of these COPCs had calculated HQs greater than 1. Calculated HQs for antimony ranged from 10 to 100, calculated HQs total xylenes ranged from 7 to 50, and calculated HQs for 2,4-dinitrotoluene ranged from 8 to 10. HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. HQs for 2,4-dinitrotoluene were driven by the maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. The HQs calculated for the 3 COPCs represent the exposure at the locations of the maximum detection only and significantly overestimates the average exposure and thus the risk across the entire site. Because of their low frequency of detection, exposure of wildlife to the three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

Because of the overestimation of bioaccumulation of phthalates in the food chain, the risk from exposure to di-n-butyl phthalate is expected to be acceptable.

3.7 Conclusions of Tier 2, Step 3a BERA Process

Although potential risk to aquatic life in surface water at Site 1 is indicated for two COPCs (aluminum and barium) in surface water within the Ephemeral Pond, concentrations of these COPCs are not at levels that are likely to cause adverse effects to the ephemeral aquatic community present. The aquatic life criteria that were used in SRA and BERA comparisons are for all aquatic life and are extremely conservative in nature. Given that ephemeral habitat species are well-adapted to environmental extremes, and that a seemingly viable and reproducing aquatic community (including *S. woottoni*) existed in the Ephemeral Pond during the sampling period, the conclusion must be made that aluminum and barium do not pose risks to these aquatic life receptors in the Site 1 Ephemeral Pond.

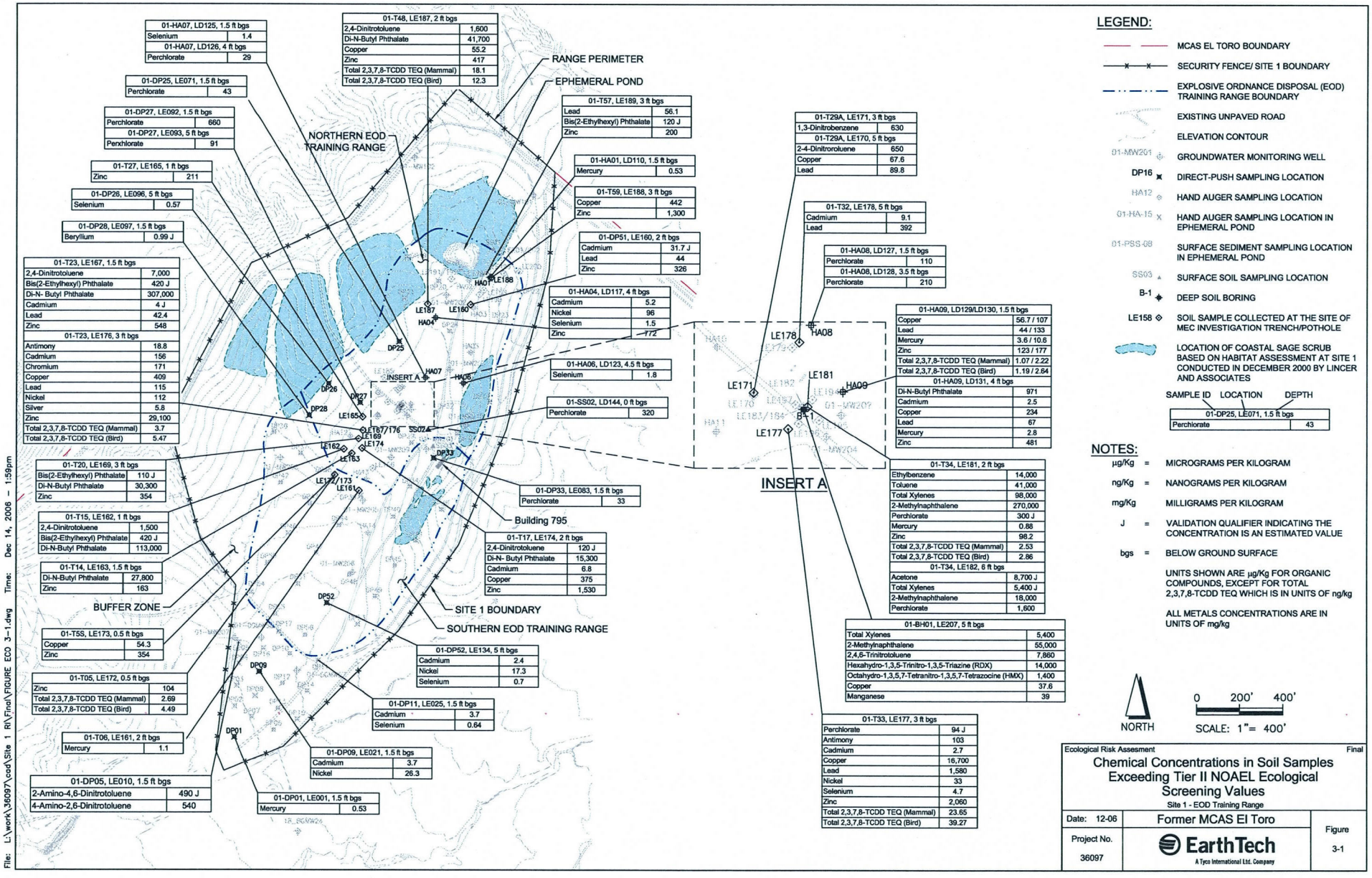
Exposure to chemicals in sediment at the Site 1 Ephemeral Pond does not present a significant threat of adverse effects to benthic receptors (based on refined exposure assumptions for sediment).

The Tier 2 HQ values for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples for calculation of a 95 percent UCL). Calculated HQ values for copper ranged from 2 to 3, and calculated HQ values for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPC is overestimated, and, thus the calculated HQ is overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected in less than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only 3 of these COPCs had calculated HQs greater than 1. Calculated HQs for antimony ranged from 10 to 100, calculated HQs for total xylenes ranged from 7 to 50, and calculated HQs for 2,4-dinitrotoluene ranged from 8 to 10. These elevated HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. The HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. The HQs for 2,4-dinitrotoluene were driven by the maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. The HQs calculated for the 3 COPCs represent the exposure at the locations of the maximum detection only and overestimates the average exposure and thus the risk to receptors across the entire site. Because of their low frequency of detection and

limited distribution, exposure of wildlife to the three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

The results of the ecological SRA and BERA evaluation suggest that chemicals reported in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individual plant and invertebrates, if colocated with the maximum reported detections of some chemicals, may suffer from adverse effects. No further evaluation to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1 is required.



01-HA07, LD125, 1.5 ft bgs	
Selenium	1.4
01-HA07, LD126, 4 ft bgs	
Perchlorate	29

01-DP25, LE071, 1.5 ft bgs	
Perchlorate	43

01-DP27, LE092, 1.5 ft bgs	
Perchlorate	660
01-DP27, LE093, 5 ft bgs	
Perxhlorate	91

01-T27, LE165, 1 ft bgs	
Zinc	211

01-DP26, LE096, 5 ft bgs	
Selenium	0.57

01-DP28, LE097, 1.5 ft bgs	
Beryllium	0.99 J

01-T23, LE167, 1.5 ft bgs	
2,4-Dinitrotoluene	7,000
Bis(2-Ethylhexyl) Phthalate	420 J
Di-N- Butyl Phthalate	307,000
Cadmium	4 J
Lead	42.4
Zinc	548
01-T23, LE176, 3 ft bgs	
Antimony	18.8
Cadmium	156
Chromium	171
Copper	409
Lead	115
Nickel	112
Silver	5.8
Zinc	29,100
Total 2,3,7,8-TCDD TEQ (Mammal)	3.7
Total 2,3,7,8-TCDD TEQ (Bird)	5.47

01-T20, LE169, 3 ft bgs	
Bis(2-Ethylhexyl) Phthalate	110 J
Di-N-Butyl Phthalate	30,300
Zinc	354

01-T15, LE162, 1 ft bgs	
2,4-Dinitrotoluene	1,500
Bis(2-Ethylhexyl) Phthalate	420 J
Di-N-Butyl Phthalate	113,000

01-T14, LE163, 1.5 ft bgs	
Di-N-Butyl Phthalate	27,800
Zinc	163

01-T5S, LE173, 0.5 ft bgs	
Copper	54.3
Zinc	354

01-T05, LE172, 0.5 ft bgs	
Zinc	104
Total 2,3,7,8-TCDD TEQ (Mammal)	2.69
Total 2,3,7,8-TCDD TEQ (Bird)	4.49

01-T06, LE161, 2 ft bgs	
Mercury	1.1

01-DP05, LE010, 1.5 ft bgs	
2-Amino-4,6-Dinitrotoluene	490 J
4-Amino-2,6-Dinitrotoluene	540

01-T48, LE187, 2 ft bgs	
2,4-Dinitrotoluene	1,600
Di-N-Butyl Phthalate	41,700
Copper	55.2
Zinc	417
Total 2,3,7,8-TCDD TEQ (Mammal)	18.1
Total 2,3,7,8-TCDD TEQ (Bird)	12.3

01-T57, LE189, 3 ft bgs	
Lead	56.1
Bis(2-Ethylhexyl) Phthalate	120 J
Zinc	200

01-HA01, LD110, 1.5 ft bgs	
Mercury	0.53

01-T59, LE188, 3 ft bgs	
Copper	442
Zinc	1,300

01-DP51, LE160, 2 ft bgs	
Cadmium	31.7 J
Lead	44
Zinc	326

01-HA04, LD117, 4 ft bgs	
Cadmium	5.2
Nickel	96
Selenium	1.5
Zinc	172

01-HA06, LD123, 4.5 ft bgs	
Selenium	1.8

01-SS02, LD144, 0 ft bgs	
Perchlorate	320

01-DP33, LE083, 1.5 ft bgs	
Perchlorate	33

01-T17, LE174, 2 ft bgs	
2,4-Dinitrotoluene	120 J
Di-N- Butyl Phthalate	15,300
Cadmium	6.8
Copper	375
Zinc	1,530

01-DP52, LE134, 5 ft bgs	
Cadmium	2.4
Nickel	17.3
Selenium	0.7

01-DP11, LE025, 1.5 ft bgs	
Cadmium	3.7
Selenium	0.64

01-DP09, LE021, 1.5 ft bgs	
Cadmium	3.7
Nickel	26.3

01-DP01, LE001, 1.5 ft bgs	
Mercury	0.53

01-T29A, LE171, 3 ft bgs	
1,3-Dinitrobenzene	630
01-T29A, LE170, 5 ft bgs	
2-4-Dinitrotoluene	650
Copper	67.6
Lead	89.8

01-T32, LE178, 5 ft bgs	
Cadmium	9.1
Lead	392

01-HA08, LD127, 1.5 ft bgs	
Perchlorate	110
01-HA08, LD128, 3.5 ft bgs	
Perchlorate	210

01-HA09, LD129/LD130, 1.5 ft bgs	
Copper	56.7 / 107
Lead	44 / 133
Mercury	3.6 / 10.6
Zinc	123 / 177
Total 2,3,7,8-TCDD TEQ (Mammal)	1.07 / 2.22
Total 2,3,7,8-TCDD TEQ (Bird)	1.19 / 2.64
01-HA09, LD131, 4 ft bgs	
Di-N-Butyl Phthalate	971
Cadmium	2.5
Copper	234
Lead	67
Mercury	2.8
Zinc	481

01-T34, LE181, 2 ft bgs	
Ethylbenzene	14,000
Toluene	41,000
Total Xylenes	98,000
2-Methylnaphthalene	270,000
Perchlorate	300 J
Mercury	0.88
Zinc	98.2
Total 2,3,7,8-TCDD TEQ (Mammal)	2.53
Total 2,3,7,8-TCDD TEQ (Bird)	2.86
01-T34, LE182, 6 ft bgs	
Acetone	8,700 J
Total Xylenes	5,400 J
2-Methylnaphthalene	18,000
Perchlorate	1,600

01-BH01, LE207, 5 ft bgs	
Total Xylenes	5,400
2-Methylnaphthalene	55,000
2,4,6-Trinitrotoluene	7,860
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	14,000
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	1,400
Copper	37.6
Manganese	39

01-T33, LE177, 3 ft bgs	
Perchlorate	94 J
Antimony	103
Cadmium	2.7
Copper	16,700
Lead	1,580
Nickel	33
Selenium	4.7
Zinc	2,060
Total 2,3,7,8-TCDD TEQ (Mammal)	23.65
Total 2,3,7,8-TCDD TEQ (Bird)	39.27

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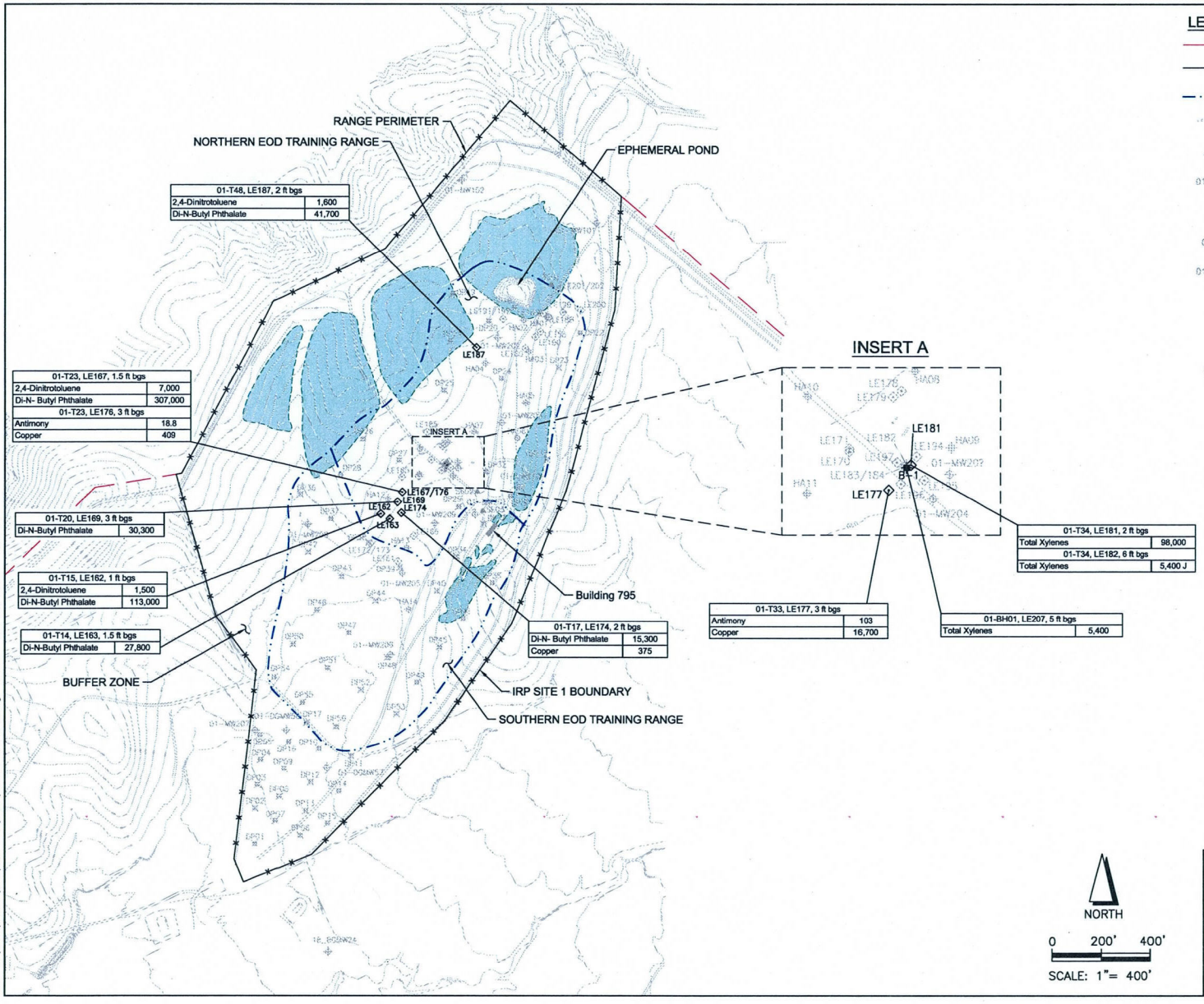

LEGEND:

- MCAS EL TORO BOUNDARY
- SECURITY FENCE/ IRP SITE 1 BOUNDARY
- EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING RANGE BOUNDARY
- EXISTING UNPAVED ROAD
- ELEVATION CONTOUR
- 01-MW201 GROUNDWATER MONITORING WELL
- DP16 DIRECT-PUSH SAMPLING LOCATION
- HA12 HAND AUGER SAMPLING LOCATION
- 01-HA-15 HAND AUGER SAMPLING LOCATION IN EPHEMERAL POND
- 01-PSS-08 SURFACE SEDIMENT SAMPLING LOCATION IN EPHEMERAL POND
- SS03 SURFACE SOIL SAMPLING LOCATION
- B-1 DEEP SOIL BORING
- LE158 SOIL SAMPLE COLLECTED AT THE SITE OF MEC INVESTIGATION TRENCH/POTHOLE
- LOCATION OF COASTAL SAGE SCRUB BASED ON HABITAT ASSESSMENT AT IRP SITE 1 CONDUCTED IN DECEMBER 2000 BY LINCER AND ASSOCIATES

SAMPLE ID LOCATION DEPTH

01-T20, LE169, 3 ft bgs	
Di-N-Butyl Phthalate	30,300

NOTES:

µg/kg	MICROGRAMS PER KILOGRAM
mg/kg	MILLIGRAMS PER KILOGRAM
bgs	BELOW GROUND SURFACE
ft	FEET
I.D.	IDENTIFICATION
IRP	INSTALLATION RESTORATION PROGRAM
MCAS	MARINE CORPS AIR STATION
MEC	MUNITIONS AND EXPLOSIVES OF CONCERN

UNITS SHOWN ARE µg/kg FOR ORGANIC COMPOUNDS.

ALL METALS CONCENTRATIONS ARE IN UNITS OF mg/kg.

THIS MAP SHOWS LOCATIONS OF INDIVIDUAL CHEMICAL CONCENTRATIONS THAT EXCEED A VALUE EQUIVALENT TO AN HQ OF 1 USING LOAEL-BASED TRVs IN TIER 2 OF THE ECOLOGICAL RISK ASSESMENT. THEY REPRESENT THE FEW SAMPLES OF MORE THAN 140 SAMPLES THAT EXCEED THE SCREENING VALUES. THE RISK CALCULATION IS BASED ON THE EXPOSURE POINT CONCENTRATION (EPC) ACROSS THE ENTIRE SITE REPRESENTED BY THE 95 PERCENT UCL AND NOT EXPOSURE AT THESE INDIVIDUAL LOCATIONS.

Ecological Risk Assessment — Final

Chemical Concentrations in Soil Samples Exceeding Tier II LOAEL Ecological Screening Values

Site 1 - EOD Training Range

Date: 12-06	Former MCAS El Toro	Figure
Project No. 36097	EarthTech — A Tyco International Ltd. Company	3-2

File: L:\work\36097\cad\Site 1 RI\Final\FIGURE ECO 3-2.dwg Time: Dec 21, 2006 - 10:17am

4. SUMMARY AND CONCLUSIONS

This ERA was conducted in order to evaluate the potential threats to ecological receptors from site-related COPCs detected above risk-based screening criteria. Soil, sediment, and surface water samples were collected and analyzed for VOCs, SVOCs, hydrocarbons, explosives, perchlorate, general dioxins, and metals.

4.1 TIER 1

Tier 1 (ecological SRA), Step 1 included a habitat assessment, contaminant identification, receptor and pathway identification, and toxicity evaluation. Tier 1, Step 2 included exposure estimation based on conservative assumptions. Risk was then estimated by comparing the media-specific exposure point concentrations to conservative, screening-level, media-specific screening values.

The results of the Tier 1 assessment for surface water indicated that four metals (aluminum, barium, copper and mercury) exceeded screening values for aquatic life receptors. The results of the Tier 1 assessment for Ephemeral Pond chemistry, sediment indicated that mercury exceeded its screening value for benthic receptors. The concentrations of four VOCs, three SVOCs, and 16 metals in surface soil exceeded the Tier 1 screening values for direct contact for terrestrial ecological receptors. Therefore, the site failed the ecological SRA, and surface water, sediment, and soil pathways required further evaluation in a BERA.

4.2 TIER 2

Tier 2 (BERA), Step 3a used the same representative species, exposure pathways, and TRVs, with refined exposure assumptions to more realistically estimate the potential risk to ecological receptors from COPCs that failed the conservative Tier 1 screening process.

The results of the Tier 2 assessment indicated potential risk to aquatic life in surface water for aluminum and barium; however, the aquatic life criteria that were used in the ecological SRA and BERA are extremely conservative in nature given that a seemingly viable and reproducing aquatic community exists in the Ephemeral Pond. Therefore, concentrations of these COPCs are not at levels that are likely to cause adverse effects to the ephemeral aquatic community present. Based on refined exposure assumptions, exposure to chemicals in sediment at the IRP Site 1 Ephemeral Pond does not present a significant threat of adverse effects to benthic receptors. The Tier 2 HQ values for all wildlife receptors only exceeded 1 for two COPCs that were detected in more than 10 surface samples across the site (the minimum number of samples for calculation of a 95 percent UCL). Calculated HQ values for copper ranged from 2 to 3, and calculated HQ values for di-n-butylphthalate ranged from 1 to 3. The 95 percent UCLs for copper and di-n-butyl phthalate are skewed upward by a single high detection in each data set. Comparison of the 95 percent UCLs for these two COPCs to their means suggests that the average EPC is overestimated, and, thus the calculated HQ is overestimated for these two COPCs.

Additionally, HQs for representative receptors were calculated for COPCs that were detected in less than 5 percent of samples using the maximum detected concentration because there were fewer than 10 detections for these chemicals. Only 3 of these COPCs had calculated HQs greater than 1. Calculated HQs for antimony ranged from 10 to 100, calculated HQs for total xylenes ranged from 7 to 50, and calculated HQs for 2,4-dinitrotoluene ranged from 8 to 10. These elevated HQs for antimony were driven by the maximum concentration of 103 mg/kg (next highest 18.8 mg/kg) among 5 detections from 143 samples. The HQs for total xylenes were driven by the maximum concentration of 98 mg/kg (next highest 5.4 mg/kg) among 3 detections from 168 samples. The HQs for 2,4-dinitrotoluene were driven by the maximum concentration of 7 mg/kg (next highest 1.6 mg/kg) among 6 detections from 147 samples. The HQs calculated for the 3 COPCs represent the

exposure at the locations of the maximum detection only and overestimates the average exposure and thus the risk to receptors across the entire site. Because of their low frequency of detection and limited distribution, exposure of wildlife to the three COPCs are not likely to aversely effect wildlife populations at IRP Site 1.

4.3 CONCLUSIONS

The results of the Tier 2 assessment indicated that concentrations of COPCs in surface water and sediment in the Ephemeral Pond are not at levels that are likely to cause adverse effects to the ephemeral aquatic and benthic community present, thus, no further evaluation is necessary to protect aquatic or benthic ecological receptors at Site 1.

The results of the ecological SRA and BERA evaluation suggest that chemicals reported in soil are not likely to adversely effect wildlife populations at IRP Site 1, although some individual plant and invertebrates, if colocated with the maximum reported detections of some chemicals, may suffer from adverse effects. No further evaluation to protect aquatic, benthic, or terrestrial ecological receptors at IRP Site 1 is required.

5. REFERENCES

Anderson, R. M. 1976. Shrikes feed on prey remains left by hawks. Condor 78: 269.

ATSDR. 1993a. Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs) (Draft).Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.

ATSDR. 1993b. "Toxicological Profile for Lead." U.S. Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

Aughey, E., L. Grant, B.L. Furman, and W.F. Dryden. 1977. The Effects of Oral Zinc Supplementation in the Mouse, Journal of Comparative Pathology, 87: 1-14.

Baker, R.H., 1983. Michigan Mammals. Michigan State University Press. USA.

Bechtel National, Inc. (BNI). 1995. *Final Work Plan Phase II Remedial Investigation/Feasibility Study*. San Diego, CA.

Bechtel Jacobs Company. 1998. *Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants.* BJC/OR-133. BJC/OR-133. Oak Ridge, TN: U.S. Department of Energy, Office of Environmental Management, Oak Ridge National Laboratory.

Beyer, W. N., and C. Stafford. 1993. Survey and Evaluation of Contaminants in Earthworms and in Soils Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. Environ. Monitor. Assess. 24:151–165.

Beyer, W. N., E. E. Connor, and S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife. *J. Wildl. Manage.* 58(2): 375–382.

Birak, P., J. Yurk, F. Adeshina, M. Lorber, K. Pollard, H. Choudhury, and S. Kroner. 2001. Travis and Arms revisited: a second look at a widely used bioconcentration algorithm. Toxicol Ind Health 17:163-175.

Borzelleca, J.F., L.W. Condie Jr., and J.L. Egle, Jr. 1988. Short-term toxicity (one-dayand ten-day gavage) of barium chloride in male and female rats. J. Am. Coll. Toxicol. 7: 675-685.

British Columbia Ministry of Environment Lands and Parks (BCMOELP). 1994. Approved and working criteria for water quality - 1994. Water Quality Branch. Environmental Protection Department. British Columbia Ministry of Environment Lands and Parks. ISBN 0-7726-2061-X. Victoria, British Columbia. 45 pp.

Brown, L. H., D. Amadon. 1968. Eagles, hawks and falcons of the world, 2., McGraw Hill, New York: 945.

Brown, N.L., Johnson, C.D., and D.F. Williams. 1996. Buena Vista Lake shrew, *Sorex ornatus relictus. Available at:* http://arnica.csustan.edu/esrpp/bvls.htm.

Bryant, Harold C. 1914. A determination of the economic status of the western meadowlark (Sturnella neglecta) in California. Univ. of Calif. Publ. Zool. 11(14): 377-510.

Burt, W. H. and R. P. Grossenheider, 1976. A Field Guide to the Mammals, 3rd. edition, Houghton Mifflin Company, Boston, MA.

Burt, W. H. and R. P. Grossenheider. 1980. A field guide to the mammals: North America and Mexico. Houghton-Mifflin, New York, New York, USA.

Cain, B.W. and E.A. Pafford. 1981. "Effects of Dietary Nickel on Survival and Growth of Mallard Ducklings." Arch. Environm. Contam. Toxicol. Volume 10. Pages 737-745.

Cain, B. W., L. Sileo, J. C. Franson, and J. Moore. 1983. Effects of Dietary Cadmium on Mallard Ducklings, Environmental Research, 32: 286-297.

California Department of Fish and Game (CDFG). 1994. Designated Endangered, Threatened, or Rare Plants and Candidates with Official Listing Dates.

Campbell, K. F. 1998. Loggerhead Shrike-*Lanius ludovicianus*. California: Species of Special Concern. Campbell BioConsulting, 40950 Via Media, Temecula, CA.

Carpenter, C.P. C.S. Weil and H.F. Smyth. 1953. Chronic toxicity of DEHP for rats, guinea pigs, and dogs. AMA Arch. Ind. Hyg. 8: 219-226.

Carriere, D., K. Fischer, D. Peakall, and P. Angehrn. 1986. Effects of Dietary Aluminum in Combination with Reduced Calcium and Phosphorus on the Ring Dove (Strptopelia risoria), Water, Air, and Soil Poll., 30: 757-764.

Deavers, D.R., and Hudson, J.W. 1981. Temperature regulation in two rodents (*Clethrionomys gapperi* and *Peromyscus leucopus*) and a shrew (*Glarina brevicauda*) inhabiting the same environment. Physiol. Zool. 54:94-108.

Department of Interior (DOI). 2002. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Endangered Status for the Buena Vista Lake Shrew (*Sorex ornatus relictus*). U.S. Fish and Wildlife Service. *In:* Federal Register 67(44):10101-10113.

Domingo, J.L., J.L. Paternain, J.M. Liobet, and others. 1985. Effects of Cobalt on Postnatal Devlopment and Late Gestation in Rats Unop Oral Administration, Rev. Esp. Fisiol., 4: 293 - 298.

Department of the Navy (DON). 1998. *Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP).* Prepared for Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM). October.

———.1999. *Navy Policy for Conducting Ecological Risk Assessments.* Letter from A. A. Granuzzo, Chief of Naval Operations, to Commander, Naval Facilities Engineering Command. Ser. N453E/9U595355. Washington, D.C. 5 April.

Dunn, Ann Bailey. 1998. A closer look: The Western Meadowlark. North Dakota Outdoors 60(8)9. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/1998/westlark/westlark.htm (Version 15MAY98).

Dunning, J. B. 1993. Body Weights of 686 Species of North American Birds. Monograph No. 1., Western Bird Banding Association, May 1984, International Wildlife Rehabilitation Council, Reprint, Suisun, CA.

Earth Tech, Inc. 2001a. *Final Work Plan, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. November.

———. 2001b. *Technical Memorandum, Verification of Perchlorate at IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. July.

———. 2001c. *Final Site-Specific Environmental Baseline Survey Report, IRP Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California.* Honolulu. August.

———. 2001d. *Work Plan, Ordnance and Explosives Range Evaluation, IRP Site 1, Explosives Ordnance Range, Marine Corps Air Station El Toro, California.* Draft Final. Honolulu. November.

_____. 2001e. ProUCL- Version 2, [software for Windows 95, accompanied by "Pro UCL User's Guide."Prepared for EPA by Lockheed Martin.

———. 2002. *Ecological Risk Assessment Memorandum, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California.* Honolulu. December.

———. 2003a. *Interim Analytical Data Package, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California.* Honolulu. January.

———. 2003b. *Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California.* Honolulu. February.

Eben, A., W. Flucke, F Mihail. 1979. *Toxicological and metabolic studies of methyl n butylketone, 2,5-hexanedione, and 2,5-hexanediol in male rats.* Ecotoxicol. Environ. Safety. 3: 204-217.

Edens, F.W., E. Benton, S.J. Bursian, and G.W. Morgan. 1976. *Effect of dietary lead on reproductive performance in Japanese quail, Coturnix coturnix japonica.* Toxicol. and Appl. Pharm. 38: 307-314.

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.* ES/ER/TM-85/R3. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN, November.

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

Ehrlich, P. R, D. S. Dobkin, and D. Wheye. 1988. *The Birder's Handbook:A field guide to the natural history of North American birds.* 1st ed. New York: Simon and Schuster, Inc.

Eisler, R. 1987. *Polycyclic aromatic hydrocarbon hazards to fish, wildlife, and invertebrates: a synoptic review.* U.S. Fish and Wldlife Service. Biological Report 85 (1.11).

Ellington, J., N. Wolfe, A. Garrison, J. Evans, J. Avants, and Q. Teng, 2001. Determination of Perchlorate in Tobacco Plants and Tobacco Products. Enviro. Sc. Technol. 35:3213-3218.

Enderson, J. H. 1960. A Population study of the sparrow hawk in the east-central Illinois. Wilson Bulletin 72:222-231.

Engineering Field Activity West (EFAW). 1998. Development of Toxicity Reference Values as Part of a Regional Approach for Conducting Ecological Risk Assessments at Naval Facilities in California. Draft Technical Memorandum. San Bruno, Calif.: Department of the Navy, Engineering Field Activity West, Naval Facilities Engineering Command. Contract N62474-94-D-7609, Contract Task Order 027. July.

Environmental Protection Agency, United States (EPA). 1977. Guidelines for the pollution classification of Great Lakes Harbor sediments. U.S. Environmental Protection Agency. Region V. Great Lakes Surveillance Branch. Chicago, Illinois.

———. 1986. 90-day gavage study in albino rats using acetone. Office of Solid Waste. Washington, D.C.

———. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Office of Emergency and Remedial Response.

———. 1989. Risk Assessment Guidance for Superfund, Vol. II: Environmental Evaluation Manual. Interim Final. EPA/540/1-89/001. March.

———. 1991. Risk Assessment Guidance for Superfund: Volume 1- Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim, EPA/540/R-92/003, US Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

———. 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* Memorandum from Larry G. Reed, Director of Hazardous Waste Site Evaluation Division, Office of Emergency and Remedial Response. EPA/9285.7-081. 22 June.

———. 1993. *Wildlife Exposure Factors Handbook, Vol. I.* EPA/600/R-93/187a. Office of Research and Development. December.

———. 1995. "Great Lakes Quality Initiative Criteria Documents for the Protection of Wildlife." U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA-820\b-95\008.

———. 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment.* Interim Final. EPA/540/R-97/006. Office of Solid Waste and Emergency Response. June.

———. 1998. Guidelines for Ecological Risk Assessment. Final. EPA/630/R-95-002F. April. Risk Assessment Forum.

———. 1999. Screening Level Ecological Risk Assessment Protocal for Hazardous Waste Combustion Facilities-Vol 1. Peer Review Draft. EPA/530/D-99-001A. Office of Solid Waste and Emergency Response. August

———. 2000a. U.S. Environmental Protection Agency. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. In: Federal Register 40 CFR Part 131. May 18, 2000.

———. 2000b. *Ecological Soil Screening Level Guidance, Draft.* US Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

———. 2000c. *Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G9, QA00 Update,* EPA/600/R-96/084 US Environmental Protection Agency, Office of Environmental Information, Washington, DC, 20460.

———. 2002. National Recommended Water Quality Criteria: 2002. Office of Water, Office of Science and Technology. EPA-822-R-02-047. November 2002.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Everett, W.T. 1979. *Threatened, declining and sensitive bird species in San Diego County.* Sketches June.

Fitchko, J. 1989. Criteria for Contaminated Soil/Sediment Cleanup. Beak Consultants Limited. Brampton, Ontario. ISBN 0-934165-29-6. Pudvan Publishing Co. Inc. Northbrook, Illinois.

Gasaway, W.C. and I.O. Buss. 1972. Zinc toxicity in the mallard duck. J. Wildl. Manage. 36: 1107-1117.

Gobas, F., C. MacIntosh, G. Webster, J. Blair, and M. Ikonomou, 2006. Including Metabolic Transformation in Bioaccumulation Assessments: The Phthalate Ester Case Study, SETAC, 27T Annual Meeting, North America, Montreal.

Graber, R. R., J. W. Graber, and E. L. Kirk. 1973. Illinois Birds: Laaniidae. Illinois. Natural History Survey Biological Notes No. 83.

Gray, L.E., Jr. And J.W. Laskey. 1980. Multivariate analysis of the effects of manganese on the reproductive physiology and behavior of the male house mouse. Journal of Toxicology and environmental health. Vol. 6. Pages 861-867.

Grinnell, J. and A. H. Miller. 1944. The Distribution of the Birds of California. Pacific Coast Avifauna 27.

Hansch, C., Leo, A., and D. Hoekman. 1995. Exploring QSAR - Hydrophobic, Electronic, and Steric Constants. Washington, DC: American Chemical Society. 175. from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Harr, J. R., J. F. Bone, I. J. Tinsley, P. H. Weswig, and R. S. Yamamoto. 1966. Selenium Toxicity in Rats, Symposium: Selenium in Biomedicine, 1st International Symposium. Oregon State University.

Haseltine S. D., L. Sileo, D. J. Hoffman. Effects of Chromium on Reproduction and Growth in Black Ducks, Unpublished Data in B. E. Sample, D. M. Opresko and G. W. Suter II. 1985.

Hayes, F. E. and W. S. Baker. 1987. Loggerhead shrike feeds on dead American coot. W. Birds 18: 133-134.

Heinz, G.H. D.J. Hoffman, and L.J. Gold. 1988. Toxicity of organic and inorganic selenium to mallard ducklings. Arch. Environ. Contam. Toxicol. 17: 561-568.

Holbrook, S.J. 1979. Habitat utilization, competitive interactions, and coexistence of three species of cricetine rodents in east-central Arizona. Ecology 60: 758-769.

Ivankovic, S. and R. Preussmann. 1975. Absence of Toxic and Carcinogenic Effects After Administration of High Doses of Chromic Oxide Pigment in Subacute and Long-term Feeding Experiments in Rats, Food and Cosmetic Toxicology 13: 347-351.

Jaagumagi, R. 1993. Development of the Ontario Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons (PAH). Ontario Ministry of Environment, Toronto, ON. 79 pp.

Jacobs Engineering Group, Inc. (JEG) 1993. Draft Phase I Remedial Investigation Technical Memorandum. Irvine, CA.

Johnson, D. Jr., A.L. Mehring, Jr., and H.W. Titus. 1960. Tolerance of chickens for barium. Proc. Soc. Exp. Biol. Med. 104: 436-438.

Johnson, D.R. 1961. The food habits of rodents in range lands of southern Idaho. Ecology 42: 407-410.

Kaufman, D.W. and Kaufman, G.A. 1989. Population biology. In: Kirkland, G.L.; Lane, J.N., eds. Advances in the study of *Peromyscus* (Rodentia). Lubbock, TX: Texas Tech University Press.

KEA Environmental (KEA). 1998. *Letter Report to Rovert Montana regarding Biological Resources Report, MCAS El Toro Habitat Preserve.* Prepared by Christina M. Schaefer. Attached field notes by C. Schaefer. May.

Khera, K.S., and Tabacova, S.A. 1973. "Effects of Methylmercuric Chloride on the Progeny of Mice and Rats Treated Before or During Gestation." Foods and Cosmetics Toxicology. Volume 11, Number 2. Pages 245-254.

Lamb, J. C., C. Chapin,IV, and R. E. Teague. 1987. Reproductive Effects of Four Phthalic Acid Esters in the Mouse, Toxicol. Appl. Pharmacol., 88; 225-269.

Lanyon, Wesley E. 1962. *Specific Limits and Distribution of Meadowlarks of the Desert Grassland.* Auk. 79:183-207.

Lanyon, Wesley E. 1994. "Western Meadowlark." In *The Birds of North America No. 104.* A. Pool, P. Stettenheim, and F. Gill, eds. The Academy of Natural Sciences, Philadelphia, and the American Ornithologists Union, Washington, D.C.

Laskey, J.W. and F.W. Edens. 1985. Effects of chronic high-level manganese exposure on male behavior in Japanese Quail (Cotirnic coturnix japonica). Poult. Sci. 64: 579-584.

Lee, CC, CB Hong, HV Ellis. 1985. Subchronic and chronic toxicity studies of 2,4 dinitrotoluene. Part II. D Rats. J Am Coll Toxicol. 4: 243-256.

Lish, PM, BS Levine, EM Furedi, EM Sagartz, VS Rac. 1984. Determination of the chronic mammalian toxicological effects of RDX: twenty-four month chronic toxicity/carcinogenicity study of hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in the B6C3F1 hybri.

Long, E.R., and L.G. Morgan. 1990. Potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program. National Oceanic and Atmospheric Administration Technical Memorandum NOS OMA 52. Seattle: National Ocean Service.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19(1): 81–97.

Mabey, W. R., J. H. Smith, R. T. Podoll, H. L. Johnson, T. Mill, T. W. Chou, J. Gates, I. W. Partridge, H. Jaber, and D. Vandenberg. 1982. *Aquatic Fate Process Data for Organic Priority Pollutants*. Prepared by SRI International for Monitoring and Data Support Division, EPA Office of Water Regulations and Standards, Washington, DC.

MacDonald, DD., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. Ecotoicol. 5:253-278.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

Marks, T.A., T,A, Ledoux, and J.A. Moore. 1982. Teratogenicity of a commercial xylene mixture in the mouse. J. Toxicol. Environ. Health. 9: 97-105.

McDuffie, B., D. J. Russel, and J. J. Dgtishar. 1984. *Potential for Migration into Groundwater.* In Proceedings of Triangle Conference on Environment and Technology, Duke University.

McNabb, A., D. Jang, and C. Larsen, 2004. Does Thyroid Function in Developing Birds Adapt to Sustained Ammonium Perchlorate Exposure? Toxicol. Sci. 82:106-113.)

Mehring, A.L. Jr., J.H. Brumbaugh, A.J. Sutherland, and H.W. Titus. 1960. The tolerance of growing chickens for dietary copper. Poult. Sci.. 30: 713-719.

Menhusen, B.R. 1963. An investigation on the food habits of four species of rodents in captivity. Trans. Kansas Acad. Sci. 66: 107-112.

Microbiological Associates. 1986. Subchronic toxicity of methyl isobutyl ketone in Sprague-Dawley rats. Study No. 5221.0. Preliminary report to Research Triangle Institute, Research Triangle Park, NC.

Millar, J.S. 1989. Reproduction and development. In: Kirkland, G.L.; Lane, J.N., eds. Advances in the study of Peromyscus (Rodentia). Lubbock, TX: Texas Tech University Press; pp. 169-205.

Mineau, P., B.T.Collins, and A. Baril. 1996. On the use of Scaling Factors to Improve Interspecies Extrapolation of Acute Toxicity in Birds. Regulatory Toxicology and Pharmacology 24, 24-29 (1996) Article No.0061.

Morgareidge, K., G.E. Cox, D.E. BAiley et al. 1975. Chronic feeding studies with beyllium sulfate in rats: Evaluation of carcinogenic potential. Final Report to the Aluminum Company of America. Food and Drug Research Laboratories, Inc., Pittsburgh,PA.

Murray, F.J., F.A Smith, K.D. Mitschke, C.G. Humiston, R.J. Kociba, and B.A. Schwetz. 1979. Three-generation reproduction study of rats given 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in the diet. Toxicol. Appl. Phramacol. 50: 241-252.

Nagy, K. A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Navarro, H.A., C.J. price, M.C. Marr, C.B. Myers, J.J. Heindel, and B.A. Schwetz. 1991. Developmental Toxicity Evaluation of naphthalene (CAS NO. 91-20-3) Administered by Gavage to Sprague-Dawley (CD) Rats on Gestation Days 6 Through 15. Chemistry of Life Sciences, Research Triangle Institute (RTI), Research Triangle park, NC. RTI Master Protocol.

Nation, J.R., A.E. Bourgeois, D.E. Clark, et al. 1983. The effects of chronic cobalt exposure on behavior and metallotheonein levels in the adult rat. Neurobehav. Toxicol. Teratol. 5: 9-15.

National Cancer Institute (NCI). 1976. Report on Carcinogensis Bioassay of Chloroform. Bethesda, MD:Carcinogenesis Program, National Cancer Institute.

———. 1979. Bioassay of N-Nitrosodiphenylamine for possible carcinogenicity. Bethesda, MD: U.S. Department of Health, Education, and Public Welfare, Public Health Service, National Institute of Health, National Cancer Institute. DHEW Publ. (NIH) 79-1720.

———. 1980. Bioassay of phenol for possible carcinogenicity. Bethesda, MD: U.S. Department of Health and Human Services, Technical Report Series No. NCI-CG-TR-203.

Naval Energy and Environmental Support Activity (NEESA). 1986. *Initial Assessment Study of Marine Corps Air Station, El Toro, California.* Port Hueneme. CA. May

National Library of Medicine, 2003. Specialized Information Services. Hazardous Substances Data Bank. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Norvell, M.J., D.A. Gable, and M.C. Thomas. 1974. Some effects high dietary levels of various salts of copper in broiler chickens. University of Missouri, Environmental Trace Substance Center and Extension Division. Proceedings of University of Missouri's 8th Annual Conference on Trace Substances in Environmental Health. Memorial Union, University of Missouri-Columbia, Columbia, Missouri. Pages 3367-372.

Nosek, J.A., S.R. Craven, J.R. Sullivan, J.R. Olson, and R.E. Peterson. 1992. Metabolism and disposition of 2,3,7,8-tetrachlorodibenzo-p-dioxin in ring-necked pheasant hens, chicks, and eggs. J. Toxicol. Environ. Health. 35: 153-164.

Ondreicka, R., E. Ginter, and J. Kortus. 1966. Chronic Toxicity of Aluminum in Rats and Miceand its Effects on Phosphorus Metabolism, Brit. Journal of Industrial Medicine, 23: 305-313.

Peakall, D.B. 1974. Effects of di-N-butylphthalate and di-2-ethylhexylphalate on the eggs of ring doves. Bull. Environ. Contam. Toxicol. 17: 213-218.

Pocino, M., L. Baute, and I. Malave. 1991. Influence of the oral administration of excess copper on the immune response. Fund Appl Toxicol. Volume 16. Pages 249-256.

Ralston, W., Hilderbrand, R. Uddin, D. et al. 1985. Potentiation of 2,5-hexaanedione neurotoxicity by methyl ethyl ketone. Toxicol Appl Pharmacol 81: 319-327.

Ribble, D.O. and Samson, F.B. 1987. Microhabitat associations of small mammals in southeastern Colorado, with special emphasis on *Peromyscus* (Rodentia). Southwest. Nat. 32: 291-303.

Sample, B. E., D. M. Opresko, and G. W. Suter. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision.* ES/ER/TM-86/R3. Oak Ridge, Tennessee: U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Oak Ridge National Laboratory. June.

Sample, B. E., J. J. Beauchamp, R. A. Efroymson, G. W. Suter II, and T. A. Ashwood. 1998. *Development and Validation of Bioaccumulation Models for Earthworms.* ES/ER/TM-220. Oak Ridge, TN: U.S. Department of Energy, Office of Environmental Management, Oak Ridge National Laboratory.

Sample, B.E. and C.A. Arenal. 1999. Allometric Models for Inter-species. Extrapolation for Wildlife Toxicity Data. Bull. Environ. Contam. Tox. **62**:653-663.

Schlesinger, W. H. and G. L. Potter, 1974. Lead, Copper, and Cadmium Concentrations in Small Mammals in the Hubbard Brook Experimental Forest. *Oikos* 25:148–152.

Schoener, Thomas W. 1968. "Sizes of Feeding Territories Among Birds." *Ecology* 49(1); 123-141.

Schroeder, H. A., M. Kanisawa, D. V. Frost, and M. Mitchner. 1968. Germanium, Tin, and Arsenic in Rats: Effects on Growth, Survival,Pathological Lesions and Life Span, Journal of Nutrition, 96: 37-45.

Shiu, W.Y. et al. 1988. Environ Sci Technol 22: 651-8. from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Shell. 1992. Initial Submission: Draft Report on immunosuppression of B6C3F1 female mice following subchronic exposure to benzene from drinking water EPA/OTS; Doc #88-920002020.

Singh, A. K., A. Singh, and M. Engelhardt, 1997. The Lognormal Distribution in Environmental Applications, EPA/600/R-97/006, Technology Support Center Issue, U. S. Environmental Protection Agency, Office of Research and Development, Washington, DC, December

Smith, K.N. 1983. Determination of the reproductive effects in mice of nine selected chemicals. Bioassay Systems Corporation. NIOSH Contract No. 210-81-6011. BSC Project No. 10867.

Smith, M.K., E.L. George, J.A. Stober, H.A. Feng, and G.L. Kimmel. 1993. "Perinatal Toxicity Associated With Nickel Chloride Exposure." Environmental Research. Volume 61. Pages 200-211.

Smith, S.L., D.D. McDonald, K.A. Kleenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. J. Great Lakes Res. 22(3), 624 – 638.

Smith, P.N., C.W. Theodorakis, T.A. Anderson, and R.J. Kendall. 2001. "Preliminary Assessment of Perchlorate in Ecological Receptors at the Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas." Ecotox. 10: 5 305-313.

Stanley, T.R. Jr., J.W. Spann, G.J. Smith, and R. Rosscoe. 1994. Main and interactive effects of arsenic and selenium on mallard reproduction and duckling growth and survival. Arch. Environ. Contam. Toxicol. 26: 444-451.

Stockinger, H.E., W.D. Wagenr, J.T. Mountain, F.R. Stacksill, O.J. Dobrogorski and R.G. Keenan. 1953. Unpublished Results. Division of Occupational Health, Cincinnati, OH. (Cited in Patty's Industrial Hygiene and Toxicology, 3rd ed., 1981).

Strenge, D. L., and S. R. Peterson. 1989. *Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (Mepas).* Version 1. PNL-7145. Richland, Wash:. Pacific Northwest Laboratories.

Sullivan, J., J. Ball, E. Brick, S. Hausmann, G. Pilarski, and D. Sopcich. 1985. Report of the technical subcommittee on determination of dredge material suitability for in-water disposal. Wisconsin Department of Natural Resources Report.

Suter II, G. W., and C. L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Revised. ES/ER/TM-96/R2. Oak Ridge, Tenn.: Oak Ridge National Laboratory.

Talmage, S. S., D. M. Opresko, C. J. Maxwell, C. J. E. Welch, F. M. Cretella, P. H. Reno, and F. B. Daniel, 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. Rev. Envtl. Contam. Toxicol., 161:1-156.

Terres, J.K. 1980. The Audubon Society Encyclopedia Of North American Birds. Alfred A. Knoph, Inc., N.Y. 1109 pp.

Travis, C. C., and A. D. Arms. 1988. *Bioconcentration of Organics in Beef, Milk, and Vegetation.* Environ. Sci. Technol. 22: 271–274.

United States Army Corps of Engineers (USACE). 1998. *Range Identification and Preliminary Range Assessment.* Draft. MCAS El Toro. St. Louis. March.

United States Army Center for Health Promotion and Preventative Medicine (USACHPPM). 2005. Wildlife Toxicity Assessment for Perchlorate. Draft Report. November.

United States Fish and Wildlife Service (USFWS). 1989. *Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Animal Notice of Review. 50 CFR Part 17.*

_____. 1990. *Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review. 50 CFR Part 17.*

_____. 1992. *Endangered and Threatened Wildlife and Plants. United States Fish and Wildlife Service Federal Register. 50 CFR 17.11 and 17.12, pp. 1–38, August 29, 1992.* as updated.

_____. 1993. Federal Register, Part 4, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review. 50 CFR, Part 17.

Van den Berg, M., L. Birnbaum, A. T. C. Bosveld, B. Brunstrom, P. Cook, M. Feely, J. P. Giesy, A. Hanberg, R. Hasegawa, S. W. Kennedy, T. Kubiak, J. C. Larsen, F. X. R. van Leeuwen, A. K. D. Liem, C. Nolt, R. E. Petyerson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxicity Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs, for Humans and Wildlife. *Environmental Health Perspectives* 106(12): 775–792.

Webster, W.S. 1978. Cadmium-induced fetal growth retardation in mice and the effects of dietary supplements of zinc, copper, iron, and selenium. Journal of Nutrition. 109: 1646-1651.

Western Ecological Services (WESCO). 1986. A review of the population status of the Suisun shrew (*Sorex ornatus sinuosus*). Final Report for U.S. Fish and Wildlife Service, Sacramento, California. 59 pp.

Whitaker, J. O., 1966. Food of *Mus musculus*, *Peromyscus maniculatus bairdi*, and *Peromyscus leucopus* in Vigo County, Indiana, J. Mammal. 47: 473-486.

White, D.H. and M.P. Deiter. 1978. Effects of dietary vanadium in mallard ducks. J. Toxicol. Environ. Health. 4: 43-50.

Wolf, M.S., V.K. Rowe, D.D. McCollister et al. 1956. Toxicological studies of certain alkylated benzenes and benzene: Experiments on laboratory animals. AMA Arch Ind Health 14: 387-398.

Wolff, J.O. and Hurlbutt, B. 1982. Day refuges of *Peromyscus leucopus* and *Peromyscus maniculatus*. J. Mammal. 63: 666-668.

Wolff, J. O. 1985. The Effects of Density, Food, and Interspecific Interference on Home Range Size in Peromyscus leucopus and Peromyscus maniculatus. Can. J. Zool. 63: 2657–2662.

Yosef, R., Reuven, and T. C. Grubb, Jr. 1993. Effect of vegetation height on hunting behavior and diet of loggerhead shrikes. Condor. 95: 127-131.

Attachment H-1
Surface Water Analytical Results and Statistics

Attachment H 1: Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	01-POND LE524 (unfiltered)	01-POND-OUTFALL LE619 (unfiltered)	01-POND-OUTFALL LE620 (filtered)	01-STREAM LE622 (unfiltered)	01-STREAM LE623 (filtered)
VOCs (ug/L)					
1,1,1-Trichloroethane	5 U	5 U	NA	5 U	NA
1,1,2,2-Tetrachloroethane	5 U	5 U	NA	5 U	NA
1,1,2-Trichloroethane	5 U	5 U	NA	5 U	NA
1,1-Dichloroethane	5 U	5 U	NA	5 U	NA
1,1-Dichloroethene	5 U	5 U	NA	5 U	NA
1,2-Dichloroethane	5 U	5 U	NA	5 U	NA
1,2-Dichloropropane	5 U	5 U	NA	5 U	NA
2-Butanone	100 U	100 U	NA	100 U	NA
2-Hexanone	50 U	50 U	NA	50 U	NA
4-Methyl-2-Pentanone	50 U	50 U	NA	50 U	NA
Acetone	50 U	6 J	NA	6 J	NA
Benzene	5 U	5 U	NA	5 U	NA
Bromodichloromethane	5 U	5 U	NA	5 U	NA
Bromoform	5 U	5 U	NA	5 U	NA
Bromomethane	5 U	5 U	NA	5 U	NA
Carbon Disulfide	5 U	0.5 U	NA	0.5 U	NA
Carbon Tetrachloride	5 U	5 U	NA	5 U	NA
Chlorobenzene	5 U	5 U	NA	5 U	NA
Chloroethane	5 U	5 U	NA	5 U	NA
Chloroform	5 U	5 U	NA	5 U	NA
Chloromethane	5 U	5 U	NA	5 U	NA
Cis-1,2-Dichloroethene	5 U	5 U	NA	5 U	NA
Cis-1,3-Dichloropropene	5 U	0.072 U	NA	0.072 U	NA
Dibromochloromethane	5 U	5 U	NA	5 U	NA
Ethylbenzene	5 U	5 U	NA	5 U	NA
Methylene Chloride	5 U	5 U	NA	5 U	NA
Styrene	5 U	5 U	NA	5 U	NA
Tetrachloroethene	5 U	5 U	NA	5 U	NA
Toluene	5 U	5 U	NA	5 U	NA
Trans-1,2-Dichloroethene	5 U	5 U	NA	5 U	NA
Trans-1,3-Dichloropropene	5 U	0.054 U	NA	0.054 U	NA
Trichloroethene	5 U	5 U	NA	5 U	NA
Vinyl Chloride	5 U	5 U	NA	5 U	NA
Total Xylenes	15 U	15 U	NA	15 U	NA
SVOCs (ug/L)					
1,2,4-Trichlorobenzene	10 U	NA	NA	NA	NA
1,2-Dichlorobenzene	10 U	9.6 U	NA	9.6 U	NA
1,3-Dichlorobenzene	10 U	9.6 U	NA	9.6 U	NA
1,4-Dichlorobenzene	10 U	9.6 U	NA	9.6 U	NA
2,2'-Oxybis(1-chloropropane)	10 U	9.6 U	NA	9.6 U	NA
2,4,5-Trichlorophenol	10 U	9.6 U	NA	9.6 U	NA
2,4,6-Trichlorophenol	10 U	9.6 U	NA	9.6 U	NA
2,4-Dichlorophenol	10 U	9.6 U	NA	9.6 U	NA
2,4-Dimethylphenol	10 U	9.6 U	NA	9.6 U	NA
2,4-Dinitrophenol	50 U	48 U	NA	48 U	NA
2-Chloronaphthalene	10 U	9.6 U	NA	9.6 U	NA
2-Chlorophenol	10 U	9.6 U	NA	9.6 U	NA
2-Methylphenol	10 U	9.6 U	NA	9.6 U	NA
2-Nitroaniline	50 U	48 U	NA	48 U	NA
2-Nitrophenol	10 U	9.6 U	NA	9.6 U	NA
3,3'-Dichlorobenzidine	20 U	9.6 U	NA	9.6 U	NA
3-Nitroaniline	50 U	48 U	NA	48 U	NA
4,6-Dinitro-2-Methylphenol	50 U	48 U	NA	48 U	NA
4-Bromophenyl Phenyl Ether	10 U	1.3 U	NA	1.3 U	NA
4-Chloro-3-Methylphenol	20 U	9.6 U	NA	9.6 U	NA
4-Chloroaniline	50 U	48 U	NA	48 U	NA
4-Chlorophenyl Phenyl Ether	10 U	9.6 U	NA	9.6 U	NA
3/4-Methylphenol	10 U	9.6 U	NA	9.6 U	NA
4-Nitroaniline	50 U	48 U	NA	48 U	NA
4-Nitrophenol	50 U	48 U	NA	48 U	NA
Bis(2-Chloroethoxy)Methane	10 U	9.6 U	NA	9.6 U	NA
Bis(2-Chloroethyl)Ether	10 U	9.6 U	NA	9.6 U	NA
Bis(2-Ethylhexyl)Phthalate	10 U	1.9 U	NA	1.9 U	NA
Butyl Benzyl Phthalate	10 U	9.6 U	NA	9.6 U	NA
Carbazole	10 U	19 U	NA	19 U	NA
Chrysene	10 U	9.6 U	NA	9.6 U	NA

Attachment H 1: Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	01-POND LE524 (unfiltered)	01-POND-OUTFALL LE619 (unfiltered)	01-POND-OUTFALL LE620 (filtered)	01-STREAM LE622 (unfiltered)	01-STREAM LE623 (filtered)
Dibenzofuran	10 U	1.1 U	NA	1.1 U	NA
Diethyl Phthalate	10 U	9.6 U	NA	9.6 U	NA
Dimethyl Phthalate	10 U	9.6 U	NA	9.6 U	NA
Di-N-Butyl Phthalate	10 U	9.6 U	NA	9.6 U	NA
Di-N-Octyl Phthalate	10 U	9.6 U	NA	9.6 U	NA
Hexachlorobenzene	10 U	9.6 U	NA	9.6 U	NA
Hexachlorobutadiene	10 U	9.6 U	NA	9.6 U	NA
Hexachlorocyclopentadiene	50 U	48 U	NA	48 U	NA
Hexachloroethane	10 U	9.6 U	NA	9.6 U	NA
Indeno(1,2,3-cd)-pyrene	10 U	9.6 U	NA	9.6 U	NA
Isophorone	10 U	9.6 U	NA	9.6 U	NA
Nitrobenzene	10 U	9.6 U	NA	9.6 U	NA
N-Nitroso-Di-N-Propylamine	50 U	9.6 U	NA	9.6 U	NA
N-Nitrosodiphenylamine	10 U	48 U	NA	48 U	NA
Pentachlorophenol	50 U	12 U	NA	12 U	NA
Phenol	10 U	9.6 U	NA	9.6 U	NA
2-Methylnaphthalene	10 U	9.6 U	NA	9.6 U	NA
PAHs (ug/L)					
Acenaphthene	10 U	0.096 U	NA	0.096 U	NA
Acenaphthylene	10 U	0.096 U	NA	0.096 U	NA
Anthracene	10 U	0.096 U	NA	0.096 U	NA
Benzo(a)anthracene	10 U	0.096 U	NA	0.096 U	NA
Benzo(a)pyrene	10 U	0.096 U	NA	0.096 U	NA
Benzo(b)fluoranthene	10 U	0.096 U	NA	0.096 U	NA
Benzo(g,h,i)perylene	10 U	0.096 U	NA	0.096 U	NA
Benzo(k)fluoranthene	10 U	0.096 U	NA	0.096 U	NA
Dibenz(a,h)anthracene	10 U	0.096 U	NA	0.096 U	NA
Fluoranthene	10 U	0.096 U	NA	0.096 U	NA
Fluorene	10 U	0.096 U	NA	0.096 U	NA
Naphthalene	10 U	0.096 U	NA	0.096 U	NA
Phenanthrene	10 U	0.096 U	NA	0.096 U	NA
Pyrene	10 U	0.096 U	NA	0.096 U	NA
Explosives (ug/L)					
1,3,5-Trinitrobenzene	1 U	1 U	NA	1 U	NA
1,3-Dinitrobenzene	1 U	1 U	NA	1 U	NA
2,4,6-Trinitrotoluene	1 U	1 U	NA	1 U	NA
2,4-Dinitrotoluene	1 U	1 U	NA	1 U	NA
2,6-Dinitrotoluene	1 U	1 U	NA	1 U	NA
2-Amino-4,6-Dinitrotoluene	1 U	1 U	NA	1 U	NA
2-Nitrotoluene	2 U	1 U	NA	1 U	NA
3-Nitrotoluene	1 U	1 U	NA	1 U	NA
4-Amino-2,6-Dinitrotoluene	1 U	1 U	NA	1 U	NA
4-Nitrotoluene	2 U	1 U	NA	1 U	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	1 U	1 U	NA	1	NA
Methyl-2,4,6-Trinitrophenylnitramine (Tetryl)	1 U	1 U	NA	1 U	NA
Nitrobenzene	1 U	1 U	NA	1 U	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	1 U	1 U	NA	1 U	NA
2,4-diamino-6-nitrotoluene	2 U	1 U	NA	1 U	NA
2,6-diamino-4-nitrotoluene	2 U	1 U	NA	1 U	NA
Hydrocarbons (mg/L)					
Motor Oil	0.09 J	0.07 J	NA	0.04 J	NA
Diesel	0.08 J	0.02 J	NA	0.01 J	NA
Gasoline	0.05	0.03 J	NA	0.05 U	NA
General Chemistry					
Perchlorate	4 U	4 U	NA	4 U	NA
Alkalinity	57.6	62.9	NA	79	NA
Hardness	NA	53	NA	66	NA
Ammonia	0.79	0.36	NA	0.28	NA
pH	7.02	7.02	NA	7.29	NA
Chloride	0.68	2.6	NA	2.2	NA
Fluoride	0.07 J	0.058 J	NA	0.075 J	NA
Nitrate as N	0.088	0.36	NA	0.029 J	NA
Nitrite as N	0.05 U	0.05 U	NA	0.05 U	NA
Sulfate	0.73	1.8	NA	1.8	NA
Metals (ug/L)					
Aluminum	2840	3740	131	1390	61.7 J
Antimony	10 U	10 U	10 U	4.7 J	3.4 J

Attachment H 1: Site 1 Ephemeral Pond and Site 1 Stream Surface Water Sample Results

Analyte	01-POND LE524 (unfiltered)	01-POND-OUTFALL LE619 (unfiltered)	01-POND-OUTFALL LE620 (filtered)	01-STREAM LE622 (unfiltered)	01-STREAM LE623 (filtered)
Arsenic	5 U	1.2	1.1	0.8	0.69
Barium	50.2	39.3	33.5	45.9	43.3
Beryllium	2 U	0.1	0.043 J	0.048 J	0.1 U
Cadmium	0.24 J	2 U	2 U	2 U	2 U
Calcium	17200	17900	17000	22900	23400
Chromium	7.9	3.3 J	1.6 J	2.4 J	2.5 J
Cobalt	1.1 J	1.1 J	0.44 J	0.55 J	0.32 J
Copper	4.1 J	5.3	2.5 J	9.6	8.1
Iron	1890	1140	81.3	725	32.3 J
Lead	3.1 J	0.93	0.35	0.95	0.59
Magnesium	3360	3830	3280	3790	3660
Manganese	26.4	24.2	15.1	13.8	3.5 J
Mercury	0.21 J	0.89	0.082 J	0.3 J	0.56
Nickel	4.1 J	3.5	2.8	2.6	3
Potassium	3440	2650	2470	5140	5230
Selenium	10 U	0.4 J	0.2 J	0.37 J	1 U
Silver	10 U	0.3 U	0.3 U	0.3 U	0.3 U
Sodium	4060	6150	6350	4140	4360
Thallium	10 U	10 U	10 U	10 U	10 U
Vanadium	6.1 J	3.8 J	2.5 J	3.9 J	1.3 J
Zinc	20.8	15.3	12.1	19.3	17

[1]US GL – Tier II Secondary Chronic Values
[2]California Toxics Rule
[3]Talmage
[4] NRWQC
[5] NRWQC – non-priority pollutants
[6]hardness adjusted value
[7]hexavalent chromium
-- No aquatic threshold established.

Exceeds screening threshold
Reporting limit exceeds threshold.

Samples LE620 and LE623 were filtered.

Attachment H-2
Sediment Analytical Results and Statistics

Attachment H 2. Ephemeral Pond Soil/Sediment Sampling Results

Analyte	Lab Method	Units	01-PSS01 0 feet bgs LE479/LE480	01-PSS05 0 feet bgs LE481/LE482	01-PSS09 0 feet bgs LE483/LE484	01-PSS13 0 feet bgs LE485/LE486	01-PSS14 0 feet bgs LE487/LE489	01-PSS14 (Dup) 0 feet bgs LE488/LE490	01-PSS10 0 feet bgs LE491/LE492	01-PSS06 0 feet bgs LE493/LE495	01-PSS06 (dup) 0 feet bgs LE494/LE496	01-PSS02 0 feet bgs LE498/LE499	01-PSS04 0 feet bgs LE500/LE501	01-PSS08 0 feet bgs LE502/LE503	01-PSS15 0 feet bgs LE505/LE506	01-PSS11 0 feet bgs LE507/LE508	01-PSS07 0 feet bgs LE509/LE510	01-PSS03 0 feet bgs LE511/LE512	01-PSS16 0 feet bgs LE513/LE514	01-PSS12 0 feet bgs LE515/LE516	01-HA15 0.5 feet bgs LE517	01-HA16 0.5 feet bgs LE518	01-HA17 0.5 feet bgs LE519
VOCs																							
1,1,1-Trichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1,2,2-Tetrachloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1,2-Trichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1-Dichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,1-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,2-Dichloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
1,2-Dichloropropane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
2-Butanone	8260B	ug/kg	47 U	47 U	55 U	52 U	51 U	49 U	55 U	51 U	50 U	49 U	55 U	51 U	56 U	51 U	49 U	65 U	52 U	55 U	49 U	49 U	56 U
2-Hexanone	8260B	ug/kg	9.4 U	9.3 U	11 U	10 U	10 U	9.7 U	11 U	10 U	10 U	9.7 U	11 U	10 U	11 U	10 U	9.8 U	13 U	10 U	11 U	9.8 U	9.9 U	11 U
4-Methyl-2-Pentanone	8260B	ug/kg	9.4 U	9.3 U	11 U	10 U	10 U	9.7 U	11 U	10 U	10 U	9.7 U	11 U	10 U	11 U	10 U	9.8 U	13 U	10 U	11 U	9.8 U	9.9 U	11 U
Acetone	8260B	ug/kg	19 UJ	19 UJ	22 UJ	21 UJ	20 UJ	19 UJ	22 UJ	20 UJ	20 UJ	19 UJ	22 UJ	20 UJ	23 UJ	20 UJ	20 UJ	26 UJ	21 UJ	22 UJ	20 UJ	20 UJ	22 UJ
Benzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromodichloromethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromoform	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Bromomethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Carbon Disulfide	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Carbon Tetrachloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chlorobenzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chlorodibromomethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloroethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloroform	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Chloromethane	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Cis-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Cis-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Ethylbenzene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Methylene Chloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	5 UJ	5.6 U
Styrene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Tetrachloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Toluene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	0.7 J	0.8 J	4.9 U	5.6 U
Trans-1,2-Dichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Trans-1,3-Dichloropropene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Trichloroethene	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Vinyl Chloride	8260B	ug/kg	4.7 U	4.7 U	5.5 U	5.2 U	5.1 U	4.9 U	5.5 U	5.1 U	5 U	4.9 U	5.5 U	5.1 U	5.6 U	5.1 U	4.9 U	6.5 U	5.2 U	5.5 U	4.9 U	4.9 U	5.6 U
Total Xylenes	8260B	ug/kg	14 U	14 U	16 U	16 U	15 U	15 U	17 U	15 U	15 U	15 U	17 U	15 U	17 U	15 U	15 U	20 U	16 U	16 U	15 U	15 U	17 U
SVOCs																							
1,2,4-Trichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,2-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,3-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
1,4-Dichlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4,5-Trichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4,6-Trichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dichlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dimethylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2,4-Dinitrophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
2-Chloronaphthalene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Chlorophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
2-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
2-Nitrophenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
3,3'-Dichlorobenzidine	8270C	ug/kg	620 U	600 U	620 UJ	580 U	600 U	610 U	620 U	610 UJ	620 UJ	630 U	580 U	570 U	610 U	590 U	650 U	760 U	630 U	680 U	580 U	620 U	630 U
3-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4-Bromophenyl Phenyl Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Chloro-3-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Chloroaniline	8270C	ug/kg	620 U	600 U	620 U	580 U	600 U	610 U	620 U	610 U	620 U	630 U	580 U	570 U	610 U	590 U	650 U	760 U	630 U	680 U	580 U	620 U	630 U
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Methylphenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
4-Nitroaniline	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
4-Nitrophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Chloroethyl)Ether	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Butyl Benzyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Carbazole	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Dibenzofuran	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Diethyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Dimethyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Di-N-Butyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Di-N-Octyl Phthalate	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorobutadiene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Hexachlorocyclopentadiene	8270C	ug/kg	1600 UJ	1600 UJ	1600 UJ	1500 UJ	1500 UJ	1600 UJ	1600 UJ	1600 UJ	1600 UJ	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Hexachloroethane	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U

Attachment H 2. Ephemeral Pond Soil/Sediment Sampling Results

Analyte	Lab Method	Units	01-PSS01 0 feet bgs LE479/LE480	01-PSS05 0 feet bgs LE481/LE482	01-PSS09 0 feet bgs LE483/LE484	01-PSS13 0 feet bgs LE485/LE486	01-PSS14 0 feet bgs LE487/LE489	01-PSS14 (Dup) 0 feet bgs LE488/LE490	01-PSS10 0 feet bgs LE491/LE492	01-PSS06 0 feet bgs LE493/LE495	01-PSS06 (dup) 0 feet bgs LE494/LE496	01-PSS02 0 feet bgs LE498/LE499	01-PSS04 0 feet bgs LE500/LE501	01-PSS08 0 feet bgs LE502/LE503	01-PSS15 0 feet bgs LE505/LE506	01-PSS11 0 feet bgs LE507/LE508	01-PSS07 0 feet bgs LE509/LE510	01-PSS03 0 feet bgs LE511/LE512	01-PSS16 0 feet bgs LE513/LE514	01-PSS12 0 feet bgs LE515/LE516	01-HA15 0.5 feet bgs LE517	01-HA16 0.5 feet bgs LE518	01-HA17 0.5 feet bgs LE519
Isophorone	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
Nitrobenzene	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
N-Nitrosodiphenylamine	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Pentachlorophenol	8270C	ug/kg	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1600 U	1600 U	1600 U	1600 U	1500 U	1500 U	1600 U	1500 U	1700 U	2000 U	1600 U	1700 U	1500 U	1600 U	1600 U
Phenol	8270C	ug/kg	310 U	300 U	310 U	290 U	300 U	310 U	310 U	300 U	310 U	310 U	290 U	280 U	310 U	300 U	320 U	380 U	310 U	340 U	290 U	310 U	320 U
PAHs																							
2-Methylnaphthalene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Acenaphthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Acenaphthylene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benz(a)anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(A)Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(b)fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(g,h,i)perylene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Benzo(k)fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Chrysene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Dibenz(a,h)anthracene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Fluoranthene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Fluorene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Indeno(1,2,3-Cd)Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Naphthalene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Phenanthrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	26 U	22 U	24 U	25 U
Pyrene	PAH-SIM	ug/kg	24 U	23 U	23 U	21 U	24 U	24 U	23 U	23 U	23 U	24 U	22 U	22 U	23 U	23 U	25 U	29 U	23 U	2 J	22 U	24 U	25 U
Explosives																							
1,3,5-Trinitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
1,3-Dinitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4,6-Trinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4-Diamino-4-nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,4-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2,6-Diamino-4-nitrotoluene	8330	ug/kg	150 U	150 U	160 U	170 U	170 U	150 U	150 U	170 U	160 U	150 U	160 U	160 U	170 U	160 U	160 U	160 U	150 U	160 U	NA	NA	NA
2,6-Dinitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
2-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
3-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	8330	ug/kg	220 UJ	220 UJ	220 UJ	230 UJ	230 UJ	220 UJ	210 UJ	240 UJ	220 UJ	220 UJ	230 UJ	220 UJ	230 UJ	220 UJ	230 UJ	230 UJ	210 UJ	220 UJ	NA	NA	NA
4-Nitrotoluene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Nitrobenzene	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 UJ	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	220 U	220 U	220 U	230 U	230 U	220 U	210 U	240 U	220 U	220 U	230 U	220 U	230 U	220 U	230 U	230 U	210 U	220 U	NA	NA	NA
Hydrocarbons																							
Motor Oil	8015B DRO	mg/kg	21	43	19	20	48	76	39	110	16	27	12	43	35	22	21	19	36	150	28	48	59
Diesel	8015B DRO	mg/kg	2 J	2 J	9.4 U	8.8 U	3 J	4 J	2 J	6 J	9.1 U	9.5 U	8.8 U	2 J	4 J	8.8 U	9.4 U	12 U	3 J	6 J	2 J	2 J	3 J
Gasoline	8015B GRO	mg/kg	9.5 U	11 U	10 U	10 U	10 U	11 U	12 U	10 U	10 U	12 U	10 U	11 U	9.9 U	9.7 U	11 U	13 U	1 J	10 U	10 U	11 U	11 U
General Chemistry																							
Perchlorate	E314	ug/kg	19 U	18 U	19 U	18 U	19 U	19 U	19 U	19 U	19 U	19 U	18 U	18 U	19 U	19 U	20 U	24 U	19 U	21 U	18 U	19 U	20 U
Total Organic Carbon (TOC)	Walkly-Black	mg/kg	1400	3390	4120	4280	9190	8930	6150	1680	920	2960	2210	4110	7480	3510	1830	5620	5590	9190	7310	5710	8320
pH	9045	pH	8.98	8.73	9.09	7.92	7.2	7.07	7.56	8.9	8.82	8.46	8.84	8.55	7.62	7.38	7.91	8.72	7.41	7.09	6.98	7.34	8.88
Metals																							
Aluminum	6010B	mg/kg	8580	5880	8700	6800	5090	6360	9670	11900	13700	8350	5950	7210	7400	6850	7980	16900	8200	10200	4220	7970	12800
Antimony	6010B	mg/kg	1.9 U	1.8 U	1.9 U	1.8 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U	1.9 U	1.9 U	2 U	2.4 U	1.9 U	2 U	1.8 U	2 U	2 U
Arsenic	6010B	mg/kg	0.69	0.47 J	0.82	0.76	0.46 J	0.6 J	0.94	1.2	1.4	0.73	0.77	0.73	0.95	0.59	0.65	1.5	0.65	0.93	0.68	0.72	1.1
Barium	6010B	mg/kg	34.2	24.6	46.4	33.3	30	30.5	47.3	54.2	61.3	32.1	33.4	31.4	30.7	29.9	35	61.7	31.2	41.7	33.2	34.8	72.5
Beryllium	6010B	mg/kg	0.38	0.17	0.33	0.17	0.12	0.17	0.34	0.41	0.52	0.25	0.31	0.27	0.12	0.21	0.28	0.98	0.22	0.29	0.11	0.22	0.57
Cadmium	6010B	mg/kg	0.042	0.13	0.047	0.069	0.08	0.062	0.15	0.016	0.014	0.033	0.046	0.079	0.044	0.043	0.088	0.059	0.036	0.19	0.21	0.094	0.34
Calcium	6010B	mg/kg	9110	2720	12100	2460	2220	2310	3820	11700	11500	5080	9920	4780	2120	2520	3440	16400	2770	3570	2160	3040	16500
Chromium	6010B	mg/kg	3.7	3	4.1	3.3	2.7	3.5	4.7	5.5	6.3	3.4	2.5	3.2	3.5	3.5	3.8	6.9	3.7	4.7	2.6	3.7	7.1
Cobalt	6010B	mg/kg	1.2 J	1 J	1.4 J	1.4 J	1.3 J	1.3 J	1.8 J	1.9 J	2.3	1.2 J	1 J	1.2 J	1.4 J	1.3 J	1.4 J	2.7 J	1.4 J	1.8 J	1.3 J	1.5 J	2.3 J
Copper	6010B	mg/kg	1.1	1.7	1.4	2.2	1.9	2.7	3.4	1.4	1.6	1.2	0.8	2.5	2	1.7	1.7	2.8	1.8	3.4	2.7	2.5	6.4
Iron	6010B	mg/kg	3650	2860	4370	3610	2920	3540	5110	5990	6910	3740	2930	3540	3640	3660	4000	7720	4410	5060	2870	4160	6480
Lead	6010B	mg/kg	2.1	3.4	2.1	4.5	5.5	5.9	6.7	2.6	2.9	2.8	1.8	3.8	6.8	3.3	2.9	5.7	3	7	6.1	5.4	12.1
Magnesium	6010B	mg/kg	1760	1140	1710	1330	1080	1300	1960	2650	3110	1430	1300	1500	1240	1270	1530	3710	1490	1970	990	1470	2830
Manganese	6010B	mg/kg	57.8	47.6	61.1	56.5	56.5	53.2	73.2	82.3	101	47	48.4	59.1	59.9	39.8	47.7	109	52.2	81.2	60.3	60.9	121
Mercury	7471A	mg/kg	0.02	0.05	0.041	0.073	0.096	0.12	0.092	0.042	0.023	0.16	0.013	0.0096	0.035	0.058	0.041	0.32	0.085	0.1	0.033	0.071	0.13
Nickel	6010B	mg/kg	1.5 J	1.4 J	2.3 J	1.6 J	1.5 J	1.6 J	2.5 J	2.6 J	3	1.5 J	1.3 J	1.5 J	1.7 J	1.7 J	1.8 J	3.8 J	1.8 J	2.4 J	1.8 J	2 J	4 J
Potassium	6010B	mg/kg	548	588	579	614	648	777	735	549	564	439	452	628	581	409	598	856	614	1170	721	777	1100
Selenium	6010B	mg/kg	0.28 UJ	0.27 UJ	0.28 UJ	0.27 UJ	0.28 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 U	0.28 UJ	0.27 UJ	0.29 UJ	0.28 UJ	0.29 UJ	0.36 UJ	0.28 UJ	0.31 UJ	0.27 UJ	0.19 J	0.3 UJ
Silver	6010B	mg/kg	0.47 U	0.46 U	0.47 U	0.46 U	0.47 U	0.48 U	0.49 U	0.46 U	0.49 U	0.48 U	0.46 UJ	0.45 UJ	0.48 UJ	0.47 UJ	0.49 UJ	0.6 UJ	0.47 UJ	0.51 UJ	0.45 UJ	0.49 UJ	0.5 U
Sodium	6010B	mg/kg	23.3 J	91 UJ	9.7 J	92 UJ	95 UJ	96 UJ	12.7 J	96 UJ	16.9 J	95 UJ	92 UJ	90 UJ	97 UJ	94 UJ	98 UJ	19.5 J	95 UJ	22.4 J	91 UJ	98 UJ	53.2
Thallium	6010B	mg/kg	0.38 U	0.37 U	0.38 U	0.37 U	0.38 U	0.39 U	0.39 U	0.38 U	0.39 U	0.38 U	0.37 U	0.36 U	0.39 U	0.38 U	0.39 U	0.48 U	0.38 U	0.41 U	0.36 U	0.39 U	0.4 U
Vanadium	6010B	mg/kg	6.3	5.3	8.6	6.6	5.4	6.3	8.8	12.8	15.3	6.7	5.4	6.1	7.3	6.5	7.1	14.4	6.7	9.2	6.1	6.9	10.6
Zinc	6010B	mg/kg	8.1 J	8.2 J	8.2 J	9.5 J	10.5 J	12 J	14.9 J	12.8 J	15.3	7.9 J	6.4 J	11.1 J	9.8 J	8.3 J	9.6 J	16.7 J	9.8 J	18.3 J	10.7 J	13.1 J	19.6 J

Attachment H-3
Surface Soil Analytical Results and Statistics

Attachment H 3. Surface Soil Statistics for COPCs with 10 or More Detections

Analyte	Lab Method	Units	Number of Detects	Number of Samples	Frequency of Detects	Location of Maximum Detection	Minimum Detect	Maximum Detect	Mininimum Non-Detect	Maxaximum Non-Detect	Arithmetic Mean	Skewness	Coefficient of Variation	95 percent UCL	Standard Bootstrap 95 % UCL
1,1,1,2-Tetrachloroethane	8260B	ug/kg	0	1	0%				1100 U	1100 U					
1,1,1-Trichloroethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,1,2,2-Tetrachloroethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,1,2-Trichloro-1,2,2-Trifluoroethane	8260B	ug/kg	0	1	0%				1100 U	1100 U					
1,1,2-Trichloroethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,1-Dichloroethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,1-Dichloroethene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,2-Dichloroethane	8260B	ug/kg	0	161	0%				4.4 U	6100 U					
1,2-Dichloropropane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,2-Dichlorotetrafluoroethane	8260B	ug/kg	0	1	0%				1100 U	1100 U					
2-Butanone	8260B	ug/kg	2	167	1%	01-SS-DP29-S01-D1.5	6 J	9 J	8.6 U	120000 U					
2-Hexanone	8260B	ug/kg	7	168	4%	01-SS-DP36-S02-D5.0	24 J	50 J	4.8 U	61000 U					
4-Methyl-2-Pentanone	8260B	ug/kg	1	168	1%	01-SS-DP24-S01-D1.5	2 J	2 J	4.8 U	61000 U					
Acetone	8260B	ug/kg	5	131	4%	01-SS-T34-S02-D6.0	12 J	8700 J	88 UJ	120000 UJ					
Benzene	8260B	ug/kg	3	168	2%	01-SS-T29A-S02-D3.0	36 J	610 J	4.4 U	1100 U					
Bromodichloromethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Bromoform	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Bromomethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Butane, 2-Methoxy-2-Methyl-	8260B	ug/kg	0	1	0%				1100 U	1100 U					
Carbon Disulfide	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Carbon Tetrachloride	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Chlorobenzene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Chlorodibromomethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Chloroethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Chloroform	8260B	ug/kg	11	168	7%	01-SS-T5-S01-D0.5	0.5 J	2.2 J	0.6 U	6100 U	87.9	8.83	7.54	407.413624	173.2632
Chloromethane	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Cis-1,2-Dichloroethene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Cis-1,3-Dichloropropene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Dichlorodifluoromethane	8260B	ug/kg	0	1	0%				1100 UJ	1100 UJ					
Diisopropyl Ether	8260B	ug/kg	0	1	0%				1100 U	1100 U					
Ethylbenzene	8260B	ug/kg	3	168	2%	01-SS-T34-S01-D2.0	530 J	14000	4.4 U	6000 U					
Methyl Tert-Butyl Ether	8260B	ug/kg	0	1	0%				1100 U	1100 U					
Methylene Chloride	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Propane, 2-Ethoxy-2-Methyl-	8260B	ug/kg	0	1	0%				1100 U	1100 U					
Styrene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Tert-Butyl Alcohol	8260B	ug/kg	0	1	0%				4400 UJ	4400 UJ					
Tetrachloroethene	8260B	ug/kg	1	168	1%	01-SS-T33-S01-D3.0	2 J	2 J	4.4 U	6100 U					
Toluene	8260B	ug/kg	24	168	14%	01-SS-T34-S01-D2.0	0.3 J	41000	4.5 U	6000 U	291.55	12.59	10.95	1830.28112	689.7339
Total Xylenes	8260B	ug/kg	3	168	2%	01-SS-T34-S01-D2.0	5400 J	98000	4.6 U	18000 U					
Trans-1,2-Dichloroethene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Trans-1,3-Dichloropropene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Trichloroethene	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
Trichlorofluoromethane	8260B	ug/kg	0	1	0%				1100 U	1100 U					
Vinyl Chloride	8260B	ug/kg	0	168	0%				4.4 U	6100 U					
1,2,4-Trichlorobenzene	8270C	ug/kg	0	143	0%				350 U	120000 U					
1,2-Dichlorobenzene	8270C	ug/kg	0	143	0%				350 U	120000 U					
1,3-Dichlorobenzene	8270C	ug/kg	0	143	0%				350 U	120000 U					
1,4-Dichlorobenzene	8270C	ug/kg	0	143	0%				350 U	120000 U					
2,4,5-Trichlorophenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2,4,6-Trichlorophenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2,4-Dichlorophenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2,4-Dimethylphenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2,4-Dinitrophenol	8270C	ug/kg	0	143	0%				1700 UJ	610000 U					

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Analyte	Lab Method	Units	Number of Detects	Number of Samples	Frequency of Detects	Location of Maximum Detection	Minimum Detect	Maximum Detect	Mininimum Non-Detect	Maxaximum Non-Detect	Arithmetic Mean	Skewness	Coefficient of Variation	95 percent UCL	Standard Bootstrap 95 % UCL
2-Chloronaphthalene	8270C	ug/kg	0	143	0%				350 U	120000 U					
2-Chlorophenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2-Methylnaphthalene	8270C	ug/kg	3	143	2%	01-SS-T34-S01-D2.0	18000	270000	350 U	120000 U					
2-Methylphenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
2-Nitroaniline	8270C	ug/kg	0	143	0%				1700 U	610000 U					
2-Nitrophenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
3,3'-Dichlorobenzidine	8270C	ug/kg	0	143	0%				350 U	120000 U					
3-Nitroaniline	8270C	ug/kg	0	143	0%				1700 U	610000 U					
4,6-Dinitro-2-Methylphenol	8270C	ug/kg	0	143	0%				1700 U	610000 U					
4-Bromophenyl Phenyl Ether	8270C	ug/kg	0	143	0%				350 U	120000 U					
4-Chloro-3-Methylphenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
4-Chloroaniline	8270C	ug/kg	0	143	0%				690 U	240000 U					
4-Chlorophenyl Phenyl Ether	8270C	ug/kg	0	143	0%				350 U	120000 U					
4-Methylphenol	8270C	ug/kg	0	143	0%				350 U	120000 U					
4-Nitroaniline	8270C	ug/kg	0	143	0%				1700 UJ	610000 U					
4-Nitrophenol	8270C	ug/kg	0	143	0%				1700 U	610000 U					
Acenaphthene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Acenaphthylene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Anthracene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Benz(A)Anthracene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Benzo(A)Pyrene	8270C	ug/kg	0	143	0%				26 U	6100 U					
Benzo(B)Fluoranthene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Benzo(G,H,I)Perylene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Benzo(K)Fluoranthene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Bis(2-Chloro-1-Methylethyl)Ether	8270C	ug/kg	0	143	0%				510 U	120000 U					
Bis(2-Chloroethoxy)Methane	8270C	ug/kg	0	143	0%				510 U	120000 U					
Bis(2-Chloroethyl)Ether	8270C	ug/kg	0	143	0%				170 U	40000 U					
Bis(2-Ethylhexyl)Phthalate	8270C	ug/kg	6	143	4%	01-SS-T23-S01-D1.5	73 J	420 J	510 U	120000 UJ					
Butyl Benzyl Phthalate	8270C	ug/kg	0	143	0%				350 U	120000 U					
Carbazole	8270C	ug/kg	0	143	0%				350 U	120000 U					
Chrysene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Dibenz(A,H)Anthracene	8270C	ug/kg	0	143	0%				37 U	8800 U					
Dibenzofuran	8270C	ug/kg	0	143	0%				350 U	120000 U					
Diethyl Phthalate	8270C	ug/kg	4	143	3%	01HA09-SS02-D4.0	72 J	250 J	350 U	120000 U					
Dimethyl Phthalate	8270C	ug/kg	0	143	0%				350 U	120000 U					
Di-N-Butyl Phthalate	8270C	ug/kg	12	143	8%	01-SS-T23-S01-D1.5	69 J	307000	350 U	120000 U	6045.8	7.69	5.1	22134.8566	10174.12
Di-N-Octyl Phthalate	8270C	ug/kg	0	143	0%				350 U	120000 U					
Fluoranthene	8270C	ug/kg	1	143	1%	01-SS-T23-S01-D1.5	38 J	38 J	350 U	120000 U					
Fluorene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Hexachlorobenzene	8270C	ug/kg	1	143	1%	01HA09-SS02-D4.0	220 J	220 J	350 U	120000 U					
Hexachlorobutadiene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Hexachlorocyclopentadiene	8270C	ug/kg	0	143	0%				1700 U	610000 U					
Hexachloroethane	8270C	ug/kg	0	143	0%				350 U	120000 U					
Indeno(1,2,3-Cd)Pyrene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Isophorone	8270C	ug/kg	0	143	0%				350 U	120000 U					
Naphthalene	8270C	ug/kg	3	143	2%	01-SS-T34-S01-D2.0	9900	128000	350 U	120000 U					
N-Nitroso-Di-N-Propylamine	8270C	ug/kg	0	143	0%				46 U	11000 U					
N-Nitrosodiphenylamine	8270C	ug/kg	6	143	4%	01-SS-T23-S01-D1.5	1300	66700	350 U	120000 U					
Pentachlorophenol	8270C	ug/kg	0	143	0%				1700 U	420000 U					
Phenanthrene	8270C	ug/kg	0	143	0%				350 U	120000 U					
Phenol	8270C	ug/kg	15	143	10%	01-SS-DP51-S02-D5.0	83 J	1200	350 U	120000 U	2317	8.18	6.12	7486.10406	4256.518
Pyrene	8270C	ug/kg	0	143	0%				350 U	120000 U					
1,3,5-Trinitrobenzene	8330	ug/kg	0	144	0%				200 U	270 U					

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Analyte	Lab Method	Units	Number of Detects	Number of Samples	Frequency of Detects	Location of Maximum Detection	Minimum Detect	Maximum Detect	Mininimum Non-Detect	Maxaximum Non-Detect	Arithmetic Mean	Skewness	Coefficient of Variation	95 percent UCL	Standard Bootstrap 95 % UCL
1,3-Dinitrobenzene	8330	ug/kg	1	144	1%	01-SS-T29A-S02-D3.0	630	630	200 U	270 U					
2,4,6-Trinitrotoluene	8330	ug/kg	2	144	1%	01-SS-BH01-S01-D5.0	278 J	7860	200 U	270 U					
2,4-Dinitrotoluene	8330	ug/kg	6	147	4%	01-SS-T23-S01-D1.5	120 J	7000	200 U	270 U					
2,6-Dinitrotoluene	8330	ug/kg	1	145	1%	01-SS-T15-S01-D1.0	44 J	44 J	200 U	270 U					
2-AMINO-4,6-DINITROTOLUENE	8330	ug/kg	1	144	1%	01-SS-DP05-S01-D1.5	310 J	310 J	200 U	270 U					
2-Nitrotoluene	8330	ug/kg	0	144	0%				200 U	270 U					
3-Nitrotoluene	8330	ug/kg	0	144	0%				200 U	270 U					
4-AMINO-2,6-DINITROTOLUENE	8330	ug/kg	1	144	1%	01-SS-DP05-S01-D1.5	228	228	200 U	270 U					
4-Nitrotoluene	8330	ug/kg	0	144	0%				200 U	270 U					
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	8330	ug/kg	5	144	3%	01-SS-BH01-S01-D5.0	650	14000	200 U	270 U					
Methyl-2,4,6-Trinitrophenylnitramine	8330	ug/kg	0	144	0%				200 U	270 U					
Nitrobenzene	8330	ug/kg	0	144	0%				200 U	270 U					
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	8330	ug/kg	1	144	1%	01-SS-BH01-S01-D5.0	1400	1400	200 U	270 U					
MOTOR OILS	8015B DRO	mg/kg	36	105	34%	01-SS-T57-S01-D3.0	4 J	69	10 U	2400 U	47.94	5.34	8.3	156.776537	88.57394
Motor Oil	M8015E	mg/kg	29	31	94%	01SS01-SS01-D0.0	0.7 J	59	11 U	11 U					
PHC AS DIESEL FUEL	8015B DRO	mg/kg	19	105	18%	01-SS-T34-S01-D2.0	3 J	37000	10 U	13 U	523.95	8.97	7.24	2837.11361	1113.387
Diesel	SW8015E	mg/kg	12	31	39%	01SS03-SS01-D0.0	1 J	27	11 U	11 U					
Gasoline	8015B GRO	mg/kg	8	136	6%	01-SS-T34-S01-D2.0	0.1 J	1600 J	8.9 U	24 U					
Perchlorate	E314	ug/kg	12	166	7%	01-SS-T34-S02-D6.0	29	1600	20 U	44 U	12.02	7.44	2.62	87.632044	15.97248
Nitrate	300.0	mg/kg	1	1	100%	01-SS-BH01-S01-D5.0	0.45 J	0.45 J							
Nitrate	CLO4METH	ug/kg	6	8	75%	01HA04-SS02-D3.5	246	2700	220 U	220 U					
NITRATE AS N	300.0	mg/kg	99	99	100%	01-SS-T33-S01-D3.0	0.32 J	52.7			2.15	8.8	2.49	4.49558881	3.051169
pH	9040	pH unit	31	31	100%	01HA06-SS02-D4.5	5.89	8.97							
pH	9045	pH	1	1	100%	01-SS-BH01-S01-D5.0	9.72	9.72							
PH	9045	pH	136	136	100%	01-SS-T34-S01-D2.0	5.01	9.92							
Aluminum	6010B	mg/kg	143	143	100%	01-SS-T33-S01-D3.0	904	190000			7555.6	9.59	2.25	13751.6804	9908.252
Antimony	6010B	mg/kg	5	143	3%	01-SS-T33-S01-D3.0	1	103	0.095 UJ	25 U					
Arsenic	6010B	mg/kg	99	143	69%	01-SS-T33-S01-D3.0	0.15	12.4	0.18 UJ	35 U	1.66	7.88	1.98	2.85110418	2.102414
Barium	6010B	mg/kg	143	143	100%	01-SS-T33-S01-D3.0	21.3	537			58.47	6.15	0.88	77.2706559	65.50323
Beryllium	6010B	mg/kg	104	143	73%	01-SS-DP23-S02-D5.0	0.047	1.1	0.019 UJ	24 U	0.57	11.55	3.47	1.30228983	0.84981
Cadmium	6010B	mg/kg	87	143	61%	01-SS-T28-S01-D3.0	0.0073 J	156	0.0067 UJ	0.24 UJ	2.2	11.05	6.07	9.15830032	4.056358
Calcium	6010B	mg/kg	143	143	100%	01-SS-DP37-S02-D5.0	677	71000			6134.63	5.32	1.24	8910.83557	7159.733
Chromium	6010B	mg/kg	143	143	100%	01-SS-T28-S01-D3.0	0.77	171			6.54	10.9	2.19	6.49301639	8.509424
Cobalt	6010B	mg/kg	142	143	99%	01-SS-DP09-S01-D1.5	0.23	6.6	59 U	59 U	2.35	10.77	2.1	4.15449463	3.030452
Copper	6010B	mg/kg	128	143	90%	01-SS-T33-S01-D3.0	0.38	16700	0.26 UJ	3.5 UJ	132.69	10.52	11.92	862.019885	317.2327
Iron	6010B	mg/kg	143	143	100%	01-SS-T29A-S01-D5.0	697	19900			5403.3	1.43	0.64	5963.62957	5868.968
Lead	6010B	mg/kg	142	143	99%	01-SS-T33-S01-D3.0	0.28	1580	1.2 UJ	1.2 UJ	21.98	10.75	6.21	93.3068627	41.12243
Magnesium	6010B	mg/kg	143	143	100%	01-SS-DP03-S02-D5.0	239 J	8340			2178.01	1.5	0.75	2772.1547	2401.931
Manganese	6010B	mg/kg	142	143	99%	01-SS-DP26-S02-D5.0	13.5	711	80.6 UJ	80.6 UJ	91.24	3.77	0.86	104.787894	102.1839
Nickel	6010B	mg/kg	141	143	99%	01-SS-T28-S01-D3.0	0.4	112	0.42 UJ	0.46 UJ	5.81	6.64	2.21	12.506695	7.563366
Potassium	6010B	mg/kg	143	143	100%	01-SS-T34-S01-D2.0	111 J	7940			931.31	4.62	0.9	1235.18004	1046.185
Selenium	6010B	mg/kg	12	143	8%	01-SS-T33-S01-D3.0	0.16	4.7	0.1 UJ	35 U	1.03	10.54	2.89	2.11930003	1.429651
Silver	6010B	mg/kg	2	143	1%	01-SS-T28-S01-D3.0	1.9	5.8	0.12 UJ	2.5 U					
Sodium	6010B	mg/kg	47	143	33%	01-SS-T34-S01-D2.0	7.2	8760	11.9 UJ	470 UJ	257.38	9.2	3.08	671.575937	364.0214
Thallium	6010B	mg/kg	2	143	1%	01-SS-T33-S01-D3.0	0.2	15.2	0.077 UJ	47 U					
Vanadium	6010B	mg/kg	143	143	100%	01-SS-DP09-S01-D1.5	1.8	60.9			11.36	2.05	0.81	14.7230671	12.60892
Zinc	6010B	mg/kg	143	143	100%	01-SS-T28-S01-D3.0	1.9 J	29100			280.71	11.77	8.7	1555.09994	625.7029
Mercury	7471A	mg/kg	117	143	82%	01HA09-SS01-D1.5	0.0062 J	7.1	0.0063 UJ	0.22 U	0.162	8.81	4.1	0.50748752	0.251969
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	9	13	69%	01-SS-T48-S01-D2.0	0.905	45.9	0.0889 U	1.5 U					
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	9	13	69%	01-SS-T48-S01-D2.0	16.31	1740	1.54 UJ	4.6 UJ					
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	10	13	77%	01-SS-T33-S01-D3.0	0.101	29.1	0.138 UJ	0.5 U					
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	9	13	69%	01-SS-T48-S01-D2.0	2.3	244	0.396 UJ	0.8 U					
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	7	13	54%	01-SS-T33-S01-D3.0	0.0568	2.39 J	0.0477 U	0.8 U					

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1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	9	13	69%	01-SS-T33-S01-D3.0	0.0472	9.91	0.0422 U	0.636 U					
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	7	13	54%	01-SS-T48-S01-D2.0	0.0597	7.76	0.0415 U	0.6 U					
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	9	13	69%	01-SS-T33-S01-D3.0	0.044	8.22	0.2 U	0.529 U					
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	8	13	62%	01-SS-T48-S01-D2.0	0.143	40.5	0.0438 U	0.6 U					
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	7	13	54%	01-SS-T33-S01-D3.0	0.06	2.88 J	0.0368 U	0.4 U					
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	8	13	62%	01-SS-T48-S01-D2.0	0.0711	26.6	0.0393 U	0.5 U					
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	9	13	69%	01-SS-T33-S01-D3.0	0.0346	7.7	0.262 U	0.4 U					
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	7	13	54%	01-SS-T48-S01-D2.0	0.0506	6.4	0.0337 U	0.6 U					
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	8	13	62%	01-SS-T33-S01-D3.0	0.0546	13.5	0.0335 U	0.3 U					
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	7	13	54%	01-SS-T33-S01-D3.0	0.0482	13.7	0.0367 UJ	0.4 U					
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	9	13	69%	01-SS-T33-S01-D3.0	0.0581	11.5	0.0464 U	0.3 U					
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	5	13	38%	01-SS-T33-S01-D3.0	0.0727	2.51	0.0556 U	0.5 U					
Heptachlorodibenzofurans	8290	ng/kg	9	13	69%	01-SS-T33-S01-D3.0	1.168	47.3	0.064917 U	0.6 U					
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	9	13	69%	01-SS-T48-S01-D2.0	2.3	448	0.64 UJ	0.946 UJ					
Hexachlorodibenzofurans	8290	ng/kg	11	13	85%	01-SS-T33-S01-D3.0	0.044	97.5	0.262417 U	0.3 U	12.52	3.29	2.09	39.94871	24.0379
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	9	13	69%	01-SS-T48-S01-D2.0	0.363	313	0.313179 U	0.5 U					
Pentachlorodibenzofurans	8290	ng/kg	8	13	62%	01-SS-T33-S01-D3.0	0.107	148	0.077 UJ	0.3 U					
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	7	13	54%	01-SS-T48-S01-D2.0	0.309636	55	0.299015 U	0.6 U					
Tetrachlorodibenzofurans	8290	ng/kg	8	13	62%	01-SS-T33-S01-D3.0	0.058096	249	0.046426 U	0.3 U					
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	7	13	54%	01-SS-T33-S01-D3.0	0.167701	43.4	0.2 U	0.5 U					
Total 2,3,7,8-TCDD - Bird	8290	ng/kg	13	13	100%	01-T33	0.1	39.3						12.8336905	
Total 2,3,7,8-TCDD - Human/Mammal	8290	ng/kg	13	13	100%	01-T33	0.1	23.7						6.73109801	

Attachment H-4
Chemical–Specific Exposure Factors

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
BTEX						
Benzene	3.20E+01	EPA, 2005	7.55E+00	Jaeger, 1998	6.66E-05	Birak et al., 2001
Ethylbenzene	1.01E-01	EPA, 2005	9.28E+00	Jaeger, 1998	2.29E-04	Birak et al., 2001
Toluene	1.58E+01	EPA, 2005	8.48E+00	Jaeger, 1998	1.42E-04	Birak et al., 2001
Xylenes, Total	9.42E+00	EPA, 2005	9.74E+00	Jaeger, 1998	2.46E-04	Birak et al., 2001
Dioxins						
2,3,7,8-TCDD TEQ - Bird	1.54E-01	EPA, 2005	5.40E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
2,3,7,8-TCDD TEQ - Mammal	1.54E-01	EPA, 2005	4.92E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
Explosive						
1,3-Dinitrobenzene	5.31E+00	EPA, 2005	7.40E-01	EPA, 2005	3.17E-05	Birak et al., 2001
2,4,6-Trinitrotoluene	4.23E+00	EPA, 2005	1.80E-01	EPA, 2005	3.49E-05	Birak et al., 2001
2,4-Dinitrotoluene	3.67E+01	EPA, 2005	9.60E-01	EPA, 2005	5.76E-05	Birak et al., 2001

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
2,6-Dinitrotoluene	4.31E+01	EPA, 2005	7.10E-01	EPA, 2005	4.85E-05	Birak et al., 2001
2-Amino-4,6-Dinitrotoluene	4.46E+01	EPA, 2005	2.48E+00	EPA, 2005	4.68E-05	Birak et al., 2001
4-Amino-2,6-Dinitrotoluene	4.17E+01	EPA, 2005	2.48E+00	EPA, 2005	5.03E-05	Birak et al., 2001
Hexahydro-1,3,5-trinitro-1,3,5 triazine (RDX)	4.30E-01	EPA, 2005	1.20E-01	EPA, 2005	1.43E-05	Birak et al., 2001
HMX	1.43E+02	EPA, 2005	2.00E-02	EPA, 2005	1.35E-05	Birak et al., 2001
Halogenated Aliphatic						
Tetrachloroethene	1.73E+01	EPA, 2005	8.48E+00	Jaeger, 1998	1.29E-04	Birak et al., 2001
Inorganic						
Aluminum	1.80E-04	Strenge and Peterson, 1989	3.40E-01	Beyer and Stafford, 1993	1.50E-03	Strenge and Peterson, 1989
Antimony	2.96E-02	Bechtel Jacobs Co. LLC, 1998	1.00E+00	EPA, 2005	3.00E-03	Napier et al., 1980
Arsenic	3.75E-02	Bechtel-Jacobs, 1998	1.15E-01	Sample et al., 1998	1.50E-03	Strenge and Peterson, 1989

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	Sample et al., 1998	5.00E-04	Strenge and Peterson, 1989
Beryllium	1.67E+00	Bechtel Jacobs Co. LLC, 1998	4.50E-02	Sample et al., 1998	8.00E-04	Strenge and Peterson, 1989
Cadmium	6.28E-02	Bechtel Jacobs Co. LLC, 1998	2.94E+00	Sample et al., 1998	1.60E-02	Strenge and Peterson, 1989
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	Sample et al., 1999	2.40E-03	Strenge and Peterson, 1989
Cobalt	7.50E-03	Bechtel-Jacobs, 1998	1.22E-01	Sample et al., 1998	1.00E-03	Strenge and Peterson, 1989
Copper	5.38E-03	Bechtel Jacobs Co. LLC, 1998	5.15E-01	Sample et al., 1999	1.00E-02	Strenge and Peterson, 1989
Lead	1.04E-02	Bechtel Jacobs Co. LLC, 1998	1.94E-01	Sample et al., 1998	2.90E-04	Strenge and Peterson, 1989
Manganese	7.90E-02	Bechtel-Jacobs, 1998	5.52E-02	Sample et al., 1998	5.00E-03	Strenge and Peterson, 1989
Mercury	1.51E-01	Bechtel Jacobs Co. LLC, 1998	9.60E-01	Beyer and Stafford, 1993	1.00E-01	Strenge and Peterson, 1989
Nickel	3.30E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	Sample et al., 1999	1.00E-03	Strenge and Peterson, 1989

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Perchlorate	2.82E+02	Ellington et al., 2001	1.00E+00	Default to 1.00	1.00E+00	Default
Selenium	5.97E-01	Bechtel Jacobs Co. LLC, 1998	6.14E-01	Sample et al., 1998	1.00E+00	Strenge and Peterson, 1989
Silver	1.40E-02	Bechtel-Jacobs, 1998	2.04E+00	Sample et al., 1998	1.70E-02	Strenge and Peterson, 1989
Thallium	2.50E-01	Strenge and Peterson, 1989	4.50E-01	Pb as surrogate	4.00E-02	Strenge and Peterson, 1989
Vanadium	4.85E-03	Bechtel-Jacobs, 1998	4.20E-02	Sample et al., 1998	2.30E-03	Strenge and Peterson, 1989
Zinc	4.93E-02	Bechtel Jacobs Co. LLC, 1998	8.56E-02	Sample et al., 1998	5.00E-02	Strenge and Peterson, 1989
PAH Group 1						
2-Methylnaphthalene	6.67E-01	EPA, 2005	3.62E+00	EPA, 2005	5.50E-04	Birak et al., 2001
Fluoranthene	5.00E-01	EPA, 2005	1.66E+00	Jaeger, 1998	2.56E-03	Birak et al., 2001
Naphthalene	1.22E+01	EPA, 2005	4.40E+00	EPA, 2005	2.99E-04	Birak et al., 2001
Phthalate Esters						

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Bis (2-ethylhexyl) phthalate	8.68E-02	EPA, 2005	1.61E+02	Jaeger, 1998	3.66E-02	Birak et al., 2001
Diethylphthalate	2.10E+01	EPA, 2005	1.36E+01	Jaeger, 1998	1.05E-04	Birak et al., 2001
Di-n-butylphthalate	3.43E-01	EPA, 2005	1.89E+00	Default	1.37E-03	Birak et al., 2001
Semivolatile Organic Compound						
Hexachlorobenzene	1.10E-01	EPA, 2005	1.51E+01	Jaeger, 1998	6.55E-03	Birak et al., 2001
N-Nitrosodiphenylamine	9.86E+00	EPA, 2005	2.72E+00	Jaeger, 1998	2.34E-04	Birak et al., 2001
Phenol	6.73E+01	EPA, 2005	5.41E+00	Jaeger, 1998	3.01E-05	Birak et al., 2001
Volatile Organic Compound						
2-Butanone	2.62E+02	EPA, 2005	4.01E+03	Jaeger, 1998	7.06E-06	Birak et al., 2001
2-Hexanone	7.55E+01	EPA, 2005	5.74E+00	EPA, 2005	2.67E-05	Birak et al., 2001
4-Methyl-2-Pentanone	6.77E+00	Travis and Arms 1988	5.91E+00	EPA, 2005	2.45E-05	Birak et al., 2001

Attachment H 4-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Acetone	2.53E+01	EPA, 2005	3.86E+00	Jaeger, 1998	3.70E-06	Birak et al., 2001
Chloroform	3.66E+02	EPA, 2005	7.32E+00	Jaeger, 1998	5.48E-05	Birak et al., 2001

Attachment H 4-2. Chemical-Specific Exposure Factors - Tier 2, Step 3a Soil Pathways

Chemical	Tier 2, Step 3a BCFp	Tier 2, Step 3a BCFp Abbreviated Reference	Tier 2, Step 3a BCFi	Tier 2, Step 3a BCFi Abbreviated Reference	Tier 2, Step 3a BTFa	Tier 2, Step 3a BTFa Abbreviated Reference
BTEX						
Ethylbenzene	1.01E-01	EPA, 2005	9.28E+00	Jaeger, 1998	2.29E-04	Birak et al., 2001
Toluene	1.58E+01	EPA, 2005	8.48E+00	Jaeger, 1998	1.42E-04	Birak et al., 2001
Xylenes, Total	9.42E+00	EPA, 2005	9.74E+00	Jaeger, 1998	2.46E-04	Birak et al., 2001
Dioxins						
2,3,7,8-TCDD TEQ - Bird	1.54E-01	EPA, 2005	4.41E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
2,3,7,8-TCDD TEQ - Mammal	1.54E-01	EPA, 2005	3.92E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
Explosive						
1,3-Dinitrobenzene	5.31E+00	EPA, 2005	7.40E-01	EPA, 2005	3.17E-05	Birak et al., 2001
2,4,6-Trinitrotoluene	4.23E+00	EPA, 2005	1.80E-01	EPA, 2005	3.49E-05	Birak et al., 2001
2,4-Dinitrotoluene	3.67E+01	EPA, 2005	9.60E-01	EPA, 2005	5.76E-05	Birak et al., 2001
2,6-Dinitrotoluene	4.31E+01	EPA, 2005	7.10E-01	EPA, 2005	4.85E-05	Birak et al., 2001
4-Amino-2,6-Dinitrotoluene	4.17E+01	EPA, 2005	2.48E+00	EPA, 2005	5.03E-05	Birak et al., 2001

Attachment H 4-2. Chemical-Specific Exposure Factors - Tier 2, Step 3a Soil Pathways

Chemical	Tier 2, Step 3a BCFp	Tier 2, Step 3a BCFp Abbreviated Reference	Tier 2, Step 3a BCFi	Tier 2, Step 3a BCFi Abbreviated Reference	Tier 2, Step 3a BTFa	Tier 2, Step 3a BTFa Abbreviated Reference
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	4.30E-01	EPA, 2005	1.20E-01	EPA, 2005	1.43E-05	Birak et al., 2001
HMX	1.43E+02	EPA, 2005	2.00E-02	EPA, 2005	1.35E-05	Birak et al., 2001
Inorganic						
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	Sample et al., 1998	5.00E-04	Strenge and Peterson, 1989
Beryllium	1.67E+00	Bechtel Jacobs Co. LLC, 1998	4.50E-02	Sample et al., 1998	8.00E-04	Strenge and Peterson, 1989
Cadmium	2.28E-01	Bechtel Jacobs Co. LLC, 1998	5.26E+00	Sample et al., 1998	1.60E-02	Strenge and Peterson, 1989
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	Sample et al., 1999	2.40E-03	Strenge and Peterson, 1989
Copper	3.24E-02	Bechtel Jacobs Co. LLC, 1998	5.15E-01	Sample et al., 1999	1.00E-02	Strenge and Peterson, 1989
Lead	3.62E-02	Bechtel Jacobs Co. LLC, 1998	3.35E-01	Sample et al., 1998	2.90E-04	Strenge and Peterson, 1989
Manganese	7.90E-02	Bechtel-Jacobs, 1998	1.01E-01	Sample et al., 1998	5.00E-03	Strenge and Peterson, 1989
Mercury	5.03E-01	Bechtel Jacobs Co. LLC, 1998	9.60E-01	Beyer and Stafford, 1993	1.00E-01	Strenge and Peterson, 1989
Nickel	5.73E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	Sample et al., 1999	1.00E-03	Strenge and Peterson, 1989

Attachment H 4-2. Chemical-Specific Exposure Factors - Tier 2, Step 3a Soil Pathways

Chemical	Tier 2, Step 3a BCFp	Tier 2, Step 3a BCFp Abbreviated Reference	Tier 2, Step 3a BCFi	Tier 2, Step 3a BCFi Abbreviated Reference	Tier 2, Step 3a BTFa	Tier 2, Step 3a BTFa Abbreviated Reference
Perchlorate	2.82E+02	Ellington et al., 2001	1.00E+00	Default to 1.00	1.00E+00	Default
Selenium	5.49E-01	Bechtel Jacobs Co. LLC, 1998	7.59E-01	Sample et al., 1998	1.00E+00	Strenge and Peterson, 1989
Vanadium	4.85E-03	Bechtel-Jacobs, 1998	4.20E-02	Sample et al., 1998	2.30E-03	Strenge and Peterson, 1989
Zinc	1.82E-01	Bechtel Jacobs Co. LLC, 1998	6.13E-01	Sample et al., 1998	5.00E-02	Strenge and Peterson, 1989
Phthalate Esters						
Di-n-butylphthalate	3.43E-01	EPA, 2005	1.89E+00	Default	1.37E-03	Birak et al., 2001
Semivolatile Organic Compound						
N-Nitrosodiphenylamine	9.86E+00	EPA, 2005	2.72E+00	Jaeger, 1998	2.34E-04	Birak et al., 2001
Volatile Organic Compound						
Acetone	2.53E+01	EPA, 2005	3.86E+00	Jaeger, 1998	3.70E-06	Birak et al., 2001

Attachment H 4-3. Chemical-Specific Kow Values Used to Estimate BCF Values for Organic Chemicals

Chemical *	Kow value	Abbreviated Reference
BTEX		
Benzene	1.35E+02	USEPA Fate Model
Ethylbenzene	1.38E+03	EPA, 1996
Toluene	5.62E+02	EPA, 1996
Xylenes, Total	1.58E+03	EPA, 1996
Dioxins		
2,3,7,8-TCDD TEQ - Bird	6.30E+06	Shiu et al., 1988
2,3,7,8-TCDD TEQ - Mammal	6.30E+06	Shiu et al., 1988
Explosive		
1,3-Dinitrobenzene	4.30E+01	KOWWIN 2005.
2,4,6-Trinitrotoluene	9.80E+01	KOWWIN 2005.
2,4-Dinitrotoluene	1.02E+02	EPA, 1996
2,6-Dinitrotoluene	7.41E+01	EPA, 1996
2-Amino-4,6-Dinitrotoluene	6.92E+01	KOWWIN 2005.
4-Amino-2,6-Dinitrotoluene	6.92E+01	KOWWIN 2005.
Hexahydro-1,3,5-trinitro-1,3,5-triazine (R	4.79E+00	KOWWIN 2005.
HMX	6.61E+00	KOWWIN 2005.
Halogenated Aliphatic		
Tetrachloroethene	4.68E+02	EPA, 1996
Inorganic		
Aluminum		
Antimony		
Arsenic		
Barium		
Beryllium		
Cadmium		
Chromium		
Cobalt		
Copper		
Lead		
Manganese		
Mercury		
Nickel		

* Kow was not used to calculate BCF values for inorganic compounds

Attachment H 4-3. Chemical-Specific Kow Values Used to Estimate BCF Values for Organic Chemicals

Chemical *	Kow value	Abbreviated Reference
Perchlorate		
Selenium		
Silver		
Thallium		
Vanadium		
Zinc		
PAH Group 1		
2-Methylnaphthalene	5.25E+03	KOWWIN 2005.
Fluoranthene	1.32E+05	EPA, 1996
Naphthalene	2.29E+03	EPA, 1996
Phthalate Esters		
Bis (2-ethylhexyl) phthalate	2.00E+07	EPA, 1996
Diethylphthalate	3.16E+02	EPA, 1996
Di-n-butylphthalate	4.07E+04	EPA, 1996
Semivolatile Organic Compound		
Hexachlorobenzene	7.76E+05	EPA, 1996
N-Nitrosodiphenylamine	1.45E+03	EPA, 1996
Phenol	3.02E+01	EPA, 1996
Volatile Organic Compound		
2-Butanone	1.95E+00	Hansch and Anderson, 1967.
2-Hexanone	1.73E+01	KOWWIN 2005.
4-Methyl-2-Pentanone	1.46E+01	KOWWIN 2005.
Acetone	5.75E-01	EPA, 1996
Chloroform	8.30E+01	EPA, 1996

* Kow was not used to calculate BCF values for inorganic compounds

Attachment H-5
Toxicity Reference Values

Table H 5-1. NOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
BTEX											
Benzene	Benzene	Mouse	LOAEL	263.6	Reproduction	Nawrot and Staples, 1979	1	1	10	1.10E+00	2.91E+01
Ethylbenzene	Ethylbenzene	Rat	NOAEL	97	Increased kidney weight	Wolf et al., 1956	1	1	1	1.28E+00	1.24E+02
Toluene	Toluene	Mouse	LOAEL	260	Reproduction	Nawrot and Staples, 1979	1	1	10	1.10E+00	2.87E+01
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.06	Fetal weights/malformations	Marks et al. 1982	1	1	1	1.10E+00	2.27E+00
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.28E+00	1.28E-06
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	NOAEL	0.04	Reproduction	USACHPPM, 2001	1	1	1	1.28E+00	5.11E-02
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	1	1.10E+00	1.10E+01
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.28E+00	4.99E+00
2,6-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.28E+00	4.99E+00
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	1.10E+00	9.93E+00
4-Amino-2,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	1.10E+00	9.93E+00
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	1	1.28E+00	3.49E+00
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	1	1.10E+00	4.30E+00
Halogenated Aliphatic											
Tetrachloroethene	Tetrachloroethene	Mouse	LOAEL	5	Increase in locomotion and total activity at 60 days of age	Fredriksson et al., 1993	1	1	10	1.10E+00	5.52E-01

Table H 5-1. NOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	1.10E+00	2.13E+00
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.90E-02
Arsenic	Arsenic	Various Mammals	NOAEL	1.04	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	1.04E+00
Barium	Barium	Various mammals	NOAEL	51.8	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.18E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.32E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.70E-01
Chromium	Chromium III	Various Mammals	NOAEL	2.4	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	2.40E+00
Cobalt	Cobalt	Various Mammals	NOAEL	7.33	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.33E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	1.10E+00	2.95E+00
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	4.70E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	1.10E+00	1.51E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.28E+00	3.20E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	1.25E+00	1.67E-01
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	1	1.00E+00	6.40E-01
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	1.09E+00	5.46E-02

Table H 5-1. NOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.28E+00	1.14E+01
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	1	1.16E+00	5.55E-01
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.28E+00	1.14E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	1.09E+00	1.05E+01
Misc. Organic											
Methylene chloride	Methylene chloride	Rat	NOAEL	5.85	Hepatic Effects	National Coffee Association, 1982.	1	1	1	1.28E+00	7.48E+00
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Acenaphthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Anthracene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Benzo(g,h,i)perylene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Fluorene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Phenanthrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Pyrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
PAH Group 2											
Benzo(a)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00

Table H 5-1. NOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Benzo(a)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Benzo(b)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Benzo(k)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Chrysene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Dibenz(a,h)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.28E+00	2.56E+01
Butylbenzylphthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	1	1.28E+00	2.56E+02
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	1.10E+00	5.06E+03
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	1	1.10E+00	6.07E+02
Semivolatile Organic Compound											
3/4-Methylphenol	3-Methylphenol	Rat	NOAEL	50	Body and organ weights, food consumption, mortality, clinical signs of toxicity, and clinical pathology	U.S. EPA, 1986	1	1	1	1.28E+00	6.39E+01
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.28E+00	2.56E+00
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	1	1.28E+00	2.56E+02
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.28E+00	9.22E+02

Table H 5-1. NOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Volatile Organic Compound											
2-Butanone	Methyl Ethyl Ketone	Rat	NOAEL	173	Neurologic	Ralston et al. 1985	1	1	1	1.28E+00	2.21E+02
2-Hexanone	2-Hexanone	Rat	NOAEL	400	Hepatic and Renal effects	Eben et al., 1979	1	1	1	1.28E+00	5.11E+02
4-Methyl-2-Pentanone	4-Methyl-2-Pentanone	Rat	NOAEL	250	Liver and kidney function	Microbiological Associates, 1986 as cited in HEAST, 1993	1	1	5	1.28E+00	6.39E+01
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	10	1.28E+00	6.39E+01
Chloroform	Chloroform	Rat	NOAEL	150	Liver, kidney, gonadal condition	Palmer et al., 1979	1	1	1	1.28E+00	1.92E+02
MTBE	MTBE	Mouse	NOAEL	100	Kidney weight	Robinson et al., 1990	1	1	1	1.10E+00	1.10E+02

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-2. NOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
BTEX											
Benzene	Benzene	Mouse	LOAEL	263.6	Reproduction	Nawrot and Staples, 1979	1	1	10	1.03E+00	2.70E+01
Ethylbenzene	Ethylbenzene	Rat	NOAEL	97	Increased kidney weight	Wolf et al., 1956	1	1	1	1.19E+00	1.15E+02
Toluene	Toluene	Mouse	LOAEL	260	Reproduction	Nawrot and Staples, 1979	1	1	10	1.03E+00	2.67E+01
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.06	Fetal weights/malformations	Marks et al. 1982	1	1	1	1.03E+00	2.11E+00
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.19E+00	1.19E-06
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	NOAEL	0.04	Reproduction	USACHPPM, 2001	1	1	1	1.19E+00	4.76E-02
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	1	1.03E+00	1.03E+01
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.19E+00	4.64E+00
2,6-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.19E+00	4.64E+00
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	1.03E+00	9.23E+00
4-Amino-2,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	1.03E+00	9.23E+00
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	1	1.19E+00	3.25E+00
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	1	1.03E+00	4.00E+00
Halogenated Aliphatic											
Tetrachloroethene	Tetrachloroethene	Mouse	LOAEL	5	Increase in locomotion and total activity at 60 days of age	Fredriksson et al., 1993	1	1	10	1.03E+00	5.13E-01
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	1.03E+00	1.98E+00

Table H 5-2. NOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.90E-02
Arsenic	Arsenic	Various Mammals	NOAEL	1.04	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	1.04E+00
Barium	Barium	Various mammals	NOAEL	51.8	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.18E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.32E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.70E-01
Chromium	Chromium III	Various Mammals	NOAEL	2.4	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	2.40E+00
Cobalt	Cobalt	Various Mammals	NOAEL	7.33	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.33E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	1.03E+00	2.74E+00
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	4.70E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	1.03E+00	1.41E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.19E+00	2.97E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	1.16E+00	1.55E-01
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	1	1.00E+00	6.40E-01
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	1.01E+00	5.07E-02
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.19E+00	1.06E+01
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	1	1.07E+00	5.16E-01
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.19E+00	1.06E+00

Table H 5-2. NOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	1.02E+00	9.76E+00
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.19E+00	2.38E+01
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	1.03E+00	4.70E+03
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	1	1.03E+00	5.64E+02
Semivolatile Organic Compound											
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.19E+00	2.38E+00
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	1	1.19E+00	2.38E+02
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.19E+00	8.57E+02
Volatile Organic Compound											
2-Butanone	Methyl Ethyl Ketone	Rat	NOAEL	173	Neurologic	Ralston et al. 1985	1	1	1	1.19E+00	2.06E+02
2-Hexanone	2-Hexanone	Rat	NOAEL	400	Hepatic and Renal effects	Eben et al., 1979	1	1	1	1.19E+00	4.76E+02
4-Methyl-2-Pentanone	4-Methyl-2-Pentanone	Rat	NOAEL	250	Liver and kidney function	Microbiological Associates, 1986 as cited in HEAST, 1993	1	1	5	1.19E+00	5.94E+01
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	10	1.19E+00	5.94E+01
Chloroform	Chloroform	Rat	NOAEL	150	Liver, kidney, gonadal condition	Palmer et al., 1979	1	1	1	1.19E+00	1.78E+02

Table H 5-2. NOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-3. NOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
BTEX											
Benzene	Benzene	Mouse	LOAEL	263.6	Reproduction	Nawrot and Staples, 1979	1	1	10	8.77E-01	2.31E+01
Ethylbenzene	Ethylbenzene	Rat	NOAEL	97	Increased kidney weight	Wolf et al., 1956	1	1	1	1.02E+00	9.86E+01
Toluene	Toluene	Mouse	LOAEL	260	Reproduction	Nawrot and Staples, 1979	1	1	10	8.77E-01	2.28E+01
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.06	Fetal weights/malformations	Marks et al. 1982	1	1	1	8.77E-01	1.81E+00
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.02E+00	1.02E-06
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	NOAEL	0.04	Reproduction	USACHPPM, 2001	1	1	1	1.02E+00	4.07E-02
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	1	8.77E-01	8.77E+00
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.02E+00	3.97E+00
2,6-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	1	1.02E+00	3.97E+00
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	8.77E-01	7.90E+00
4-Amino-2,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	1	8.77E-01	7.90E+00
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	1	1.02E+00	2.78E+00
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	1	8.77E-01	3.42E+00
Halogenated Aliphatic											
Tetrachloroethene	Tetrachloroethene	Mouse	LOAEL	5	Increase in locomotion and total activity at 60 days of age	Fredriksson et al., 1993	1	1	10	8.77E-01	4.39E-01
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	8.77E-01	1.69E+00

Table H 5-3. NOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.90E-02
Arsenic	Arsenic	Various Mammals	NOAEL	1.04	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	1.04E+00
Barium	Barium	Various mammals	NOAEL	51.8	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.18E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	5.32E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.70E-01
Chromium	Chromium III	Various Mammals	NOAEL	2.4	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	2.40E+00
Cobalt	Cobalt	Various Mammals	NOAEL	7.33	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.33E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	8.77E-01	2.34E+00
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	4.70E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	8.77E-01	1.20E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.02E+00	2.54E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	9.96E-01	1.33E-01
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	1	1.00E+00	6.40E-01
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	8.68E-01	4.34E-02
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.02E+00	9.05E+00
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	1	9.19E-01	4.41E-01
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.02E+00	9.05E-01

Table H 5-3. NOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	8.70E-01	8.35E+00
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.02E+00	2.03E+01
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	8.77E-01	4.02E+03
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	1	8.77E-01	4.83E+02
Semivolatile Organic Compound											
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.02E+00	2.03E+00
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	10	1.02E+00	2.03E+01
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.02E+00	7.33E+02
Volatile Organic Compound											
2-Butanone	Methyl Ethyl Ketone	Rat	NOAEL	173	Neurologic	Ralston et al. 1985	1	1	1	1.02E+00	1.76E+02
2-Hexanone	2-Hexanone	Rat	NOAEL	400	Hepatic and Renal effects	Eben et al., 1979	1	1	1	1.02E+00	4.07E+02
4-Methyl-2-Pentanone	4-Methyl-2-Pentanone	Rat	NOAEL	250	Liver and kidney function	Microbiological Associates, 1986 as cited in HEAST, 1993	1	1	1	1.02E+00	2.54E+02
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	10	1.02E+00	5.08E+01
Chloroform	Chloroform	Rat	NOAEL	150	Liver, kidney, gonadal condition	Palmer et al., 1979	1	1	1	1.02E+00	1.53E+02

Table H 5-3. NOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	N-TRV (mg/kg-day)

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-4. NOAEL-Based Toxicity Reference Values for Birds

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	N-TRV (mg/kg-day)
BTEX												
Benzene	Benzene	Mouse	NOAEL	Not Available	1.95E+02	Decreased body weight	Shell, 1992	1	10	1	1.00E+00	1.95E+01
Ethylbenzene	Ethylbenzene	Rat	NOAEL	Not Available	9.70E+01	Increased kidney weight	Wolf et al., 1956	1	10	1	1.00E+00	9.70E+00
Toluene	Toluene	Mouse	NOAEL	Not Available	2.50E+03	Production of viable litters	Smith, 1983	1	10	1	1.00E+00	2.50E+02
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	Not Available	2.06E+00	Fetal weights/malformations	Marks et al. 1982	1	10	1	1.00E+00	2.06E-01
Dioxins												
2,3,7,8-TCDD TEQ - Bird	2,3,7,8-TCDD	Ring-necked Pheasant	NOAEL	Not Available	1.43E-05	Reproduction	Nosek et al., 1992	1	1	1	1.00E+00	1.43E-05
Explosive												
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Red-winged Blackbird	LD50	42.2	4.20E+01	Mortality	Schafer et al., 1983	1	1	500	1.00E+00	8.40E-02
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Northern Bobwhite	NOAEL	Not Available	7.00E-01	Mortality	Gogal et al., 2000	1	1	1	1.00E+00	7.00E-01
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Birds	LOAEL	0	1.30E+00	Decreased body weight	USACHPPM, 2006	1	1	10	1.00E+00	1.30E-01
2,6-Dinitrotoluene	2,4-Dinitrotoluene	Birds	LOAEL	0	1.30E+00	Decreased body weight	USACHPPM, 2006	1	1	10	1.00E+00	1.30E-01
2-Amino-4,6-Dinitrotoluene	2,4,6-Trinitrotoluene	Northern Bobwhite	NOAEL	Not Available	7.00E-01	Mortality	Gogal et al., 2000	1	1	1	1.00E+00	7.00E-01
4-Amino-2,6-Dinitrotoluene	2,4,6-Trinitrotoluene	Northern Bobwhite	NOAEL	Not Available	7.00E-01	Mortality	Gogal et al., 2000	1	1	1	1.00E+00	7.00E-01
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Quail	NOAEL	0	8.14E+00	Egg production	Salice et al., 2001	1	10	1	1.00E+00	8.14E-01
HMX	HMX	Mouse	NOAEL	0	3.00E+01	Mortality	Everett and Maddock 1985	1	10	1	1.00E+00	3.00E+00
Halogenated Aliphatic												
Tetrachloroethene	Tetrachloroethene	Mouse	LOAEL	Not Available	5.00E+00	Increase in locomotion and total activity at 60 days of age	Fredriksson et al., 1993	1	10	10	1.00E+00	5.00E-02
Inorganic												
Aluminum	Aluminum	Ring Dove	NOAEL	Not Available	1.10E+02	Reproduction	Carriere et al., 1986	1	1	1	1.00E+00	1.10E+02
Antimony	Antimony	Various Mammals	NOAEL	Not Available	5.90E-02	Reproduction, growth, and survival	EPA, 2005	1	10	1	1.00E+00	5.90E-03
Arsenic	Arsenic	Various	NOAEL	Not Available	2.24E+00	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	2.24E+00
Barium	Barium	Chicks	NOAEL	Not Available	2.08E+01	Mortality	Johnson et al., 1960	1	1	1	1.00E+00	2.08E+01
Beryllium	Beryllium	Various Mammals	NOAEL	Not Available	5.32E-01	Reproduction, growth, and survival	EPA, 2005	1	10	1	1.00E+00	5.32E-02
Cadmium	Cadmium	Various	NOAEL	Not Available	1.47E+00	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	1.47E+00
Chromium	Chromium	Various	NOAEL	Not Available	2.66E+00	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	2.66E+00
Cobalt	Cobalt	Various	NOAEL	Not Available	7.61E+00	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	7.61E+00
Copper	Copper	Chicks	NOAEL	Not Available	2.30E+00	No effect on weight gain	Norvell and others, 1974	1	1	1	1.00E+00	2.30E+00
Lead	Lead	Various	NOAEL	Not Available	1.63E+00	Reproduction, growth, and survival	EPA, 2005	1	1	1	1.00E+00	1.63E+00

Table H 5-4. NOAEL-Based Toxicity Reference Values for Birds

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	N-TRV (mg/kg-day)
Manganese	Manganese	Japanese Quail	NOAEL	Not Available	7.76E+01	Growth, aggressive behavior	Laskey and Edens, 1985	1	1	1	1.00E+00	7.76E+01
Mercury	Mercury	Mallard Duck	NOAEL	Not Available	3.90E-02	Reproduction	EPA-Great Lakes, Heinz 1974, 1975, 1976, 1979	1	1	1	1.00E+00	3.90E-02
Nickel	Nickel	Mallard Duckling	NOAEL	Not Available	1.38E+00	No effect on tremors and edema in toe and leg joints	Cain and Pafford, 1981	1	1	1	1.00E+00	1.38E+00
Perchlorate	Perchlorate	Japanese Quail	NOAEL	Not Available	1.30E+00	Growth	McNabb et al., 2004	1	1	1	1.00E+00	1.30E+00
Selenium	Selenium	Mallard Duck	NOAEL	Not Available	2.30E-01	Food consumption, growth, mortality	Heinz et al., 1988	1	1	1	1.00E+00	2.30E-01
Silver	Silver	Rat	LOAEL	0	8.90E+01	Ventricular hypertrophy	Olcott, 1950	1	10	10	1.00E+00	8.90E-01
Thallium	Thallium	Quail	LOAEL	29.6	2.56E+00 *	Death	Shaw, 1933	1	1	10	1.00E+00	2.56E-01
Vanadium	Vanadium	Mallard Duck	NOAEL	110	1.14E+01	Weight loss, mortality, Vd residues in eggs	White and Deiter, 1978	1	1	1	1.00E+00	1.14E+01
Zinc	Zinc	Mallard Duck	NOAEL	Not Available	1.72E+01	Body weight, reproductive and pancreatic effects	Gasaway and Buss 1972	1	1	1	1.00E+00	1.72E+01
PAH Group 1												
2-Methylnaphthalene	Phenanthrene	Mallard Duck	LOAEL	4000	2.25E+02 *	Increased liver weight and blood flow to liver	Eisler, 1987	1	1	10	1.00E+00	2.25E+01
Fluoranthene	Phenanthrene	Mallard Duck	LOAEL	4000	2.25E+02 *	Increased liver weight and blood flow to liver	Eisler, 1987	1	1	10	1.00E+00	2.25E+01
Naphthalene	Phenanthrene	Mallard Duck	LOAEL	4000	2.25E+02 *	Increased liver weight and blood flow to liver	Eisler, 1987	1	1	10	1.00E+00	2.25E+01
Phthalate Esters												
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Ringed Dove	NOAEL	Not Available	1.10E+00	Reproduction	Peakall, 1974	1	1	1	1.00E+00	1.10E+00
Diethylphthalate	Bis (2-ethylhexyl) phthalate	Ringed Dove	NOAEL	Not Available	1.10E+00	Reproduction	Peakall, 1974	1	1	1	1.00E+00	1.10E+00
Di-n-butylphthalate	Di-n-butylphthalate	Ringed Dove	NOAEL	Not Available	1.10E-01	Reproduction	Peakall, 1974	1	1	1	1.00E+00	1.10E-01
Semivolatile Organic Compound												
Hexachlorobenzene	Hexachlorobenzene	Japanese Quail	NOAEL	5	4.32E-01 *	Decreased egg volume	Vos et al., 1971	1	1	1	1.00E+00	4.32E-01
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	0	2.00E+02	Renal	NCI, 1979	1	10	10	1.00E+00	2.00E+00
Phenol	Phenol	Rat	NOAEL	Not Available	7.21E+02	Liver abnormalitites	NCI, 1980	1	10	1	1.00E+00	7.21E+01
Volatile Organic Compound												
2-Butanone	2-Butanone	Rat	NOAEL	0	1.73E+02	Neurologic	Ralston et al. 1985	1	10	1	1.00E+00	1.73E+01
2-Hexanone	2-Hexanone	Rat	NOAEL	Not Available	4.00E+02	Hepatic and Renal effects	Eben et al., 1979	1	10	1	1.00E+00	4.00E+01
4-Methyl-2-Pentanone	4-Methyl-2-Pentanone	Rat	NOAEL	0	2.50E+02	Liver and kidney function	Microbiological Associates, 1986 as cited in HEAST, 1993	1	10	1	1.00E+00	2.50E+01
Acetone	Acetone	Rat	NOEAL	0	1.00E+02	Liver and Kidney damage	EPA, 1986	1	10	1	1.00E+00	1.00E+01
Chloroform	Chloroform	Rat	NOAEL	0	2.00E+02	Reproduction	NCI, 1976	1	10	1	1.00E+00	2.00E+01

* = Dose calculated from concentration in feed as described in the text.
Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-5. LOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
BTEX											
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.1	Fetal weights/malformations	Marks et al. 1982	1	1	0.1	1.10E+00	2.32E+01
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	0.1	1.28E+00	1.28E-05
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	LOAEL	0.2	Reproduction	Holdsworth and Salice, 2001	1	1	1	1.28E+00	2.56E-01
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	0.1	1.10E+00	1.10E+02
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	0.1	1.28E+00	4.99E+01
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	0.1	1.10E+00	9.93E+01
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	0.1	1.28E+00	3.49E+01
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	0.1	1.10E+00	4.30E+01
Inorganic											
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.90E-01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.32E+00
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	7.70E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	0.1	1.10E+00	2.95E+01
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	4.70E+01

Table H 5-5. LOAEL-Based Toxicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	0.1	1.28E+00	3.20E+00
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	0.1	1.25E+00	1.67E+00
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	0.1	1.00E+00	6.40E+00
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	0.1	1.09E+00	5.46E-01
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	1	1.28E+00	1.14E+02
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	0.1	1.16E+00	5.55E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	0.1	1.09E+00	1.05E+02
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.26E+00	6.30E+02
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.26E+00	6.30E+02
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	1	1.28E+00	2.56E+02
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	0.1	1.10E+00	6.07E+03
Semivolatile Organic Compound											
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	1	1.28E+00	2.56E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	1	1.28E+00	6.39E+02

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-6. LOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
BTEX											
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.1	Fetal weights/malformations	Marks et al. 1982	1	1	0.1	1.03E+00	2.15E+01
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	0.1	1.19E+00	1.19E-05
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	LOAEL	0.2	Reproduction	Holdsworth and Salice, 2001	1	1	1	1.19E+00	2.38E-01
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	0.1	1.03E+00	1.03E+02
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	0.1	1.19E+00	4.64E+01
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	0.1	1.03E+00	9.23E+01
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	0.1	1.19E+00	3.25E+01
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	0.1	1.03E+00	4.00E+01
Inorganic											
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.90E-01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.32E+00
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	7.70E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	0.1	1.03E+00	2.74E+01
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	4.70E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	0.1	1.19E+00	2.97E+00

Table H 5-6. LOAEL-Based Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	0.1	1.16E+00	1.55E+00
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	0.1	1.00E+00	6.40E+00
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	0.1	1.01E+00	5.07E-01
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	1	1.19E+00	1.06E+02
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	0.1	1.07E+00	5.16E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	0.1	1.02E+00	9.76E+01
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.17E+00	5.86E+02
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.17E+00	5.86E+02
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	1	1.19E+00	2.38E+02
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	0.1	1.03E+00	5.64E+03
Semivolatile Organic Compound											
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	1	1.19E+00	2.38E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	1	1.19E+00	5.94E+02

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-7. LOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
BTEX											
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	2.1	Fetal weights/malformations	Marks et al. 1982	1	1	0.1	1.03E+00	2.15E+01
Dioxins											
2,3,7,8-TCDD TEQ - Mammal	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	0.1	1.19E+00	1.19E-05
Explosive											
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Rat	LOAEL	0.2	Reproduction	Holdsworth and Salice, 2001	1	1	1	1.19E+00	2.38E-01
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Mouse	NOAEL	10	Liver, anemia	Furedi et al. 1984	1	1	0.1	1.03E+00	1.03E+02
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Rat	NOAEL	3.9	Decreased body weight	Lee et al., 1985	1	1	0.1	1.19E+00	4.64E+01
2-Amino-4,6-Dinitrotoluene	2-Amino-4,6-Dinitrotoluene	Mouse	NOAEL	9	Survival	USACHPPM, 2001	1	1	0.1	1.03E+00	9.23E+01
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Rat	NOAEL	2.73	Growth	Salice et al, 2001	1	1	0.1	1.19E+00	3.25E+01
HMX	HMX	Mouse	NOAEL	3.9	Mortality	Everett and Maddock 1985	1	1	0.1	1.03E+00	4.00E+01
Inorganic											
Antimony	Antimony	Various Mammals	NOAEL	0.059	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.90E-01
Beryllium	Beryllium	Various Mammals	NOAEL	0.532	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	5.32E+00
Cadmium	Cadmium	Various Mammals	NOAEL	0.77	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	7.70E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	0.1	1.03E+00	2.74E+01
Lead	Lead	Various Mammals	NOAEL	4.7	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	4.70E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	0.1	1.19E+00	2.97E+00

Table H 5-7. LOAEL-Based Toxicity Reference Values for Long-Tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	L-TRV (mg/kg-day)
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	0.1	1.16E+00	1.55E+00
Perchlorate	Perchlorate	Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	0.1	1.00E+00	6.40E+00
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	0.1	1.01E+00	5.07E-01
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	1	1.19E+00	1.06E+02
Thallium	Thallium	Rat	NOAEL	0.48	No hair loss	Downs, et al., 1960	1	1	0.1	1.07E+00	5.16E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	0.1	1.02E+00	9.76E+01
PAH Group 1											
2-Methylnaphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.17E+00	5.86E+02
Naphthalene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	0.1	1.17E+00	5.86E+02
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	1	1.19E+00	2.38E+02
Di-n-butylphthalate	Di-n-butylphthalate	Mouse	NOAEL	550	Reproduction	Lamb et al., 1987	1	1	0.1	1.03E+00	5.64E+03
Semivolatile Organic Compound											
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	LOAEL	200	Renal	NCI, 1979	1	1	1	1.19E+00	2.38E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	LOAEL	500	Liver and Kidney damage	EPA, 1986	1	1	1	1.19E+00	5.94E+02

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Table H 5-8. LOAEL-Based Toxicity Reference Values for Birds

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	L-TRV (mg/kg-day)
BTEX												
Xylenes, Total	Xylenes, Total	Mouse	NOAEL	Not Available	2.06E+00	Fetal weights/malformations	Marks et al. 1982	1	10	0.1	1.00E+00	2.06E+00
Explosive												
1,3-Dinitrobenzene	1,3-Dinitrobenzene	Red-winged Blackbird	LD50	42.2	4.20E+01	Mortality	Schafer et al., 1983	1	1	50	1.00E+00	8.40E-01
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	Northern Bobwhite	NOAEL	Not Available	7.00E-01	Mortality	Gogal et al., 2000	1	1	0.1	1.00E+00	7.00E+00
2,4-Dinitrotoluene	2,4-Dinitrotoluene	Birds	LOAEL	0	1.30E+00	Decreased body weight	USACHPPM, 2006	1	1	1	1.00E+00	1.30E+00
2-Amino-4,6-Dinitrotoluene	2,4,6-Trinitrotoluene	Northern Bobwhite	NOAEL	Not Available	7.00E-01	Mortality	Gogal et al., 2000	1	1	0.1	1.00E+00	7.00E+00
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Quail	NOAEL	0	8.14E+00	Egg production	Salice et al., 2001	1	1	0.1	1.00E+00	8.14E+01
HMX	HMX	Mouse	NOAEL	0	3.00E+01	Mortality	Everett and Maddock 1985	1	10	0.1	1.00E+00	3.00E+01
Inorganic												
Antimony	Antimony	Various Mammals	NOAEL	Not Available	5.90E-02	Reproduction, growth, and survival	EPA, 2005	1	10	0.1	1.00E+00	5.90E-02
Beryllium	Beryllium	Various Mammals	NOAEL	Not Available	5.32E-01	Reproduction, growth, and survival	EPA, 2005	1	10	0.1	1.00E+00	5.32E-01
Cadmium	Cadmium	Various	NOAEL	Not Available	1.47E+00	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	1.47E+01
Copper	Copper	Chicks	NOAEL	Not Available	2.30E+00	No effect on weight gain	Norvell and others, 1974	1	1	0.1	1.00E+00	2.30E+01
Lead	Lead	Various	NOAEL	Not Available	1.63E+00	Reproduction, growth, and survival	EPA, 2005	1	1	0.1	1.00E+00	1.63E+01
Mercury	Mercury	Mallard Duck	NOAEL	Not Available	3.90E-02	Reproduction	EPA-Great Lakes, Heinz 1974, 1975, 1976, 1979	1	1	0.1	1.00E+00	3.90E-01
Nickel	Nickel	Mallard Duckling	NOAEL	Not Available	1.38E+00	No effect on tremors and edema in toe and leg joints	Cain and Pafford, 1981	1	1	0.1	1.00E+00	1.38E+01
Perchlorate	Perchlorate	Japanese Quail	NOAEL	Not Available	1.30E+00	Growth	McNabb et al., 2004	1	1	0.1	1.00E+00	1.30E+01
Selenium	Selenium	Mallard Duck	NOAEL	Not Available	2.30E-01	Food consumption, growth, mortality	Heinz et al., 1988	1	1	0.1	1.00E+00	2.30E+00
Silver	Silver	Rat	LOAEL	0	8.90E+01	Ventricular hypertrophy	Olcott, 1950	1	10	1	1.00E+00	8.90E+00
Thallium	Thallium	Quail	LOAEL	29.6	2.56E+00 *	Death	Shaw, 1933	1	1	1	1.00E+00	2.56E+00
Zinc	Zinc	Mallard Duck	NOAEL	Not Available	1.72E+01	Body weight, reproductive and pancreatic effects	Gasaway and Buss 1972	1	1	0.1	1.00E+00	1.72E+02
PAH Group 1												
2-Methylnaphthalene	Phenanthrene	Mallard Duck	LOAEL	4000	2.25E+02 *	Increased liver weight and blood flow to liver	Eisler, 1987	1	1	1	1.00E+00	2.25E+02
Naphthalene	Phenanthrene	Mallard Duck	LOAEL	4000	2.25E+02 *	Increased liver weight and blood flow to liver	Eisler, 1987	1	1	1	1.00E+00	2.25E+02
Phthalate Esters												
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Ringed Dove	NOAEL	Not Available	1.10E+00	Reproduction	Peakall, 1974	1	1	0.1	1.00E+00	1.10E+01
Di-n-butylphthalate	Di-n-butylphthalate	Ringed Dove	NOAEL	Not Available	1.10E-01	Reproduction	Peakall, 1974	1	1	0.1	1.00E+00	1.10E+00

Table H 5-8. LOAEL-Based Toxicity Reference Values for Birds

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	L-TRV (mg/kg-day)
Semivolatile Organic Compound												
N-Nitrosodiphenylamine	N-Nitrosodiphenylamine	Rat	NOAEL	0	2.00E+02	Renal	NCI, 1979	1	10	0.1	1.00E+00	2.00E+02
Volatile Organic Compound												
Acetone	Acetone	Rat	NOAEL	0	1.00E+02	Liver and Kidney damage	EPA, 1986	1	10	0.1	1.00E+00	1.00E+02

* = Dose calculated from concentration in feed as described in the text.
Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

Attachment H-6
Comparison of Maximum Media Concentrations to Direct Contact Ecological Screening Values

Attachment H 6-1. Site 1 Ephemeral Pond Surface Water Sample Results

Analyte	Risk-based Screening Values	LE624 01-POND Sample			Risk-based Screening Values	LE619 01-POND-OUTFALL Total Sample			LE620 01-POND-OUTFALL Filtered Sample			Risk-based Screening Values	LE622 01-STREAM Total Sample			LE623 01-STREAM Filtered Sample	
VOCs (ug/L)																	
1,1,1-Trichloroethane	11 [1]	5	U	---	11 [1]	5	U	---	NA			11 [1]	5	U	---	NA	
1,1,2,2-Tetrachloroethane	610 [1]	5	U	---	610 [1]	5	U	---	NA			610 [1]	5	U	---	NA	
1,1,2-Trichloroethane	1200 [1]	5	U	---	1200 [1]	5	U	---	NA			1200 [1]	5	U	---	NA	
1,1-Dichloroethane	47 [1]	5	U	---	47 [1]	5	U	---	NA			47 [1]	5	U	---	NA	
1,1-Dichloroethene	25 [1]	5	U	---	25 [1]	5	U	---	NA			25 [1]	5	U	---	NA	
1,2-Dichloroethane	910 [1]	5	U	---	910 [1]	5	U	---	NA			910 [1]	5	U	---	NA	
1,2-Dichloropropane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
2-Butanone	14000 [1]	100	U	---	14000 [1]	100	U	---	NA			14000 [1]	100	U	---	NA	
2-Hexanone	99 [1]	50	U	---	99 [1]	50	U	---	NA			99 [1]	50	U	---	NA	
4-Methyl-2-Pentanone	170 [1]	50	U	---	170 [1]	50	U	---	NA			170 [1]	50	U	---	NA	
Acetone	1500 [1]	50	U	---	1500 [1]	6	J	---	NA			1500 [1]	6	J	---	NA	
Benzene	130 [1]	5	U	---	130 [1]	5	U	---	NA			130 [1]	5	U	---	NA	
Bromodichloromethane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Bromoform	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Bromomethane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Carbon Disulfide	0.92 [1]	5	U	YES	0.92 [1]	0.5	U	---	NA			0.92 [1]	0.5	U	---	NA	
Carbon Tetrachloride	9.8 [1]	5	U	---	9.8 [1]	5	U	---	NA			9.8 [1]	5	U	---	NA	
Chlorobenzene	64 [1]	5	U	---	64 [1]	5	U	---	NA			64 [1]	5	U	---	NA	
Chloroethane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Chloroform	28 [1]	5	U	---	28 [1]	5	U	---	NA			28 [1]	5	U	---	NA	
Chloromethane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Cis-1,2-Dichloroethene	590 [1]	5	U	---	590 [1]	5	U	---	NA			590 [1]	5	U	---	NA	
Cis-1,3-Dichloropropene	0.055 [1]	5	U	YES	0.055 [1]	0.072	U	YES	NA			0.055 [1]	0.072	U	YES	NA	
Dibromochloromethane	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Ethylbenzene	7.3 [1]	5	U	---	7.3 [1]	5	U	---	NA			7.3 [1]	5	U	---	NA	
Methylene Chloride	2200 [1]	5	U	---	2200 [1]	5	U	---	NA			2200 [1]	5	U	---	NA	
Styrene	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Tetrachloroethene	98 [1]	5	U	---	98 [1]	5	U	---	NA			98 [1]	5	U	---	NA	
Toluene	9.8 [1]	5	U	---	9.8 [1]	5	U	---	NA			9.8 [1]	5	U	---	NA	
Trans-1,2-Dichloroethene	590 [1]	5	U	---	590 [1]	5	U	---	NA			590 [1]	5	U	---	NA	
Trans-1,3-Dichloropropene	0.055 [1]	5	U	YES	0.055 [1]	0.054	U	---	NA			0.055 [1]	0.054	U	---	NA	
Trichloroethene	47 [1]	5	U	---	47 [1]	5	U	---	NA			47 [1]	5	U	---	NA	
Vinyl Chloride	dg	5	U	dg	dg	5	U	dg	NA			dg	5	U	dg	NA	
Total Xylenes	13 [1]	15	U	YES	13 [1]	15	U	YES	NA			13 [1]	15	U	YES	NA	
SVOCs (ug/L)																	
1,2,4-Trichlorobenzene	110 [1]	10	U	---	110 [1]	NA		dg	NA			110 [1]	NA		dg	NA	
1,2-Dichlorobenzene	14 [1]	10	U	---	14 [1]	9.6	U	---	NA			14 [1]	9.6	U	---	NA	
1,3-Dichlorobenzene	71 [1]	10	U	---	71 [1]	9.6	U	---	NA			71 [1]	9.6	U	---	NA	
1,4-Dichlorobenzene	15 [1]	10	U	---	15 [1]	9.6	U	---	NA			15 [1]	9.6	U	---	NA	
2,2'-Oxybis(1-chloropropane)	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2,4,5-Trichlorophenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2,4,6-Trichlorophenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2,4-Dichlorophenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2,4-Dimethylphenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2,4-Dinitrophenol	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
2-Chloronaphthalene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2-Chlorophenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
2-Methylphenol	13 [1]	10	U	---	13 [1]	9.6	U	---	NA			13 [1]	9.6	U	---	NA	
2-Nitroaniline	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
2-Nitrophenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
3,3'-Dichlorobenzidine	dg	20	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
3-Nitroaniline	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
4,6-Dinitro-2-Methylphenol	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
4-Bromophenyl Phenyl Ether	1.5 [1]	10	U	YES	1.5 [1]	1.3	U	---	NA			1.5 [1]	1.3	U	---	NA	
4-Chloro-3-Methylphenol	dg	20	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
4-Chloroaniline	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
4-Chlorophenyl Phenyl Ether	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
3/4-Methylphenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
4-Nitroaniline	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
4-Nitrophenol	300 [1]	50	U	---	300 [1]	48	U	---	NA			300 [1]	48	U	---	NA	
Bis(2-Chloroethoxy)Methane	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Bis(2-Chloroethyl)Ether	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Bis(2-Ethylhexyl)Phthalate	3 [1]	10	U	YES	3 [1]	1.9	U	---	NA			3 [1]	1.9	U	---	NA	
Butyl Benzyl Phthalate	19 [1]	10	U	---	19 [1]	9.6	U	---	NA			19 [1]	9.6	U	---	NA	
Carbazole	dg	10	U	dg	dg	19	U	dg	NA			dg	19	U	dg	NA	
Dibenzofuran	3.7 [1]	10	U	YES	3.7 [1]	1.1	U	---	NA			3.7 [1]	1.1	U	---	NA	
Diethyl Phthalate	210 [1]	10	U	---	210 [1]	9.6	U	---	NA			210 [1]	9.6	U	---	NA	
Dimethyl Phthalate	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Di-N-Butyl Phthalate	35 [1]	10	U	---	35 [1]	9.6	U	---	NA			35 [1]	9.6	U	---	NA	
Di-N-Octyl Phthalate	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Hexachlorobenzene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Hexachlorobutadiene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Hexachlorocyclopentadiene	dg	50	U	dg	dg	48	U	dg	NA			dg	48	U	dg	NA	
Hexachloroethane	12 [1]	10	U	---	12 [1]	9.6	U	---	NA			12 [1]	9.6	U	---	NA	
Isophorone	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Nitrobenzene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
N-Nitroso-Di-N-Propylamine	dg	50	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
N-Nitrosodiphenylamine	210 [1]	10	U	---	210 [1]	48	U	---	NA			210 [1]	48	U	---	NA	
Pentachlorophenol	15 [2]	50	U	YES	15 [2]	12	U	---	NA			15 [2]	12	U	---	NA	
Phenol	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
PAHs (ug/L)																	
2-Methylnaphthalene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Acenaphthene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Acenaphthylene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Anthracene	0.73 [1]	10	U	YES	0.73 [1]	0.096	U	---	NA			0.73 [1]	0.096	U	---	NA	
Benzo(a)anthracene	0.027 [1]	10	U	YES	0.027 [1]	0.096	U	YES	NA			0.027 [1]	0.096	U	YES	NA	
Benzo(a)pyrene	0.014 [1]	10	U	YES	0.014 [1]	0.096	U	YES	NA			0.014 [1]	0.096	U	YES	NA	
Benzo(b)fluoranthene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Benzo(g,h,i)perylene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Benzo(k)fluoranthene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Chrysene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Dibenz(a,h)anthracene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Fluoranthene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Fluorene	3.9 [1]	10	U	YES	3.9 [1]	0.096	U	---	NA			3.9 [1]	0.096	U	---	NA	
Indeno(1,2,3-cd)-pyrene	dg	10	U	dg	dg	9.6	U	dg	NA			dg	9.6	U	dg	NA	
Naphthalene	12 [1]	10	U	---	12 [1]	0.096	U	---	NA			12 [1]	0.096	U	---	NA	
Phenanthrene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Pyrene	dg	10	U	dg	dg	0.096	U	dg	NA			dg	0.096	U	dg	NA	
Explosives (ug/L)																	
1,3,5-Trinitrobenzene	11 [3]	1	U	---	11 [3]	1	U	---	NA			11 [3]	1	U	---	NA	
1,3-Dinitrobenzene	17 [3]	1	U	---	17 [3]	1	U	---	NA			17 [3]	1	U	---	NA	
2,4,6-Trinitrotoluene	93 [3]	1	U	---	93 [3]	1	U	---	NA			93 [3]	1	U	---	NA	
2,4-Dinitrotoluene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
2,6-Dinitrotoluene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
2-Amino-4,6-Dinitrotoluene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
2-Nitrotoluene	dg	2	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
3-Nitrotoluene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
4-Amino-2,6-Dinitrotoluene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
4-Nitrotoluene	dg	2	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	186 [3]	1	U	---	186 [3]	1	U	---	NA			186 [3]	1		---	NA	
Methyl-2,4,6-Trinitrophenylnitramine (Tetryl)	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
Nitrobenzene	dg	1	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	330 [3]	1	U	---	330 [3]	1	U	---	NA			330 [3]	1	U	---	NA	
2,4-diamino-6-nitrotoluene	dg	2	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
2,6-diamino-4-nitrotoluene	dg	2	U	dg	dg	1	U	dg	NA			dg	1	U	dg	NA	
Hydrocarbons																	
Motor Oil	dg	0.09	J	dg	dg	0.07	J	dg	NA			dg	0.04	J	dg	NA	
Diesel	dg	0.08	J	dg	dg	0.02	J	dg	NA			dg	0.01	J	dg	NA	
Gasoline	dg	0.05		dg	dg	0.03	J	dg	NA			dg	0.05	U	dg	NA	
General Chemistry																	
Perchlorate	dg	4	U	dg	dg	4	U	dg	NA			dg	4	U	dg	NA	
Alkalinity	dg	57.6		dg	dg	62.9		dg	NA			dg	79		dg	NA	
Hardness	dg	57		dg	dg	53		dg	NA			dg	66		dg	NA	
Ammonia	dg	0.79		dg	dg	0.36		dg	NA			dg	0.28		dg	NA	
pH	dg	7.02		dg	dg	7.02		dg	NA			dg	7.29		dg	NA	
Chloride	dg	0.68		dg	dg	2.6		dg	NA			dg	2.2		dg	NA	
Fluoride	dg	0.07	J	dg	dg	0.058	J	dg	NA			dg	0.075	J	dg	NA	
Nitrate as N	dg	0.088		dg	dg	0.36		dg	NA			dg	0.029	J	dg	NA	
Nitrite as N	dg	0.05	U	dg	dg	0.05	U	dg	NA			dg	0.05	U	dg	NA	
Sulfate	dg	0.73		dg	dg	1.8		dg	NA			dg	1.8		dg	NA	
Metals (ug/L)																	
Aluminum	87 [4]	2840		YES	87 [4]	3740		YES	131		YES	87 [4]	1390		YES	61.7	J ---
Antimony	30 [1]	10	U	---	30 [1]	10	U	---	10	U	---	30 [1]	4.7	J	---	3.4	J ---
Arsenic	150 [2]	5	U	---	150 [2]	1.2		---	1.1		---	150 [2]	0.8		---	0.69	---
Barium	4 [1]	50.2		YES	4 [1]	39.3		YES	33.5		YES	4 [1]	45.9		YES	43.3	YES
Beryllium	0.66 [1]	2	U	YES	0.66 [1]	0.1		---	0.043	J	---	0.66 [1]	0.048	J	---	0.1	U ---
Cadmium	1.47 [2,5]	0.24	J	---	1.49 [2,5]	2	U	YES	2	U	YES	1.66 [2,5]	2	U	YES	2	U YES
Calcium	dg	17200		dg	dg	17900		dg	17000		---	dg	22900		dg	23400	---
Chromium	11 [2,6]	7.9		---	11 [2,6]	3.3	J	---	1.6	J	---	11 [2,6]	2.4	J	---	2.5	J ---
Cobalt	23 [1]	1.1	J	---	23 [1]	1.1	J	---	0.44	J	---	23 [1]	0.55	J	---	0.32	J ---
Copper	5.52 [2,5]	4.1	J	---	5.21 [2,5]	5.3		YES	2.5	J	---	6.28 [2,5]	9.6		YES	8.1	YES
Iron	1000 [4]	1890		YES	1000 [4]	1140		YES	81.3		---	1000 [4]	725		---	32.3	J ---
Lead	1.35 [2,5]	3.1	J	YES	1.25 [2,5]	0.93		---	0.35		---	1.60 [2,5]	0.95		---	0.59	---
Magnesium	dg	3360		dg	dg	3630		dg	3290		---	dg	3790		dg	3660	---
Manganese	120 [1]	26.4		---	120 [1]	24.2		---	15.1		---	120 [1]	13.8		---	3.5	J ---
Mercury	0.77 [4]	0.21	J	---	0.77 [4]	0.89		YES	0.082	J	---	0.77 [4]	0.3	J	---	0.56	---
Nickel	32.3 [2,5]	4.1	J	---	30.4 [2,5]	3.5		---	2.8		---	36.6 [2,5]	2.6		---	3	---
Potassium	dg	3440		dg	dg	2650		dg	2470		---	dg	5140		dg	5230	---
Selenium	5 [2]	10	U	YES	5 [2]	0.4	J	---	0.2	J	---	5 [2]	0.37	J	---	1	U ---
Silver	0.36 [1]	10	U	YES	0.36 [1]	0.3	U	---	0.3	U	---	0.36 [1]	0.3	U	---	0.3	U ---
Sodium	dg	4060		dg	dg	6150		dg	6350		---	dg	4140		dg	4360	---
Thallium	12 [1]	10	U	---	12 [1]	10	U	---	10	U	---	12 [1]	10	U	---	10	U ---
Vanadium	20 [1]	6.1	J	---	20 [1]	3.8	J	---	2.5	J	---	20 [1]	3.9	J	---	1.3	J ---
Zinc	73 [2,5]	20.8		---	69 [2,5]	15.3		---	12.1		---	83 [2,5]	19.3		---	17	---

Notes

dg = data gap (i.e., no data available or provided)

--- = a). maximum reporting limit is less than the risk-based screening value; or b). maximum detected concentration is less than the risk-based screening value.

YES = a). maximum reporting limit is greater than the risk-based screening value; or b). maximum detected concentration is greater than the risk-based screening value.

NA = not analyzed

Data Qualifiers

J indicates that the analyte was positively identified but the associate numerical value is below the practical quantitation limit but above the method detection limit.

U indicates that the analyte was analyzed for, but was not detected above the detection limit.

UJ indicates that the analyte was analyzed for, but not detected. The associated detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

References

[1] Great Lakes Tier II Secondary Chronic Values in: Suter II, G. W., and C. L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Revised. ES/ER/TM-96/R2. Oak Ridge, Tenn.: Oak Ridge National Laboratory.

[2] California Toxics Rule Values in: EPA. 2000. U.S. Environmental Protection Agency. Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. In: Federal Register 40 CFR Part 131. May 18, 2000.

[3] Secondary Chronic Values in: Talmage, S. S., D. M. Opresko, C. J. Maxwell, C. J. E. Welch, F. M. Cretella, P. H. Reno, and F. B. Daniel, 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. Rev. Envtl. Contam. Toxicol., 161:1-156.

[4] CCC (Criterion Continuous Concentration) values in: EPA. 2002. National Recommended Water Quality Criteria: 2002. Office of Water, Office of Science and Technology. EPA-822-R-02-047. November 2002.

[5] Screening values were adjusted for hardness as described in: EPA. 2000. U.S. Environmental Protection Agency. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. In: Federal Register 40 CFR Part 131. May 18, 2000.

[6] Value for hexavalent chromium.

Maximum reporting limit exceeds screening level.

Maximum dectected concentration exceeds screening level.

Attachment H 6-2. Site 1 Ephemeral Pond Sediment Sample Results

Analyte	Frequency of Detects	Sample Location for Maximum Detection	Risk-based Screening Values	Minimum Reporting Limit	Maximum Reporting Limit		Minimum Detected Concentration	Maximum Detected Concentration		UCL	Mean-Ln	SD-Ln
VOCs (µg/kg)												
1,1,1-Trichloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,1,2,2-Tetrachloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,1,2-Trichloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,1-Dichloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,1-Dichloroethene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,2-Dichloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
1,2-Dichloropropane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
2-Butanone	0%		dg	47 U	65 U	dg	nd	nd	dg	dg	dg	dg
2-Hexanone	0%		dg	9.3 U	13 U	dg	nd	nd	dg	dg	dg	dg
4-Methyl-2-Pentanone	0%		dg	9.3 U	13 U	dg	nd	nd	dg	dg	dg	dg
Acetone	0%		dg	19 UJ	26 UJ	dg	nd	nd	dg	dg	dg	dg
Benzene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Bromodichloromethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Bromoform	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Bromomethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Carbon Disulfide	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Carbon Tetrachloride	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Chlorobenzene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Chlorodibromomethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Chloroethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Chloroform	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Chloromethane	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
cis-1,2-Dichloroethene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
cis-1,3-Dichloropropene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Ethylbenzene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Methylene Chloride	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Styrene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Tetrachloroethene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Toluene	11%	01-SS-HA15-S01-D0.5	dg	4.7 U	6.5 U	dg	0.70 J	0.8 J	dg	dg	dg	dg
Total xylenes	0%		dg	14 U	20 U	dg	nd	nd	dg	dg	dg	dg
trans-1,2-Dichloroethene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
trans-1,3-Dichloropropene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Trichloroethene	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
Vinyl chloride	0%		dg	4.7 U	6.5 U	dg	nd	nd	dg	dg	dg	dg
SVOCs (µg/kg)												
1,2,4-Trichlorobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
1,2-Dichlorobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
1,3-Dichlorobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
1,4-Dichlorobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2,4,5-Trichlorophenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2,4,6-Trichlorophenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2,4-Dichlorophenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2,4-Dimethylphenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2,4-Dinitrophenol	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
2-Chloronaphthalene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2-Chlorophenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2-Methylphenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2-Nitroaniline	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
2-Nitrophenol	0%		dg	570 U	760 U	dg	nd	nd	dg	dg	dg	dg
3,3'-Dichlorobenzidine	0%		dg	dg	dg	dg	nd	nd	dg	dg	dg	dg
3-Nitroaniline	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
4,6-Dinitro-2-Methylphenol	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
4-Bromophenyl Phenyl Ether	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
4-Chloro-3-Methylphenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
4-Chloroaniline	0%		dg	570 U	760 U	dg	nd	nd	dg	dg	dg	dg
4-Chlorophenyl Phenyl Ether	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
4-Methylphenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
4-Nitroaniline	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
4-Nitrophenol	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
Bis(2-Chloro-1-Methylethyl)Ether	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Bis(2-Chloroethoxy)Methane	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Bis(2-Chloroethyl)Ether	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Bis(2-Ethylhexyl)Phthalate	0%		182 [9]	280 U	380 U	YES	nd	nd	dg	dg	dg	dg
butyl Benzyl phthalate	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Carbazole	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Dibenzofuran	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Diethyl Phthalate	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Dimethyl Phthalate	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Di-N-Butyl Phthalate	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Di-N-Octyl Phthalate	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Hexachlorobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Hexachlorobutadiene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Hexachlorocyclopentadiene	0%		dg	1500 UJ	2000 U	dg	nd	nd	dg	dg	dg	dg
Hexachloroethane	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Isophorone	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
Nitrobenzene	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
N-Nitroso-Di-N-Propylamine	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
N-Nitrosodiphenylamine	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
Pentachlorophenol	0%		dg	1500 U	2000 U	dg	nd	nd	dg	dg	dg	dg
Phenol	0%		dg	280 U	380 U	dg	nd	nd	dg	dg	dg	dg
2-Methylnaphthalene	0%		70 [2]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Acenaphthene	0%		150 [3]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Acenaphthylene	0%		44 [2]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Anthracene	0%		85 [3]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Benz(a)anthracene	0%		31.7 [8]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Benzo(a)pyrene	0%		31.9 [8]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Benzo(b)fluoranthene	0%		dg	21 U	29 U	dg	nd	nd	dg	dg	dg	dg
Benzo(g,h,i)perylene	0%		170 [10]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Benzo(k)fluoranthene	0%		240 [10]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Chrysene	0%		57.1 [8]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Dibenz(a,h)anthracene	0%		60 [3]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Fluoranthene	0%		111 [8]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Fluorene	0%		35 [3]	21 U	29 U	---	nd	nd	dg	dg	dg	dg

Attachment H 6-2. Site 1 Ephemeral Pond Sediment Sample Results

Analyte	Frequency of Detects	Sample Location for Maximum Detection	Risk-based Screening Values	Minimum Reporting Limit	Maximum Reporting Limit		Minimum Detected Concentration	Maximum Detected Concentration		UCL	Mean-Ln	SD-Ln
Indeno(1,2,3-Cd)Pyrene	0%		200 [10]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Naphthalene	0%		176 [1]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Phenanthrene	0%		41.9 [8]	21 U	29 U	---	nd	nd	dg	dg	dg	dg
Pyrene	5%	01-SS-PSS12-S01-D0.0	53 [8]	21 U	29 U	---	2.00 J	2 J	---	dg	dg	dg
Explosives (µg/kg)												
1,3,5-Trinitrobenzene	0%		2 [11]	210 U	230 U	YES	nd	nd	dg	dg	dg	dg
1,3-Dinitrobenzene	0%		6.7 [11]	210 U	230 U	YES	nd	nd	dg	dg	dg	dg
2,4,6-Trinitrotoluene	0%		92 [11]	210 U	230 U	YES	nd	nd	dg	dg	dg	dg
2,4-Diamino-4-nitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
2,4-Dinitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
2,6-Diamino-4-nitrotoluene	0%		dg	150 U	170 U	dg	nd	nd	dg	dg	dg	dg
2,6-Dinitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
2-Amino-4,6-Dinitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
2-Nitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
3-Nitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
4-Amino-2,6-Dinitrotoluene	0%		dg	210 UJ	230 UJ	dg	nd	nd	dg	dg	dg	dg
4-Nitrotoluene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	0%		12.7 [11]	210 U	230 U	YES	nd	nd	dg	dg	dg	dg
Methyl-2,4,6-TrinitrophenylNitramine	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
Nitrobenzene	0%		dg	210 U	230 U	dg	nd	nd	dg	dg	dg	dg
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	0%		4.74 [11]	210 U	230 U	YES	nd	nd	dg	dg	dg	dg
Hydrocarbons (mg/kg)												
PHC as Diesel Fuel	63%	01-SS-PSS12-S01-D0.0	dg	8.8 U	12 U	dg	2.00 J	6 J	dg	8.89	1.49	0.681
TEPH as Motor Oil	100%	01-SS-PSS12-S01-D0.0	dg	dg	dg	dg	12.00	150	dg	52.37	3.51	0.591
Gasoline	5%	01-SS-PSS16-S01-D0.0	dg	9.5 U	13 U	dg	1.00 J	1 J	dg	dg	dg	dg
General Chemistry												
Perchlorate (µg/kg)	0%		dg	18 U	24 U	dg	nd	nd	dg	dg	dg	dg
TOTAL ORGANIC CARBON, (TOC) (mg/kg)	100%	01-SS-PSS12-S01-D0.0	dg	dg	dg	dg	1300.00	9190	dg	5927	8.35	0.606
pH	100%	01-SS-PSS09-S01-D0.0	dg	dg	dg	dg	6.98	9.09	dg	8.38	2.08	0.093
Metals (mg/kg)												
Aluminum	100%	01-SS-PSS03-S01-D0.0	dg	dg	dg	dg	4220.00	16900	dg	9774	9.00	0.323
Antimony	0%		2.00 [3]	1.8 U	2.4 U	YES	nd	nd	dg	dg	dg	dg
Arsenic	100%	01-SS-PSS03-S01-D0.0	9.79 [1]	dg	dg	dg	0.47 J	1.5	---	0.922	-0.245	0.290
Barium	100%	01-SS-PSS03-S01-D0.0	500 [4]	dg	dg	dg	24.60	81.7	---	46.12	3.64	0.317
Beryllium	100%	01-SS-PSS03-S01-D0.0	dg	dg	dg	dg	0.11	0.98	dg	0.387	-1.33	0.533
Cadmium	100%	01-SS-HA17-S01-D0.5	0.990 [1]	dg	dg	dg	0.02	0.34	---	0.129	-2.64	0.756
Calcium	100%	01-SS-HA17-S01-D0.5	dg	dg	dg	dg	2120.00	16500	dg	11010	8.45	0.723
Chromium	100%	01-SS-HA17-S01-D0.5	43.40 [1]	dg	dg	dg	2.50	7.1	---	4.54	1.35	0.291
Cobalt	100%	01-SS-PSS03-S01-D0.0	50.00 [5]	dg	dg	dg	1.00 J	2.7 J	---	1.69	0.377	0.264
Copper	100%	01-SS-HA17-S01-D0.5	31.60 [1]	dg	dg	dg	0.80	6.4	---	2.77	0.708	0.472
Iron	100%	01-SS-PSS03-S01-D0.0	dg	dg	dg	dg	2860.00	7720	dg	4833	8.32	0.282
Lead	100%	01-SS-HA17-S01-D0.5	35.80 [1]	dg	dg	dg	1.80	12.1	---	5.72	1.41	0.505
Magnesium	100%	01-SS-PSS03-S01-D0.0	dg	dg	dg	dg	990.00	3710	dg	2000	7.39	0.344
Manganese	100%	01-SS-HA17-S01-D0.5	300 [6]	dg	dg	dg	39.80	121	---	73.31	4.13	0.294
Mercury	100%	01-SS-PSS03-S01-D0.0	0.180 [1]	dg	dg	dg	0.01	0.32	YES	0.110	-2.89	0.866
Nickel	100%	01-SS-HA17-S01-D0.5	22.70 [1]	dg	dg	dg	1.30 J	4 J	---	2.35	0.660	0.323
Potassium	100%	01-SS-PSS12-S01-D0.0	dg	dg	dg	dg	409.00	1170	dg	749	6.47	0.276
Selenium	5%	01-SS-HA16-S01-D0.5	5.00 [7]	0.27 UJ	0.36 UJ	---	0.19 J	0.19 J	---	dg	dg	dg
Silver	0%		1.00 [2]	0.45 UJ	0.6 UJ	---	nd	nd	dg	dg	dg	dg
Sodium	37%	01-SS-HA17-S01-D0.5	dg	90 UJ	98 UJ	dg	9.70 J	53.2	dg	dg	dg	dg
Thallium	0%		dg	0.36 U	0.48 U	dg	nd	nd	dg	dg	dg	dg
Vanadium	100%	01-SS-PSS03-S01-D0.0	dg	dg	dg	dg	5.30	14.4	dg	8.86	2.01	0.289
Zinc	100%	01-SS-HA17-S01-D0.5	121 [1]	dg	dg	dg	6.40 J	19.6 J	---	12.66	2.37	0.303

Notes

dg = data gap (i.e., no data available or provided)

nd = not detected

--- = a). maximum reporting limit is less than the risk-based screening value; or b). maximum detected concentration is less than the risk-based screening value.

YES = a). maximum reporting limit is greater than the risk-based screening value; or b). maximum detected concentration is greater than the risk-based screening value.

Data Qualifiers

J indicates that the analyte was positively identified but the associate numerical value is below the practical quantitation limit but above the method detection limit.

U indicates that the analyte was analyzed for, but was not detected above the detection limit.

UJ indicates that the analyte was analyzed for, but not detected. The associated detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the anal in the sample.

References

(1) TEC = Threshold Effect Concentration in: MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

(2) ERL = Effects Range Low in: Long, E.R., D.D. MacDonald, S.L. Smith, and F.D Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19(1): 81–97.

(3) ER-L = Effects Range Low in: Long, E.R., and L.G. Morgan. 1990. Potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program. National Oceanic and Atmospheric Administration Technical Memorandum NOS OMA 52. Seattle: National Ocean Service.

(4) Interim Criteria for In-Water Disposal of Dredged Sediments in: Sullivan, J., J. Ball, E. Brick, S. Hausmann, G. Pilarski, and D. Sopcich. 1985. Report of the technical subcommittee on determination of dredge material suitability for in-water disposal. Wisconsin Department of Natural Resources Report. (As cited in Fitchko 1989).

(5) OMOE Open Water Disposal Criteria in: Fitchko, J. 1989. Criteria for Contaminated Soil/Sediment Cleanup. Beak Consultants Limited. Brampton, Ontario. ISBN 0-934165-29-6. Pudvan Publishing Co. Inc. Northbrook, Illinois.

(6) Non Polluted Sediment Quality Guidelines for USEPA Region 5 Harbour Classification in: EPA. 1977. Guidelines for the pollution classification of Great Lakes Harbor sediments. U.S. Environmental Protection Agency. Reg V. Great Lakes Surveillance Branch. Chicago, Illinois. (As cited in SAIC 1991).

(7) British Columbia Ministry of Environment Criterion in: BCMOELP (British Columbia Ministry of Environment Lands and Parks). 1994. Approved and working criteria for water quality - 1994. Water Quality Branch. Environmental Protection Department. British Columbia Ministry of Environment Lands and Parks. ISBN 0-7726-2061-X. Victoria, British Columbia. 45 pp.

(8) TEL = Threshold Effect Level in: Smith, S.L., D.D. McDonald, K.A. Kleenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. J. Great Lakes Res. 22(3), 624 – 638.

(9) TEL = Threshold Effect Level in: MacDonald, DD., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. Ecotoicol. 5:253-278.

(10) LEL = Lowest Effect Level in: Jaagumagi, R. 1993. Development of the Ontario Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons (PAH). Ontario Ministry of Environment, Toronto, ON. 79 pp.

(11) $SQB_{1\%}$ = Sediment Quality Benchmark when organic carbon content is 1%, in: Talmage, S. S., D. M. Opresko, C. J. Maxwell, C. J. E. Welch, F. M. Cretella, P. H. Reno, and F. B. Daniel, 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. Rev. Envtl. Contam. Toxicol., 161:1-156.

Attachment H 6-3. Comparison of Maximum Reporting Limits to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Undetected	Maximum Undetected	Units	ORNL Soil Benchmark [1]	Is Max Reporting Limit>ORNL Soil Benchmark?
VOCs								
1,1,1,2-Tetrachloroethane	0	1	0%	1100	1100	ug/kg	DG	-
1,1,1-Trichloroethane	0	168	0%	4.4	6100	ug/kg	DG	-
1,1,2,2-Tetrachloroethane	0	168	0%	4.4	6100	ug/kg	DG	-
1,1,2-Trichloro-1,2,2-Trifluoroethane	0	1	0%	1100	1100	ug/kg	DG	-
1,1,2-Trichloroethane	0	168	0%	4.4	6100	ug/kg	DG	-
1,1-Dichloroethane	0	168	0%	4.4	6100	ug/kg	DG	-
1,1-Dichloroethene	0	168	0%	4.4	6100	ug/kg	DG	-
1,2-Dichloroethane	0	161	0%	4.4	6100	ug/kg	DG	-
1,2-Dichloropropane	0	168	0%	4.4	6100	ug/kg	700000	No
1,2-Dichlorotetrafluoroethane	0	1	0%	1100	1100	ug/kg	DG	-
2-Butanone	2	167	1%	8.6	120000	ug/kg	DG	-
2-Hexanone	7	168	4%	4.8	61000	ug/kg	DG	-
4-Methyl-2-Pentanone	1	168	1%	4.8	61000	ug/kg	DG	-
Acetone	5	131	4%	88	120000	ug/kg	DG	-
Benzene	3	168	2%	4.4	1100	ug/kg	500 [3]	Yes
Bromodichloromethane	0	168	0%	4.4	6100	ug/kg	DG	-
Bromoform	0	168	0%	4.4	6100	ug/kg	DG	-
Bromomethane	0	168	0%	4.4	6100	ug/kg	DG	-
Butane, 2-Methoxy-2-Methyl-	0	1	0%	1100	1100	ug/kg	DG	-
Carbon Disulfide	0	168	0%	4.4	6100	ug/kg	DG	-
Carbon Tetrachloride	0	168	0%	4.4	6100	ug/kg	DG	-
Chlorobenzene	0	168	0%	4.4	6100	ug/kg	40000	No
Chlorodibromomethane	0	168	0%	4.4	6100	ug/kg	DG	-
Chloroethane	0	168	0%	4.4	6100	ug/kg	DG	-
Chloroform	11	168	7%	0.6	6100	ug/kg	DG	-
Chloromethane	0	168	0%	4.4	6100	ug/kg	40000	No
Cis-1,2-Dichloroethene	0	168	0%	4.4	6100	ug/kg	DG	-
Cis-1,3-Dichloropropene	0	168	0%	4.4	6100	ug/kg	DG	-
Dichlorodifluoromethane	0	1	0%	1100	1100	ug/kg	DG	-
Diisopropyl Ether	0	1	0%	1100	1100	ug/kg	DG	-
Ethylbenzene	3	168	2%	4.4	6000	ug/kg	1200 [3]	Yes
Methyl Tert-Butyl Ether	0	1	0%	1100	1100	ug/kg	DG	-
Methylene Chloride	0	168	0%	4.4	6100	ug/kg	DG	-
Propane, 2-Ethoxy-2-Methyl-	0	1	0%	1100	1100	ug/kg	DG	-
Styrene	0	168	0%	4.4	6100	ug/kg	300000	No
Tert-Butyl Alcohol	0	1	0%	4400	4400	ug/kg	DG	-
Tetrachloroethene	1	168	1%	4.4	6100	ug/kg	DG	-

Attachment H 6-3. Comparison of Maximum Reporting Limits to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Undetected	Maximum Undetected	Units	ORNL Soil Benchmark [1]	Is Max Reporting Limit>ORNL Soil Benchmark?
Toluene	24	168	14%	4.5	6000	ug/kg	800 [3]	Yes
Total Xylenes	3	168	2%	4.6	18000	ug/kg	1000 [3]	Yes
Trans-1,2-Dichloroethene	0	168	0%	4.4	6100	ug/kg	DG	-
Trans-1,3-Dichloropropene	0	168	0%	4.4	6100	ug/kg	DG	-
Trichloroethene	0	168	0%	4.4	6100	ug/kg	DG	-
Trichlorofluoromethane	0	1	0%	1100	1100	ug/kg	DG	-
Vinyl Chloride	0	168	0%	4.4	6100	ug/kg	DG	-
SVOCs								
1,2,4-Trichlorobenzene	0	143	0%	350	120000	ug/kg	20000	Yes
1,2-Dichlorobenzene	0	143	0%	350	120000	ug/kg	DG	-
1,3-Dichlorobenzene	0	143	0%	350	120000	ug/kg	DG	-
1,4-Dichlorobenzene	0	143	0%	350	120000	ug/kg	20000	Yes
2,4,5-Trichlorophenol	0	143	0%	350	120000	ug/kg	4000	Yes
2,4,6-Trichlorophenol	0	143	0%	350	120000	ug/kg	10000	Yes
2,4-Dichlorophenol	0	143	0%	350	120000	ug/kg	DG	-
2,4-Dimethylphenol	0	143	0%	350	120000	ug/kg	DG	-
2,4-Dinitrophenol	0	143	0%	1700	610000	ug/kg	20000	Yes
2-Chloronaphthalene	0	143	0%	350	120000	ug/kg	DG	-
2-Chlorophenol	0	143	0%	350	120000	ug/kg	DG	-
2-Methylnaphthalene	3	143	2%	350	120000	ug/kg	DG	-
2-Methylphenol	0	143	0%	350	120000	ug/kg	DG	-
2-Nitroaniline	0	143	0%	1700	610000	ug/kg	DG	-
2-Nitrophenol	0	143	0%	350	120000	ug/kg	DG	-
3,3'-Dichlorobenzidine	0	143	0%	350	120000	ug/kg	DG	-
3-Nitroaniline	0	143	0%	1700	610000	ug/kg	DG	-
4,6-Dinitro-2-Methylphenol	0	143	0%	1700	610000	ug/kg	DG	-
4-Bromophenyl Phenyl Ether	0	143	0%	350	120000	ug/kg	DG	-
4-Chloro-3-Methylphenol	0	143	0%	350	120000	ug/kg	DG	-
4-Chloroaniline	0	143	0%	690	240000	ug/kg	DG	-
4-Chlorophenyl Phenyl Ether	0	143	0%	350	120000	ug/kg	DG	-
4-Methylphenol	0	143	0%	350	120000	ug/kg	DG	-
4-Nitroaniline	0	143	0%	1700	610000	ug/kg	DG	-
4-Nitrophenol	0	143	0%	1700	610000	ug/kg	7000	Yes
Acenaphthene	0	143	0%	350	120000	ug/kg	20000	Yes
Acenaphthylene	0	143	0%	350	120000	ug/kg	DG	-
Anthracene	0	143	0%	350	120000	ug/kg	DG	-
Benz(A)Anthracene	0	143	0%	350	120000	ug/kg	DG	-
Benzo(A)Pyrene	0	143	0%	26	6100	ug/kg	DG	-

Attachment H 6-3. Comparison of Maximum Reporting Limits to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Undetected	Maximum Undetected	Units	ORNL Soil Benchmark [1]	Is Max Reporting Limit>ORNL Soil Benchmark?
Benzo(B)Fluoranthene	0	143	0%	350	120000	ug/kg	DG	-
Benzo(G,H,I)Perylene	0	143	0%	350	120000	ug/kg	DG	-
Benzo(K)Fluoranthene	0	143	0%	350	120000	ug/kg	DG	-
Bis(2-Chloro-1-Methylethyl)Ether	0	143	0%	510	120000	ug/kg	DG	-
Bis(2-Chloroethoxy)Methane	0	143	0%	510	120000	ug/kg	DG	-
Bis(2-Chloroethyl)Ether	0	143	0%	170	40000	ug/kg	DG	-
Bis(2-Ethylhexyl)Phthalate	6	143	4%	510	120000	ug/kg	DG	-
Butyl Benzyl Phthalate	0	143	0%	350	120000	ug/kg	DG	-
Carbazole	0	143	0%	350	120000	ug/kg	DG	-
Chrysene	0	143	0%	350	120000	ug/kg	DG	-
Dibenz(A,H)Anthracene	0	143	0%	37	8800	ug/kg	DG	-
Dibenzofuran	0	143	0%	350	120000	ug/kg	DG	-
Diethyl Phthalate	4	143	3%	350	120000	ug/kg	100000	Yes
Dimethyl Phthalate	0	143	0%	350	120000	ug/kg	200000	No
Di-N-Butyl Phthalate	12	143	8%	350	120000	ug/kg	200000	No
Di-N-Octyl Phthalate	0	143	0%	350	120000	ug/kg	DG	-
Fluoranthene	1	143	1%	350	120000	ug/kg	37000 [4]	Yes
Fluorene	0	143	0%	350	120000	ug/kg	30000	Yes
Hexachlorobenzene	1	143	1%	350	120000	ug/kg	DG	-
Hexachlorobutadiene	0	143	0%	350	120000	ug/kg	DG	-
Hexachlorocyclopentadiene	0	143	0%	1700	610000	ug/kg	10000	Yes
Hexachloroethane	0	143	0%	350	120000	ug/kg	DG	-
Indeno(1,2,3-Cd)Pyrene	0	143	0%	350	120000	ug/kg	DG	-
Isophorone	0	143	0%	350	120000	ug/kg	DG	-
Naphthalene	3	143	2%	350	120000	ug/kg	20000 [4]	Yes
N-Nitroso-Di-N-Propylamine	0	143	0%	46	11000	ug/kg	20000	No
N-Nitrosodiphenylamine	6	143	4%	350	120000	ug/kg	20000	Yes
Pentachlorophenol	0	143	0%	1700	420000	ug/kg	5000 [2]	Yes
Phenanthrene	0	143	0%	350	120000	ug/kg	DG	-
Phenol	15	143	10%	350	120000	ug/kg	30000	Yes
Pyrene	0	143	0%	350	120000	ug/kg	DG	-
Explosives								
1,3,5-Trinitrobenzene	0	144	0%	200	270	ug/kg	DG	-
1,3-Dinitrobenzene	1	144	1%	200	270	ug/kg	DG	-
2,4,6-Trinitrotoluene	2	144	1%	200	270	ug/kg	30000	No
2,4-Dinitrotoluene	6	147	4%	200	270	ug/kg	DG	-
2,6-Dinitrotoluene	1	145	1%	200	270	ug/kg	DG	-
2-Amino-4,6-Dinitrotoluene	1	144	1%	200	270	ug/kg	80000	No

Attachment H 6-3. Comparison of Maximum Reporting Limits to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Undetected	Maximum Undetected	Units	ORNL Soil Benchmark [1]	Is Max Reporting Limit>ORNL Soil Benchmark?
2-Nitrotoluene	0	144	0%	200	270	ug/kg	DG	-
3-Nitrotoluene	0	144	0%	200	270	ug/kg	DG	-
4-Amino-2,6-Dinitrotoluene	1	144	1%	200	270	ug/kg	DG	-
4-Nitrotoluene	0	144	0%	200	270	ug/kg	DG	-
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	5	144	3%	200	270	ug/kg	46700	No
Methyl-2,4,6-Trinitrophenylnitramine	0	144	0%	200	270	ug/kg	DG	-
Nitrobenzene	0	144	0%	200	270	ug/kg	DG	-
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	1	144	1%	200	270	ug/kg	15600	No
General Chemistry								
Perchlorate	12	166	7%	20	44	ug/kg	DG	-
Metals								
Aluminum	143	143	100%			mg/kg	50	RS
Antimony	5	143	3%	0.095	25	mg/kg	78 [2]	No
Arsenic	99	143	69%	0.18	35	mg/kg	18 [2]	Yes
Barium	143	143	100%			mg/kg	330 [2]	RS
Beryllium	104	143	73%	0.019	24	mg/kg	40 [2]	No
Cadmium	87	143	61%	0.0067	0.24	mg/kg	32 [2]	No
Calcium	143	143	100%			mg/kg	DG	RS
Chromium	143	143	100%			mg/kg	0.4	RS
Cobalt	142	143	99%	59	59	mg/kg	13 [2]	Yes
Copper	128	143	90%	0.26	3.5	mg/kg	50	No
Iron	143	143	100%			mg/kg	200	RS
Lead	142	143	99%	1.2	1.2	mg/kg	110 [2]	No
Magnesium	143	143	100%			mg/kg	DG	RS
Manganese	142	143	99%	80.6	80.6	mg/kg	500	No
Nickel	141	143	99%	0.42	0.46	mg/kg	30	No
Potassium	143	143	100%			mg/kg	DG	RS
Selenium	12	143	8%	0.1	35	mg/kg	1	Yes
Silver	2	143	1%	0.12	2.5	mg/kg	2	Yes
Sodium	47	143	33%	11.9	470	mg/kg	DG	-
Thallium	2	143	1%	0.077	47	mg/kg	1	Yes
Vanadium	143	143	100%			mg/kg	2	RS
Zinc	143	143	100%			mg/kg	50	RS
Mercury	117	143	82%	0.0063	0.22	mg/kg	0.1	Yes
Dioxins								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	9	13	69%	0.0889	1.5	ng/kg	DG	-
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	9	13	69%	1.54	4.6	ng/kg	DG	-

Attachment H 6-3. Comparison of Maximum Reporting Limits to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Undetected	Maximum Undetected	Units	ORNL Soil Benchmark (1)	Is Max Reporting Limit>ORNL Soil Benchmark?
1,2,3,4,6,7,8-Heptachlorodibenzofuran	10	13	77%	0.138	0.5	ng/kg	DG	-
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	9	13	69%	0.396	0.8	ng/kg	DG	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran	7	13	54%	0.0477	0.8	ng/kg	DG	-
1,2,3,4,7,8-Hexachlorodibenzofuran	9	13	69%	0.0422	0.636	ng/kg	DG	-
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	7	13	54%	0.0415	0.6	ng/kg	DG	-
1,2,3,6,7,8-Hexachlorodibenzofuran	9	13	69%	0.2	0.529	ng/kg	DG	-
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8	13	62%	0.0438	0.6	ng/kg	DG	-
1,2,3,7,8,9-Hexachlorodibenzofuran	7	13	54%	0.0368	0.4	ng/kg	DG	-
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8	13	62%	0.0393	0.5	ng/kg	DG	-
1,2,3,7,8-Pentachlorodibenzofuran	9	13	69%	0.262	0.4	ng/kg	DG	-
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	7	13	54%	0.0337	0.6	ng/kg	DG	-
2,3,4,6,7,8-Hexachlorodibenzofuran	8	13	62%	0.0335	0.3	ng/kg	DG	-
2,3,4,7,8-Pentachlorodibenzofuran	7	13	54%	0.0367	0.4	ng/kg	DG	-
2,3,7,8-Tetrachlorodibenzofuran	9	13	69%	0.0464	0.3	ng/kg	DG	-
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	5	13	38%	0.0556	0.5	ng/kg	DG	-
Heptachlorodibenzofurans	9	13	69%	0.064917	0.6	ng/kg	DG	-
Heptachlorodibenzo-P-Dioxins	9	13	69%	0.64	0.946	ng/kg	DG	-
Hexachlorodibenzofurans	11	13	85%	0.262417	0.3	ng/kg	DG	-
Hexachlorodibenzo-P-Dioxins	9	13	69%	0.313179	0.5	ng/kg	DG	-
Pentachlorodibenzofurans	8	13	62%	0.077	0.3	ng/kg	DG	-
Pentachlorodibenzo-P-Dioxins	7	13	54%	0.299015	0.6	ng/kg	DG	-
Tetrachlorodibenzofurans	8	13	62%	0.046426	0.3	ng/kg	DG	-
Tetrachlorodibenzo-P-Dioxins	7	13	54%	0.2	0.5	ng/kg	DG	-
Total 2,3,7,8-TCDD - Bird	13	13	100%			ng/kg	DG	-
Total 2,3,7,8-TCDD - Human/Mammal	13	13	100%			ng/kg	DG	-

Notes:

(1) The lesser of the plant screening values (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b).

(2) Eco SSLs (EPA, 2005)

(3) Canadian Council of Ministers of the Environment, 1999

(4) Jensen and Sverdrup, 2003

DG--Screening criteria not available.

RS--Reporting limit sufficient, 100 percent detecton.

Attachment H 6-4. Comparison of Maximum Detections in Surface Soil to Ecological Screening Values for Lower Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detect	Maximum Detect	Units	95% UCL	ORNL Soil Benchmark [1]	Is Max Detection>ORNL Soil Benchmark?
VOCs									
2-Butanone	2	167	1%	6	9	ug/kg		DG	-
2-Hexanone	7	168	4%	24	50	ug/kg		DG	-
4-Methyl-2-Pentanone	1	168	1%	2	2	ug/kg		DG	-
Acetone	5	131	4%	12	8700	ug/kg		DG	-
Benzene	3	168	2%	36	610	ug/kg		500 [3]	Yes
Chloroform	11	168	7%	0.5	2.2	ug/kg	407.414	DG	-
Ethylbenzene	3	168	2%	530	14000	ug/kg		1200 [3]	Yes
Tetrachloroethene	1	168	1%	2	2	ug/kg		DG	-
Toluene	24	168	14%	0.3	41000	ug/kg	1830.281	800 [3]	Yes
Total Xylenes	3	168	2%	5400	98000	ug/kg		1000 [3]	Yes
SVOCs									
2-Methylnaphthalene	3	143	2%	18000	270000	ug/kg		DG	-
Bis(2-Ethylhexyl)Phthalate	6	143	4%	73	420	ug/kg		DG	-
Diethyl Phthalate	4	143	3%	72	250	ug/kg		100000	No
Di-N-Butyl Phthalate	12	143	8%	69	307000	ug/kg	22134.857	200000	Yes
Fluoranthene	1	143	1%	38	38	ug/kg		37000 [4]	No
Hexachlorobenzene	1	143	1%	220	220	ug/kg		DG	-
Naphthalene	3	143	2%	9900	128000	ug/kg		20000 [4]	Yes
N-Nitrosodiphenylamine	6	143	4%	1300	66700	ug/kg		20000	Yes
Phenol	15	143	10%	83	1200	ug/kg	7486.104	30000	No
Explosives									
1,3-Dinitrobenzene	1	144	1%	630	630	ug/kg		DG	-
2,4,6-Trinitrotoluene	2	144	1%	278	7860	ug/kg		30,000	No
2,4-Dinitrotoluene	6	147	4%	120	7000	ug/kg		DG	-
2,6-Dinitrotoluene	1	145	1%	44	44	ug/kg		DG	-
2-Amino-4,6-Dinitrotoluene	1	144	1%	310	310	ug/kg		80000	No
4-Amino-2,6-Dinitrotoluene	1	144	1%	228	228	ug/kg		DG	-
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine	5	144	3%	650	14000	ug/kg		46700	No
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine	1	144	1%	1400	1400	ug/kg		15600	No
General Chemistry									
Perchlorate	12	166	7%	29	1600	ug/kg	87.632	DG	-
Metals									
Aluminum	143	143	100%	904	190000	mg/kg	13751.680	50	Yes
Antimony	5	143	3%	1	103	mg/kg		78 [2]	Yes
Arsenic	99	143	69%	0.15	12.4	mg/kg	2.851	18 [2]	No

Attachment H 6-4. Comparison of Maximum Detections in Surface Soil to Ecological Screening Values for Lower Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detect	Maximum Detect	Units	95% UCL	ORNL Soil Benchmark [1]	Is Max Detection>ORNL Soil Benchmark?
Barium	143	143	100%	21.3	537	mg/kg	77.271	330 [2]	Yes
Beryllium	104	143	73%	0.047	1.1	mg/kg	1.302	40 [2]	No
Cadmium	87	143	61%	0.0073	156	mg/kg	9.158	32 [2]	Yes
Calcium	143	143	100%	677	71000	mg/kg	8910.836	DG	-
Chromium	143	143	100%	0.77	171	mg/kg	6.493	0.4	Yes
Cobalt	142	143	99%	0.23	6.6	mg/kg	4.154	13 [2]	No
Copper	128	143	90%	0.38	16700	mg/kg	862.020	50	Yes
Iron	143	143	100%	697	19900	mg/kg	5963.630	200	Yes
Lead	142	143	99%	0.28	1580	mg/kg	93.307	110 [2]	Yes
Magnesium	143	143	100%	239	8340	mg/kg	2772.155	DG	-
Manganese	142	143	99%	13.5	711	mg/kg	104.788	500	Yes
Nickel	141	143	99%	0.4	112	mg/kg	12.507	30	Yes
Potassium	143	143	100%	111	7940	mg/kg	1235.180	DG	-
Selenium	12	143	8%	0.16	4.7	mg/kg	2.119	1	Yes
Silver	2	143	1%	1.9	5.8	mg/kg		2	Yes
Sodium	47	143	33%	7.2	8760	mg/kg	671.576	DG	-
Thallium	2	143	1%	0.2	15.2	mg/kg		1	Yes
Vanadium	143	143	100%	1.8	60.9	mg/kg	14.723	2	Yes
Zinc	143	143	100%	1.9	29100	mg/kg	1555.100	50	Yes
Mercury	117	143	82%	0.0062	7.1	mg/kg	0.507	0.1	Yes
Dioxins									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	9	13	69%	0.905	45.9	ng/kg		DG	-
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	9	13	69%	16.31	1740	ng/kg		DG	-
1,2,3,4,6,7,8-Heptachlorodibenzofuran	10	13	77%	0.101	29.1	ng/kg		DG	-
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	9	13	69%	2.3	244	ng/kg		DG	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran	7	13	54%	0.0568	2.39	ng/kg		DG	-
1,2,3,4,7,8-Hexachlorodibenzofuran	9	13	69%	0.0472	9.91	ng/kg		DG	-
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	7	13	54%	0.0597	7.76	ng/kg		DG	-
1,2,3,6,7,8-Hexachlorodibenzofuran	9	13	69%	0.044	8.22	ng/kg		DG	-
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8	13	62%	0.143	40.5	ng/kg		DG	-
1,2,3,7,8,9-Hexachlorodibenzofuran	7	13	54%	0.06	2.88	ng/kg		DG	-
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8	13	62%	0.0711	26.6	ng/kg		DG	-
1,2,3,7,8-Pentachlorodibenzofuran	9	13	69%	0.0346	7.7	ng/kg		DG	-
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	7	13	54%	0.0506	6.4	ng/kg		DG	-
2,3,4,6,7,8-Hexachlorodibenzofuran	8	13	62%	0.0546	13.5	ng/kg		DG	-
2,3,4,7,8-Pentachlorodibenzofuran	7	13	54%	0.0482	13.7	ng/kg		DG	-

Attachment H 6-4. Comparison of Maximum Detections in Surface Soil to Ecological Screening Values for Lower Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detect	Maximum Detect	Units	95% UCL	ORNL Soil Benchmark (1)	Is Max Detection>ORNL Soil Benchmark?
2,3,7,8-Tetrachlorodibenzofuran	9	13	69%	0.0581	11.5	ng/kg		DG	-
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	5	13	38%	0.0727	2.51	ng/kg		DG	-
Heptachlorodibenzofurans	9	13	69%	1.168	47.3	ng/kg		DG	-
Heptachlorodibenzo-P-Dioxins	9	13	69%	2.3	448	ng/kg		DG	-
Hexachlorodibenzofurans	11	13	85%	0.044	97.5	ng/kg	39.949	DG	-
Hexachlorodibenzo-P-Dioxins	9	13	69%	0.363	313	ng/kg		DG	-
Pentachlorodibenzofurans	8	13	62%	0.107	148	ng/kg		DG	-
Pentachlorodibenzo-P-Dioxins	7	13	54%	0.309636	55	ng/kg		DG	-
Tetrachlorodibenzofurans	8	13	62%	0.058096	249	ng/kg		DG	-
Tetrachlorodibenzo-P-Dioxins	7	13	54%	0.167701	43.4	ng/kg		DG	-
Total 2,3,7,8-TCDD - Bird	13	13	100%	0.1	39.3	ng/kg	12.834	DG	-
Total 2,3,7,8-TCDD - Human/Mammal	13	13	100%	0.1	23.7	ng/kg	6.731	DG	-

Notes:

(1) The lesser of plant screening value (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b).

(2) Eco SSLs (EPA, 2005).

(3) Canadian Council of Ministers of the Environment, 1999

(4) Jensen and Sverdrup, 2003

DG--Screening criteria not available.

Attachment H-7
Calculation of Tier 1, Step 2 HQ Values for Wildlife

Attachment H 7-1. Ornate Shrew Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	5.88E-03	0.00E+00	1.48E+00	1.49E+00	2.91E+01	5E-02	1
Ethylbenzene	1.40E+01	1.35E-01	0.00E+00	4.17E+01	4.19E+01	1.24E+02	3E-01	1
Toluene	4.10E+01	3.95E-01	0.00E+00	1.12E+02	1.12E+02	2.87E+01	4E+00	1
Xylenes, Total	9.80E+01	9.44E-01	0.00E+00	3.07E+02	3.08E+02	2.32E+00	1E+02	1
2,3,7,8-TCDD TEQ - Mammal	2.36E-05	2.28E-07	0.00E+00	3.74E-05	3.76E-05	1.28E-06	3E+01	1
1,3-Dinitrobenzene	6.30E-01	6.07E-03	0.00E+00	1.50E-01	1.56E-01	1.02E-02	2E+01	1
2,4,6-Trinitrotoluene	7.86E+00	7.57E-02	0.00E+00	4.54E-01	5.30E-01	4.63E-01	1E+00	1
2,4-Dinitrotoluene	7.00E+00	6.75E-02	0.00E+00	2.16E+00	2.23E+00	4.99E+00	4E-01	1
2,6-Dinitrotoluene	4.40E-02	4.24E-04	0.00E+00	1.00E-02	1.05E-02	4.99E+00	2E-03	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.99E-03	0.00E+00	2.47E-01	2.50E-01	9.93E+00	3E-02	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	2.20E-04	0.00E+00	1.82E-02	1.84E-02	9.93E+00	2E-03	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.35E-01	0.00E+00	5.40E-01	6.75E-01	3.49E+00	2E-01	1
HMX	1.40E+00	1.35E-02	0.00E+00	8.99E-03	2.25E-02	3.31E+00	7E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Tetrachloroethene	2.00E-03	1.93E-05	0.00E+00	5.45E-03	5.47E-03	5.52E-01	1E-02	1
Aluminum	1.90E+05	1.83E+03	0.00E+00	2.08E+04	2.26E+04	2.13E+00	1E+04	1
Antimony	1.03E+02	9.93E-01	0.00E+00	3.31E+01	3.41E+01	5.90E-02	6E+02	1
Arsenic	1.24E+01	1.19E-01	0.00E+00	4.59E-01	5.78E-01	1.04E+00	6E-01	1
Barium	5.37E+02	5.17E+00	0.00E+00	1.57E+01	2.09E+01	5.18E+01	4E-01	1
Beryllium	1.10E+00	1.06E-02	0.00E+00	1.59E-02	2.65E-02	5.32E-01	5E-02	1
Cadmium	1.56E+02	1.50E+00	0.00E+00	1.47E+02	1.49E+02	7.70E-01	2E+02	1
Chromium	1.71E+02	1.65E+00	0.00E+00	1.68E+01	1.85E+01	2.40E+00	8E+00	1
Cobalt	6.60E+00	6.36E-02	0.00E+00	2.59E-01	3.22E-01	7.33E+00	4E-02	1
Copper	1.67E+04	1.61E+02	0.00E+00	2.76E+03	2.92E+03	2.95E+00	1E+03	1
Lead	1.58E+03	1.52E+01	0.00E+00	9.85E+01	1.14E+02	4.70E+00	2E+01	1
Manganese	7.11E+02	6.85E+00	0.00E+00	1.26E+01	1.95E+01	1.51E+01	1E+00	1
Mercury	7.10E+00	6.84E-02	0.00E+00	2.19E+00	2.26E+00	3.20E-01	7E+00	1
Nickel	1.12E+02	1.08E+00	0.00E+00	3.81E+01	3.92E+01	1.67E-01	2E+02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	1.60E+00	1.54E-02	0.00E+00	5.14E-01	5.29E-01	6.40E-01	8E-01	1
Selenium	4.70E+00	4.53E-02	0.00E+00	9.27E-01	9.72E-01	5.46E-02	2E+01	1
Silver	5.80E+00	5.59E-02	0.00E+00	3.81E+00	3.87E+00	1.14E+01	3E-01	1
Thallium	1.52E+01	1.46E-01	0.00E+00	2.20E+00	2.34E+00	5.55E-01	4E+00	1
Vanadium	6.09E+01	5.87E-01	0.00E+00	8.22E-01	1.41E+00	4.16E+00	3E-01	1
Zinc	2.91E+04	2.80E+02	0.00E+00	8.00E+02	1.08E+03	1.05E+01	1E+02	1
2-Methylnaphthalene	2.70E+02	2.60E+00	0.00E+00	3.14E+02	3.17E+02	6.30E+01	5E+00	1
Fluoranthene	3.80E-02	3.66E-04	0.00E+00	2.03E-02	2.06E-02	6.30E+01	3E-04	1
Naphthalene	1.28E+02	1.23E+00	0.00E+00	1.81E+02	1.82E+02	6.30E+01	3E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	4.05E-03	0.00E+00	2.17E+01	2.17E+01	2.56E+01	8E-01	1
Diethylphthalate	2.50E-01	2.41E-03	0.00E+00	1.09E+00	1.09E+00	5.06E+03	2E-04	1
Di-n-butylphthalate	3.07E+02	2.96E+00	0.00E+00	1.86E+02	1.89E+02	6.07E+02	3E-01	1
Hexachlorobenzene	2.20E-01	2.12E-03	0.00E+00	1.07E+00	1.07E+00	2.56E+00	4E-01	1
N-Nitrosodiphenylamine	6.67E+01	6.43E-01	0.00E+00	5.83E+01	5.89E+01	2.56E+01	2E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Phenol	1.20E+00	1.16E-02	0.00E+00	2.09E+00	2.10E+00	9.22E+02	2E-03	1
2-Butanone	9.00E-03	8.67E-05	0.00E+00	1.16E+01	1.16E+01	2.21E+02	5E-02	1
2-Hexanone	5.00E-02	4.82E-04	0.00E+00	9.22E-02	9.27E-02	5.11E+02	2E-04	1
4-Methyl-2-Pentanone	2.00E-03	1.93E-05	0.00E+00	3.80E-03	3.82E-03	6.39E+01	6E-05	1
Acetone	8.70E+00	8.38E-02	0.00E+00	1.08E+01	1.09E+01	1.28E+01	9E-01	1
Chloroform	2.15E-03	2.07E-05	0.00E+00	5.06E-03	5.08E-03	1.92E+01	3E-04	1

Note: Blank space indicates insufficient data available to estimate exposure and HQ values.

Attachment H 7-2. Deer Mouse Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	3.73E-03	3.73E+00	0.00E+00	3.74E+00	2.70E+01	1E-01	1
Ethylbenzene	1.40E+01	8.57E-02	2.70E-01	0.00E+00	3.56E-01	1.15E+02	3E-03	1
Toluene	4.10E+01	2.51E-01	1.24E+02	0.00E+00	1.24E+02	2.67E+01	5E+00	1
Xylenes, Total	9.80E+01	6.00E-01	1.77E+02	0.00E+00	1.77E+02	2.15E+00	8E+01	1
2,3,7,8-TCDD TEQ - Mammal	2.36E-05	1.45E-07	6.97E-07	0.00E+00	8.41E-07	1.19E-06	7E-01	1
1,3-Dinitrobenzene	6.30E-01	3.86E-03	6.40E-01	0.00E+00	6.44E-01	9.51E-03	7E+01	1
2,4,6-Trinitrotoluene	7.86E+00	4.81E-02	6.36E+00	0.00E+00	6.41E+00	4.30E-01	1E+01	1
2,4-Dinitrotoluene	7.00E+00	4.28E-02	4.91E+01	0.00E+00	4.92E+01	4.64E+00	1E+01	1
2,6-Dinitrotoluene	4.40E-02	2.69E-04	3.63E-01	0.00E+00	3.63E-01	4.64E+00	8E-02	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	1.90E-03	2.64E+00	0.00E+00	2.65E+00	9.23E+00	3E-01	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	1.40E-04	1.82E-01	0.00E+00	1.82E-01	9.23E+00	2E-02	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	8.57E-02	1.15E+00	0.00E+00	1.24E+00	3.25E+00	4E-01	1
HMX	1.40E+00	8.57E-03	3.83E+01	0.00E+00	3.83E+01	3.08E+00	1E+01	1
Tetrachloroethene	2.00E-03	1.22E-05	6.62E-03	0.00E+00	6.63E-03	5.13E-01	1E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	1.90E+05	1.16E+03	6.54E+00	0.00E+00	1.17E+03	1.98E+00	6E+02	1
Antimony	1.03E+02	6.30E-01	5.83E-01	0.00E+00	1.21E+00	5.90E-02	2E+01	1
Arsenic	1.24E+01	7.59E-02	8.89E-02	0.00E+00	1.65E-01	1.04E+00	2E-01	1
Barium	5.37E+02	3.29E+00	1.60E+01	0.00E+00	1.93E+01	5.18E+01	4E-01	1
Beryllium	1.10E+00	6.73E-03	3.51E-01	0.00E+00	3.57E-01	5.32E-01	7E-01	1
Cadmium	1.56E+02	9.55E-01	1.87E+00	0.00E+00	2.83E+00	7.70E-01	4E+00	1
Chromium	1.71E+02	1.05E+00	1.34E+00	0.00E+00	2.39E+00	2.40E+00	1E+00	1
Cobalt	6.60E+00	4.04E-02	9.47E-03	0.00E+00	4.99E-02	7.33E+00	7E-03	1
Copper	1.67E+04	1.02E+02	1.72E+01	0.00E+00	1.19E+02	2.74E+00	4E+01	1
Lead	1.58E+03	9.67E+00	3.16E+00	0.00E+00	1.28E+01	4.70E+00	3E+00	1
Manganese	7.11E+02	4.35E+00	1.07E+01	0.00E+00	1.51E+01	1.41E+01	1E+00	1
Mercury	7.10E+00	4.35E-02	2.05E-01	0.00E+00	2.49E-01	2.97E-01	8E-01	1
Nickel	1.12E+02	6.86E-01	7.06E-01	0.00E+00	1.39E+00	1.55E-01	9E+00	1
Perchlorate	1.60E+00	9.79E-03	8.63E+01	0.00E+00	8.63E+01	6.40E-01	1E+02	1
Selenium	4.70E+00	2.88E-02	5.37E-01	0.00E+00	5.65E-01	5.07E-02	1E+01	1
Silver	5.80E+00	3.55E-02	1.55E-02	0.00E+00	5.10E-02	1.06E+01	5E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Thallium	1.52E+01	9.30E-02	7.27E-01	0.00E+00	8.20E-01	5.16E-01	2E+00	1
Vanadium	6.09E+01	3.73E-01	5.65E-02	0.00E+00	4.29E-01	4.16E+00	1E-01	1
Zinc	2.91E+04	1.78E+02	2.75E+02	0.00E+00	4.53E+02	9.76E+00	5E+01	1
2-Methylnaphthalene	2.70E+02	1.65E+00	3.44E+01	0.00E+00	3.61E+01	5.86E+01	6E-01	1
Fluoranthene	3.80E-02	2.33E-04	3.63E-03	0.00E+00	3.87E-03	5.86E+01	7E-05	1
Naphthalene	1.28E+02	7.84E-01	2.99E+02	0.00E+00	2.99E+02	5.86E+01	5E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	2.57E-03	6.97E-03	0.00E+00	9.54E-03	2.38E+01	4E-04	1
Diethylphthalate	2.50E-01	1.53E-03	1.00E+00	0.00E+00	1.01E+00	4.70E+03	2E-04	1
Di-n-butylphthalate	3.07E+02	1.88E+00	2.01E+01	0.00E+00	2.20E+01	5.64E+02	4E-02	1
Hexachlorobenzene	2.20E-01	1.35E-03	4.63E-03	0.00E+00	5.98E-03	2.38E+00	3E-03	1
N-Nitrosodiphenylamine	6.67E+01	4.08E-01	1.26E+02	0.00E+00	1.26E+02	2.38E+01	5E+00	1
Phenol	1.20E+00	7.35E-03	1.54E+01	0.00E+00	1.55E+01	8.57E+02	2E-02	1
2-Butanone	9.00E-03	5.51E-05	4.51E-01	0.00E+00	4.51E-01	2.06E+02	2E-03	1
2-Hexanone	5.00E-02	3.06E-04	7.22E-01	0.00E+00	7.22E-01	4.76E+02	2E-03	1
4-Methyl-2-Pentanone	2.00E-03	1.22E-05	2.59E-03	0.00E+00	2.60E-03	2.97E+02	9E-06	1
Acetone	8.70E+00	5.33E-02	4.21E+01	0.00E+00	4.22E+01	1.19E+01	4E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Chloroform	2.15E-03	1.32E-05	1.51E-01	0.00E+00	1.51E-01	1.78E+01	8E-03	1

Note: Blank space indicates insufficient data available to estimate exposure and HQ values.

Attachment H 7-3. Long-tailed Weasel Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	8.19E-03	0.00E+00	0.00E+00	2.22E-06	1.98E-07	8.19E-03	2.31E+01	4E-04	1
Ethylbenzene	1.40E+01	1.88E-01	0.00E+00	0.00E+00	7.26E-07	1.92E-05	1.88E-01	9.86E+01	2E-03	1
Toluene	4.10E+01	5.50E-01	0.00E+00	0.00E+00	1.57E-04	3.18E-05	5.51E-01	2.28E+01	2E-02	1
Xylenes, Total	9.80E+01	1.32E+00	0.00E+00	0.00E+00	3.88E-04	1.51E-04	1.32E+00	1.84E+00	7E-01	1
2,3,7,8-TCDD TEQ - Mammal	2.36E-05	3.17E-07	0.00E+00	0.00E+00	1.49E-10	1.50E-09	3.19E-07	1.02E-06	3E-01	1
1,3-Dinitrobenzene	6.30E-01	8.46E-03	0.00E+00	0.00E+00	1.82E-07	9.88E-09	8.46E-03	8.13E-03	1E+00	1
2,4,6-Trinitrotoluene	7.86E+00	1.06E-01	0.00E+00	0.00E+00	1.99E-06	3.70E-08	1.06E-01	3.68E-01	3E-01	1
2,4-Dinitrotoluene	7.00E+00	9.40E-02	0.00E+00	0.00E+00	2.52E-05	2.56E-07	9.40E-02	3.97E+00	2E-02	1
2,6-Dinitrotoluene	4.40E-02	5.91E-04	0.00E+00	0.00E+00	1.57E-07	1.01E-09	5.91E-04	3.97E+00	1E-04	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	4.16E-03	0.00E+00	0.00E+00	1.10E-06	2.34E-08	4.16E-03	7.90E+00	5E-04	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	3.06E-04	0.00E+00	0.00E+00	8.15E-08	1.85E-09	3.06E-04	7.90E+00	4E-05	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.88E-01	0.00E+00	0.00E+00	1.57E-07	1.93E-08	1.88E-01	2.78E+00	7E-02	1
HMX	1.40E+00	1.88E-02	0.00E+00	0.00E+00	4.60E-06	6.07E-10	1.88E-02	2.63E+00	7E-03	1
Tetrachloroethene	2.00E-03	2.68E-05	0.00E+00	0.00E+00	7.61E-09	1.41E-09	2.69E-05	4.39E-01	6E-05	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	1.90E+05	2.55E+03	0.00E+00	0.00E+00	1.56E-02	6.77E-02	2.55E+03	1.69E+00	2E+03	1
Antimony	1.03E+02	1.38E+00	0.00E+00	0.00E+00	3.24E-05	2.04E-04	1.38E+00	5.90E-02	2E+01	1
Arsenic	1.24E+01	1.66E-01	0.00E+00	0.00E+00	2.20E-06	1.73E-06	1.66E-01	1.04E+00	2E-01	1
Barium	5.37E+02	7.21E+00	0.00E+00	0.00E+00	8.60E-05	2.09E-05	7.21E+00	5.18E+01	1E-01	1
Beryllium	1.10E+00	1.48E-02	0.00E+00	0.00E+00	2.55E-06	4.24E-08	1.48E-02	5.32E-01	3E-02	1
Cadmium	1.56E+02	2.09E+00	0.00E+00	0.00E+00	4.03E-04	4.76E-03	2.10E+00	7.70E-01	3E+00	1
Chromium	1.71E+02	2.30E+00	0.00E+00	0.00E+00	5.10E-05	8.86E-05	2.30E+00	2.40E+00	1E+00	1
Cobalt	6.60E+00	8.86E-02	0.00E+00	0.00E+00	4.44E-07	6.44E-07	8.86E-02	7.33E+00	1E-02	1
Copper	1.67E+04	2.24E+02	0.00E+00	0.00E+00	1.06E-02	5.85E-02	2.24E+02	2.34E+00	1E+02	1
Lead	1.58E+03	2.12E+01	0.00E+00	0.00E+00	3.31E-05	6.60E-05	2.12E+01	4.70E+00	5E+00	1
Manganese	7.11E+02	9.54E+00	0.00E+00	0.00E+00	6.72E-04	1.95E-04	9.54E+00	1.20E+01	8E-01	1
Mercury	7.10E+00	9.53E-02	0.00E+00	0.00E+00	2.21E-04	4.52E-04	9.60E-02	2.54E-01	4E-01	1
Nickel	1.12E+02	1.50E+00	0.00E+00	0.00E+00	1.24E-05	7.83E-05	1.50E+00	1.33E-01	1E+01	1
Perchlorate	1.60E+00	2.15E-02	0.00E+00	0.00E+00	7.68E-01	1.06E-03	7.91E-01	6.40E-01	1E+00	1
Selenium	4.70E+00	6.31E-02	0.00E+00	0.00E+00	5.03E-03	1.94E-03	7.01E-02	4.34E-02	2E+00	1
Silver	5.80E+00	7.79E-02	0.00E+00	0.00E+00	7.72E-06	1.31E-04	7.80E-02	9.05E+00	9E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Thallium	1.52E+01	2.04E-01	0.00E+00	0.00E+00	2.92E-04	1.87E-04	2.05E-01	4.41E-01	5E-01	1
Vanadium	6.09E+01	8.17E-01	0.00E+00	0.00E+00	8.79E-06	6.48E-06	8.17E-01	4.16E+00	2E-01	1
Zinc	2.91E+04	3.91E+02	0.00E+00	0.00E+00	2.01E-01	1.08E-01	3.91E+02	8.35E+00	5E+01	1
2-Methylnaphthalene	2.70E+02	3.62E+00	0.00E+00	0.00E+00	1.77E-04	3.48E-04	3.62E+00	5.01E+01	7E-02	1
Fluoranthene	3.80E-02	5.10E-04	0.00E+00	0.00E+00	8.81E-08	1.06E-07	5.10E-04	5.01E+01	1E-05	1
Naphthalene	1.28E+02	1.72E+00	0.00E+00	0.00E+00	7.97E-04	1.09E-04	1.72E+00	5.01E+01	3E-02	1
Bis (2-ethylhexyl) phthalate	4.20E-01	5.64E-03	0.00E+00	0.00E+00	3.11E-06	1.59E-03	7.23E-03	2.03E+01	4E-04	1
Diethylphthalate	2.50E-01	3.36E-03	0.00E+00	0.00E+00	9.40E-07	2.30E-07	3.36E-03	4.02E+03	8E-07	1
Di-n-butylphthalate	3.07E+02	4.12E+00	0.00E+00	0.00E+00	2.69E-04	5.19E-04	4.12E+00	4.83E+02	9E-03	1
Hexachlorobenzene	2.20E-01	2.95E-03	0.00E+00	0.00E+00	3.48E-07	1.40E-05	2.97E-03	2.03E+00	1E-03	1
N-Nitrosodiphenylamine	6.67E+01	8.95E-01	0.00E+00	0.00E+00	2.63E-04	2.76E-05	8.96E-01	2.03E+01	4E-02	1
Phenol	1.20E+00	1.61E-02	0.00E+00	0.00E+00	4.14E-06	1.26E-07	1.61E-02	7.33E+02	2E-05	1
2-Butanone	9.00E-03	1.21E-04	0.00E+00	0.00E+00	2.83E-08	1.64E-07	1.21E-04	1.76E+02	7E-07	1
2-Hexanone	5.00E-02	6.71E-04	0.00E+00	0.00E+00	1.72E-07	4.95E-09	6.71E-04	4.07E+02	2E-06	1
4-Methyl-2-Pentanone	2.00E-03	2.68E-05	0.00E+00	0.00E+00	5.68E-10	1.87E-10	2.68E-05	2.54E+02	1E-07	1
Acetone	8.70E+00	1.17E-01	0.00E+00	0.00E+00	1.39E-06	8.04E-08	1.17E-01	1.02E+01	1E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Chloroform	2.15E-03	2.89E-05	0.00E+00	0.00E+00	7.34E-08	5.56E-10	2.89E-05	1.53E+01	2E-06	1

Note: Blank space indicates insufficient data available to estimate exposure and HQ values.

Attachment H 7-4. Mourning Dove Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	1.36E-02	3.13E+00	0.00E+00	3.14E+00	1.95E+01	2E-01	1
Ethylbenzene	1.40E+01	3.12E-01	2.26E-01	0.00E+00	5.38E-01	9.70E+00	6E-02	1
Toluene	4.10E+01	9.13E-01	1.04E+02	0.00E+00	1.05E+02	2.50E+02	4E-01	1
Xylenes, Total	9.80E+01	2.18E+00	1.48E+02	0.00E+00	1.50E+02	2.06E-01	7E+02	1
2,3,7,8-TCDD TEQ - Bird	3.93E-05	8.74E-07	9.68E-07	0.00E+00	1.84E-06	1.43E-05	1E-01	1
1,3-Dinitrobenzene	6.30E-01	1.40E-02	5.36E-01	0.00E+00	5.50E-01	8.40E-02	7E+00	1
2,4,6-Trinitrotoluene	7.86E+00	1.75E-01	5.32E+00	0.00E+00	5.50E+00	7.00E-01	8E+00	1
2,4-Dinitrotoluene	7.00E+00	1.56E-01	4.11E+01	0.00E+00	4.13E+01	3.90E-01	1E+02	1
2,6-Dinitrotoluene	4.40E-02	9.79E-04	3.04E-01	0.00E+00	3.05E-01	3.90E-01	8E-01	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	6.90E-03	2.21E+00	0.00E+00	2.22E+00	7.00E-01	3E+00	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	5.07E-04	1.52E-01	0.00E+00	1.53E-01	7.00E-01	2E-01	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	3.12E-01	9.64E-01	0.00E+00	1.28E+00	8.14E-01	2E+00	1
HMX	1.40E+00	3.12E-02	3.21E+01	0.00E+00	3.21E+01	3.00E+00	1E+01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Tetrachloroethene	2.00E-03	4.45E-05	5.54E-03	0.00E+00	5.58E-03	5.00E-02	1E-01	1
Aluminum	1.90E+05	4.23E+03	5.48E+00	0.00E+00	4.23E+03	1.10E+02	4E+01	1
Antimony	1.03E+02	2.29E+00	4.88E-01	0.00E+00	2.78E+00	5.90E-03	5E+02	1
Arsenic	1.24E+01	2.76E-01	7.45E-02	0.00E+00	3.50E-01	2.24E+00	2E-01	1
Barium	5.37E+02	1.20E+01	1.34E+01	0.00E+00	2.54E+01	2.08E+01	1E+00	1
Beryllium	1.10E+00	2.45E-02	2.94E-01	0.00E+00	3.18E-01	5.32E-02	6E+00	1
Cadmium	1.56E+02	3.47E+00	1.57E+00	0.00E+00	5.04E+00	1.47E+00	3E+00	1
Chromium	1.71E+02	3.81E+00	1.12E+00	0.00E+00	4.93E+00	2.66E+00	2E+00	1
Cobalt	6.60E+00	1.47E-01	7.93E-03	0.00E+00	1.55E-01	7.61E+00	2E-02	1
Copper	1.67E+04	3.72E+02	1.44E+01	0.00E+00	3.86E+02	2.30E+00	2E+02	1
Lead	1.58E+03	3.52E+01	2.64E+00	0.00E+00	3.78E+01	1.63E+00	2E+01	1
Manganese	7.11E+02	1.58E+01	8.99E+00	0.00E+00	2.48E+01	7.76E+01	3E-01	1
Mercury	7.10E+00	1.58E-01	1.72E-01	0.00E+00	3.30E-01	3.90E-02	8E+00	1
Nickel	1.12E+02	2.49E+00	5.91E-01	0.00E+00	3.08E+00	1.38E+00	2E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	1.60E+00	3.56E-02	7.22E+01	0.00E+00	7.23E+01	1.30E+00	6E+01	1
Selenium	4.70E+00	1.05E-01	4.49E-01	0.00E+00	5.54E-01	2.30E-01	2E+00	1
Silver	5.80E+00	1.29E-01	1.30E-02	0.00E+00	1.42E-01	8.90E-01	2E-01	1
Thallium	1.52E+01	3.38E-01	6.08E-01	0.00E+00	9.47E-01	2.56E-01	4E+00	1
Vanadium	6.09E+01	1.36E+00	4.73E-02	0.00E+00	1.40E+00	3.44E-01	4E+00	1
Zinc	2.91E+04	6.48E+02	2.30E+02	0.00E+00	8.78E+02	1.72E+01	5E+01	1
2-Methylnaphthalene	2.70E+02	6.01E+00	2.88E+01	0.00E+00	3.48E+01	2.25E+01	2E+00	1
Fluoranthene	3.80E-02	8.46E-04	3.04E-03	0.00E+00	3.89E-03	2.25E+01	2E-04	1
Naphthalene	1.28E+02	2.85E+00	2.50E+02	0.00E+00	2.53E+02	2.25E+01	1E+01	1
Bis (2-ethylhexyl) phthalate	4.20E-01	9.35E-03	5.84E-03	0.00E+00	1.52E-02	1.10E+00	1E-02	1
Diethylphthalate	2.50E-01	5.56E-03	8.41E-01	0.00E+00	8.46E-01	1.10E+00	8E-01	1
Di-n-butylphthalate	3.07E+02	6.83E+00	1.69E+01	0.00E+00	2.37E+01	1.10E-01	2E+02	1
Hexachlorobenzene	2.20E-01	4.90E-03	3.87E-03	0.00E+00	8.77E-03	4.32E-01	2E-02	1
N-Nitrosodiphenylamine	6.67E+01	1.48E+00	1.05E+02	0.00E+00	1.07E+02	2.00E+01	5E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Phenol	1.20E+00	2.67E-02	1.29E+01	0.00E+00	1.30E+01	7.21E+01	2E-01	1
2-Butanone	9.00E-03	2.00E-04	3.78E-01	0.00E+00	3.78E-01	1.73E+01	2E-02	1
2-Hexanone	5.00E-02	1.11E-03	6.04E-01	0.00E+00	6.06E-01	4.00E+01	2E-02	1
4-Methyl-2-Pentanone	2.00E-03	4.45E-05	2.17E-03	0.00E+00	2.21E-03	2.50E+01	9E-05	1
Acetone	8.70E+00	1.94E-01	3.52E+01	0.00E+00	3.54E+01	1.00E+01	4E+00	1
Chloroform	2.15E-03	4.79E-05	1.26E-01	0.00E+00	1.26E-01	2.00E+01	6E-03	1

Note: Blank space indicates insufficient data available to estimate exposure and HQ values.

Attachment H 7-5. Western Meadowlark Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	2.16E-02	0.00E+00	9.95E-01	1.02E+00	1.95E+01	5E-02	1
Ethylbenzene	1.40E+01	4.96E-01	0.00E+00	2.81E+01	2.86E+01	9.70E+00	3E+00	1
Toluene	4.10E+01	1.45E+00	0.00E+00	7.51E+01	7.65E+01	2.50E+02	3E-01	1
Xylenes, Total	9.80E+01	3.47E+00	0.00E+00	2.06E+02	2.10E+02	2.06E-01	1E+03	1
2,3,7,8-TCDD TEQ - Bird	3.93E-05	1.39E-06	0.00E+00	4.58E-05	4.72E-05	1.43E-05	3E+00	1
1,3-Dinitrobenzene	6.30E-01	2.23E-02	0.00E+00	1.01E-01	1.23E-01	8.40E-02	1E+00	1
2,4,6-Trinitrotoluene	7.86E+00	2.78E-01	0.00E+00	3.06E-01	5.84E-01	7.00E-01	8E-01	1
2,4-Dinitrotoluene	7.00E+00	2.48E-01	0.00E+00	1.45E+00	1.70E+00	3.90E-01	4E+00	1
2,6-Dinitrotoluene	4.40E-02	1.56E-03	0.00E+00	6.75E-03	8.31E-03	3.90E-01	2E-02	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	1.10E-02	0.00E+00	1.66E-01	1.77E-01	7.00E-01	3E-01	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	8.08E-04	0.00E+00	1.22E-02	1.30E-02	7.00E-01	2E-02	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	4.96E-01	0.00E+00	3.63E-01	8.59E-01	8.14E-01	1E+00	1
HMX	1.40E+00	4.96E-02	0.00E+00	6.05E-03	5.56E-02	3.00E+00	2E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Tetrachloroethene	2.00E-03	7.08E-05	0.00E+00	3.66E-03	3.73E-03	5.00E-02	7E-02	1
Aluminum	1.90E+05	6.73E+03	0.00E+00	1.40E+04	2.07E+04	1.10E+02	2E+02	1
Antimony	1.03E+02	3.65E+00	0.00E+00	2.22E+01	2.59E+01	5.90E-03	4E+03	1
Arsenic	1.24E+01	4.39E-01	0.00E+00	3.08E-01	7.48E-01	2.24E+00	3E-01	1
Barium	5.37E+02	1.90E+01	0.00E+00	1.06E+01	2.96E+01	2.08E+01	1E+00	1
Beryllium	1.10E+00	3.90E-02	0.00E+00	1.07E-02	4.97E-02	5.32E-02	9E-01	1
Cadmium	1.56E+02	5.53E+00	0.00E+00	9.91E+01	1.05E+02	1.47E+00	7E+01	1
Chromium	1.71E+02	6.06E+00	0.00E+00	1.13E+01	1.74E+01	2.66E+00	7E+00	1
Cobalt	6.60E+00	2.34E-01	0.00E+00	1.74E-01	4.08E-01	7.61E+00	5E-02	1
Copper	1.67E+04	5.91E+02	0.00E+00	1.86E+03	2.45E+03	2.30E+00	1E+03	1
Lead	1.58E+03	5.60E+01	0.00E+00	6.62E+01	1.22E+02	1.63E+00	7E+01	1
Manganese	7.11E+02	2.52E+01	0.00E+00	8.47E+00	3.37E+01	7.76E+01	4E-01	1
Mercury	7.10E+00	2.51E-01	0.00E+00	1.47E+00	1.72E+00	3.90E-02	4E+01	1
Nickel	1.12E+02	3.97E+00	0.00E+00	2.56E+01	2.96E+01	1.38E+00	2E+01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	1.60E+00	5.67E-02	0.00E+00	3.46E-01	4.02E-01	1.30E+00	3E-01	1
Selenium	4.70E+00	1.66E-01	0.00E+00	6.23E-01	7.89E-01	2.30E-01	3E+00	1
Silver	5.80E+00	2.05E-01	0.00E+00	2.56E+00	2.77E+00	8.90E-01	3E+00	1
Thallium	1.52E+01	5.38E-01	0.00E+00	1.48E+00	2.02E+00	2.56E-01	8E+00	1
Vanadium	6.09E+01	2.16E+00	0.00E+00	5.52E-01	2.71E+00	3.44E-01	8E+00	1
Zinc	2.91E+04	1.03E+03	0.00E+00	5.38E+02	1.57E+03	1.72E+01	9E+01	1
2-Methylnaphthalene	2.70E+02	9.56E+00	0.00E+00	2.11E+02	2.21E+02	2.25E+01	1E+01	1
Fluoranthene	3.80E-02	1.35E-03	0.00E+00	1.36E-02	1.50E-02	2.25E+01	7E-04	1
Naphthalene	1.28E+02	4.53E+00	0.00E+00	1.22E+02	1.26E+02	2.25E+01	6E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	1.49E-02	0.00E+00	1.46E+01	1.46E+01	1.10E+00	1E+01	1
Diethylphthalate	2.50E-01	8.85E-03	0.00E+00	7.34E-01	7.43E-01	1.10E+00	7E-01	1
Di-n-butylphthalate	3.07E+02	1.09E+01	0.00E+00	1.25E+02	1.36E+02	1.10E-01	1E+03	1
Hexachlorobenzene	2.20E-01	7.79E-03	0.00E+00	7.17E-01	7.25E-01	4.32E-01	2E+00	1
N-Nitrosodiphenylamine	6.67E+01	2.36E+00	0.00E+00	3.92E+01	4.15E+01	2.00E+01	2E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Phenol	1.20E+00	4.25E-02	0.00E+00	1.40E+00	1.44E+00	7.21E+01	2E-02	1
2-Butanone	9.00E-03	3.19E-04	0.00E+00	7.79E+00	7.79E+00	1.73E+01	5E-01	1
2-Hexanone	5.00E-02	1.77E-03	0.00E+00	6.20E-02	6.38E-02	4.00E+01	2E-03	1
4-Methyl-2-Pentanone	2.00E-03	7.08E-05	0.00E+00	2.55E-03	2.62E-03	2.50E+01	1E-04	1
Acetone	8.70E+00	3.08E-01	0.00E+00	7.25E+00	7.56E+00	1.00E+01	8E-01	1
Chloroform	2.15E-03	7.61E-05	0.00E+00	3.40E-03	3.48E-03	2.00E+01	2E-04	1

Note: Blank space indicates insufficient data available to estimate exposure and HQ values.

Attachment H 7-6. Loggerhead Shrike Soil Pathway, EOD Site 1, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzene	6.10E-01	5.82E-03	0.00E+00	0.00E+00	6.28E-06	1.31E-06	5.82E-03	1.95E+01	3E-04	1
Ethylbenzene	1.40E+01	1.33E-01	0.00E+00	0.00E+00	3.70E-06	1.27E-04	1.34E-01	9.70E+00	1E-02	1
Toluene	4.10E+01	3.91E-01	0.00E+00	0.00E+00	4.47E-04	2.10E-04	3.92E-01	2.50E+02	2E-03	1
Xylenes, Total	9.80E+01	9.34E-01	0.00E+00	0.00E+00	1.11E-03	9.99E-04	9.37E-01	2.06E-01	5E+00	1
2,3,7,8-TCDD TEQ - Bird	3.93E-05	3.74E-07	0.00E+00	0.00E+00	1.10E-09	1.82E-08	3.94E-07	1.43E-05	3E-02	1
1,3-Dinitrobenzene	6.30E-01	6.01E-03	0.00E+00	0.00E+00	5.24E-07	7.55E-08	6.01E-03	8.40E-02	7E-02	1
2,4,6-Trinitrotoluene	7.86E+00	7.49E-02	0.00E+00	0.00E+00	5.77E-06	3.95E-07	7.49E-02	7.00E-01	1E-01	1
2,4-Dinitrotoluene	7.00E+00	6.67E-02	0.00E+00	0.00E+00	7.15E-05	1.90E-06	6.68E-02	3.90E-01	2E-01	1
2,6-Dinitrotoluene	4.40E-02	4.20E-04	0.00E+00	0.00E+00	4.44E-07	7.80E-09	4.20E-04	3.90E-01	1E-03	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.96E-03	0.00E+00	0.00E+00	3.12E-06	1.60E-07	2.96E-03	7.00E-01	4E-03	1
4-Amino-2,6-Dinitrotoluene	2.28E-02	2.17E-04	0.00E+00	0.00E+00	2.31E-07	1.27E-08	2.18E-04	7.00E-01	3E-04	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.33E-01	0.00E+00	0.00E+00	5.48E-07	2.38E-07	1.33E-01	8.14E-01	2E-01	1
HMX	1.40E+00	1.33E-02	0.00E+00	0.00E+00	1.30E-05	1.45E-08	1.34E-02	3.00E+00	4E-03	1
Tetrachloroethene	2.00E-03	1.91E-05	0.00E+00	0.00E+00	2.17E-08	9.33E-09	1.91E-05	5.00E-02	4E-04	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	1.90E+05	1.81E+03	0.00E+00	0.00E+00	1.91E-01	6.01E-01	1.81E+03	1.10E+02	2E+01	1
Antimony	1.03E+02	9.82E-01	0.00E+00	0.00E+00	2.51E-04	1.50E-03	9.84E-01	5.90E-03	2E+02	1
Arsenic	1.24E+01	1.18E-01	0.00E+00	0.00E+00	1.58E-05	2.17E-05	1.18E-01	2.24E+00	5E-02	1
Barium	5.37E+02	5.12E+00	0.00E+00	0.00E+00	3.81E-04	2.86E-04	5.12E+00	2.08E+01	2E-01	1
Beryllium	1.10E+00	1.05E-02	0.00E+00	0.00E+00	7.65E-06	7.69E-07	1.05E-02	5.32E-02	2E-01	1
Cadmium	1.56E+02	1.49E+00	0.00E+00	0.00E+00	2.42E-03	3.24E-02	1.52E+00	1.47E+00	1E+00	1
Chromium	1.71E+02	1.63E+00	0.00E+00	0.00E+00	3.56E-04	8.07E-04	1.63E+00	2.66E+00	6E-01	1
Cobalt	6.60E+00	6.29E-02	0.00E+00	0.00E+00	4.65E-06	7.90E-06	6.29E-02	7.61E+00	8E-03	1
Copper	1.67E+04	1.59E+02	0.00E+00	0.00E+00	1.16E-01	4.74E-01	1.60E+02	2.30E+00	7E+01	1
Lead	1.58E+03	1.51E+01	0.00E+00	0.00E+00	3.30E-04	6.86E-04	1.51E+01	1.63E+00	9E+00	1
Manganese	7.11E+02	6.78E+00	0.00E+00	0.00E+00	3.73E-03	3.26E-03	6.79E+00	7.76E+01	9E-02	1
Mercury	7.10E+00	6.77E-02	0.00E+00	0.00E+00	9.91E-04	3.34E-03	7.20E-02	3.90E-02	2E+00	1
Nickel	1.12E+02	1.07E+00	0.00E+00	0.00E+00	9.27E-05	5.73E-04	1.07E+00	1.38E+00	8E-01	1
Perchlorate	1.60E+00	1.53E-02	0.00E+00	0.00E+00	2.17E+00	7.79E-03	2.20E+00	1.30E+00	2E+00	1
Selenium	4.70E+00	4.48E-02	0.00E+00	0.00E+00	1.66E-02	1.53E-02	7.67E-02	2.30E-01	3E-01	1
Silver	5.80E+00	5.53E-02	0.00E+00	0.00E+00	7.26E-05	9.11E-04	5.63E-02	8.90E-01	6E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Thallium	1.52E+01	1.45E-01	0.00E+00	0.00E+00	1.14E-03	1.56E-03	1.48E-01	2.56E-01	6E-01	1
Vanadium	6.09E+01	5.81E-01	0.00E+00	0.00E+00	9.70E-05	1.21E-04	5.81E-01	3.44E-01	2E+00	1
Zinc	2.91E+04	2.77E+02	0.00E+00	0.00E+00	1.32E+00	1.52E+00	2.80E+02	1.72E+01	2E+01	1
2-Methylnaphthalene	2.70E+02	2.57E+00	0.00E+00	0.00E+00	5.76E-04	2.35E-03	2.58E+00	2.25E+01	1E-01	1
Fluoranthene	3.80E-02	3.62E-04	0.00E+00	0.00E+00	2.99E-07	7.42E-07	3.63E-04	2.25E+01	2E-05	1
Naphthalene	1.28E+02	1.22E+00	0.00E+00	0.00E+00	2.27E-03	7.31E-04	1.22E+00	2.25E+01	5E-02	1
Bis (2-ethylhexyl) phthalate	4.20E-01	4.00E-03	0.00E+00	0.00E+00	1.67E-05	1.04E-02	1.44E-02	1.10E+00	1E-02	1
Diethylphthalate	2.50E-01	2.38E-03	0.00E+00	0.00E+00	2.67E-06	1.51E-06	2.39E-03	1.10E+00	2E-03	1
Di-n-butylphthalate	3.07E+02	2.93E+00	0.00E+00	0.00E+00	9.76E-04	3.61E-03	2.93E+00	1.10E-01	3E+01	1
Hexachlorobenzene	2.20E-01	2.10E-03	0.00E+00	0.00E+00	1.73E-06	9.20E-05	2.19E-03	4.32E-01	5E-03	1
N-Nitrosodiphenylamine	6.67E+01	6.36E-01	0.00E+00	0.00E+00	7.51E-04	1.88E-04	6.37E-01	2.00E+01	3E-02	1
Phenol	1.20E+00	1.14E-02	0.00E+00	0.00E+00	1.17E-05	8.42E-07	1.15E-02	7.21E+01	2E-04	1
2-Butanone	9.00E-03	8.58E-05	0.00E+00	0.00E+00	8.02E-08	1.07E-06	8.70E-05	1.73E+01	5E-06	1
2-Hexanone	5.00E-02	4.77E-04	0.00E+00	0.00E+00	4.86E-07	3.30E-08	4.77E-04	4.00E+01	1E-05	1
4-Methyl-2-Pentanone	2.00E-03	1.91E-05	0.00E+00	0.00E+00	1.63E-09	1.24E-09	1.91E-05	2.50E+01	8E-07	1
Acetone	8.70E+00	8.30E-02	0.00E+00	0.00E+00	3.94E-06	5.42E-07	8.30E-02	1.00E+01	8E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Chloroform	2.15E-03	2.05E-05	0.00E+00	0.00E+00	2.08E-07	3.69E-09	2.07E-05	2.00E+01	1E-06	1

Attachment H-8
Calculation of Tier 2, Step 3a HQ Values for Wildlife

Table H 8-1. Ornate Shrew Soil Pathway, EOD Site 1, Tier 2, Step 3a-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Toluene	1.83E+00	3.15E-03	2.77E-01	2.79E+00	3.07E+00	2.87E+01	1E-01	1
Ethylbenzene	1.40E+01	2.41E-02	1.35E-02	2.34E+01	2.34E+01	1.24E+02	2E-01	1
Xylenes, Total	9.80E+01	1.69E-01	8.83E+00	1.72E+02	1.81E+02	2.32E+00	8E+01	1
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	1.16E-08	9.91E-09	5.97E-06	5.99E-06	1.28E-06	5E+00	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	5.34E-04	1.32E-01	1.38E-01	2.71E-01	9.93E+00	3E-02	1
1,3-Dinitrobenzene	6.30E-01	1.08E-03	3.20E-02	8.39E-02	1.17E-01	5.11E-02	2E+00	1
HMX	1.40E+00	2.41E-03	1.91E+00	5.04E-03	1.92E+00	4.30E+00	4E-01	1
2,4-Dinitrotoluene	7.00E+00	1.21E-02	2.46E+00	1.21E+00	3.68E+00	4.99E+00	7E-01	1
2,4,6-Trinitrotoluene	7.86E+00	1.35E-02	3.18E-01	2.55E-01	5.86E-01	1.10E+01	5E-02	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	2.41E-02	5.76E-02	3.02E-01	3.84E-01	3.49E+00	1E-01	1
Perchlorate	8.70E-02	1.50E-04	2.35E-01	1.57E-02	2.50E-01	6.40E-01	4E-01	1
Mercury	5.07E-01	8.73E-04	7.33E-04	8.76E-02	8.92E-02	3.20E-01	3E-01	1
Beryllium	1.10E+00	1.89E-03	1.75E-02	8.91E-03	2.83E-02	5.32E-01	5E-02	1
Selenium	2.12E+00	3.65E-03	1.21E-02	2.34E-01	2.50E-01	5.46E-02	5E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Silver	5.80E+00	9.98E-03	7.77E-04	2.13E+00	2.15E+00	1.14E+01	2E-01	1
Chromium	6.49E+00	1.12E-02	2.54E-03	3.57E-01	3.71E-01	2.40E+00	2E-01	1
Cadmium	9.15E+00	1.58E-02	5.50E-03	4.84E+00	4.87E+00	7.70E-01	6E+00	1
Nickel	1.25E+01	2.15E-02	3.95E-03	2.38E+00	2.41E+00	1.67E-01	1E+01	1
Vanadium	1.47E+01	2.53E-02	6.83E-04	1.11E-01	1.37E-01	1.14E+00	1E-01	1
Thallium	1.52E+01	2.62E-02	3.63E-02	1.23E+00	1.29E+00	5.55E-01	2E+00	1
Barium	7.73E+01	1.33E-01	1.15E-01	1.27E+00	1.51E+00	5.18E+01	3E-02	1
Lead	9.33E+01	1.61E-01	9.32E-03	3.26E+00	3.43E+00	4.70E+00	7E-01	1
Manganese	1.05E+02	1.80E-01	7.92E-02	1.04E+00	1.30E+00	1.51E+01	9E-02	1
Antimony	1.30E+02	2.24E-01	3.68E-02	2.34E+01	2.37E+01	5.90E-02	4E+02	1
Copper	8.62E+02	1.48E+00	4.44E-02	7.99E+01	8.14E+01	2.95E+00	3E+01	1
Zinc	1.56E+03	2.68E+00	7.34E-01	2.40E+01	2.74E+01	1.05E+01	3E+00	1
Naphthalene	1.28E+02	2.20E-01	1.49E+01	1.01E+02	1.17E+02	6.30E+01	2E+00	1
2-Methylnaphthalene	2.70E+02	4.65E-01	1.72E+00	1.76E+02	1.78E+02	6.30E+01	3E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	7.23E-04	3.49E-04	1.22E+01	1.22E+01	2.56E+01	5E-01	1
Di-n-butylphthalate	2.21E+01	3.81E-02	7.26E-02	7.53E+00	7.64E+00	6.07E+02	1E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	3.79E-04	2.31E-04	5.98E-01	5.99E-01	2.56E+00	2E-01	1
N-Nitrosodiphenylamine	6.67E+01	1.15E-01	6.29E+00	3.27E+01	3.91E+01	2.56E+02	2E-01	1
Acetone	8.70E+00	1.50E-02	2.11E+00	6.04E+00	8.16E+00	6.39E+01	1E-01	1

Table H 8-2. Deer Mouse Soil Pathway, EOD Site 1, Tier 2, Step 3A-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Ethylbenzene	1.40E+01	2.85E-02	1.18E-01	1.09E+01	1.10E+01	1.15E+02	1E-01	1
Toluene	1.83E+00	3.72E-03	2.42E+00	1.30E+00	3.72E+00	2.67E+01	1E-01	1
Xylenes, Total	9.80E+01	1.99E-01	7.73E+01	7.99E+01	1.57E+02	2.15E+00	7E+01	1
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	1.37E-08	8.68E-08	2.21E-06	2.31E-06	1.19E-06	2E+00	1
1,3-Dinitrobenzene	6.30E-01	1.28E-03	2.80E-01	3.90E-02	3.20E-01	4.76E-02	7E+00	1
2,4,6-Trinitrotoluene	7.86E+00	1.60E-02	2.78E+00	1.18E-01	2.92E+00	1.03E+01	3E-01	1
2,4-Dinitrotoluene	7.00E+00	1.42E-02	2.15E+01	5.63E-01	2.21E+01	4.64E+00	5E+00	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	6.31E-04	1.16E+00	6.44E-02	1.22E+00	9.23E+00	1E-01	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	2.85E-02	5.04E-01	1.41E-01	6.73E-01	3.25E+00	2E-01	1
HMX	1.40E+00	2.85E-03	1.68E+01	2.34E-03	1.68E+01	4.00E+00	4E+00	1
Antimony	1.30E+02	2.64E-01	3.17E-01	1.09E+01	1.15E+01	5.90E-02	2E+02	1
Barium	7.73E+01	1.57E-01	1.01E+00	5.89E-01	1.76E+00	5.18E+01	3E-02	1
Beryllium	1.10E+00	2.24E-03	1.53E-01	4.14E-03	1.60E-01	5.32E-01	3E-01	1
Cadmium	9.15E+00	1.86E-02	1.74E-01	4.03E+00	4.22E+00	7.70E-01	5E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Chromium	6.49E+00	1.32E-02	2.23E-02	1.66E-01	2.02E-01	2.40E+00	8E-02	1
Copper	8.62E+02	1.75E+00	2.34E+00	3.72E+01	4.13E+01	2.74E+00	2E+01	1
Lead	9.33E+01	1.90E-01	2.83E-01	2.62E+00	3.09E+00	4.70E+00	7E-01	1
Manganese	1.05E+02	2.13E-01	6.93E-01	8.90E-01	1.80E+00	1.41E+01	1E-01	1
Mercury	5.07E-01	1.03E-03	2.14E-02	4.08E-02	6.32E-02	2.97E-01	2E-01	1
Nickel	1.25E+01	2.54E-02	6.00E-02	1.11E+00	1.19E+00	1.55E-01	8E+00	1
Perchlorate	8.70E-02	1.77E-04	2.05E+00	7.28E-03	2.06E+00	6.40E-01	3E+00	1
Selenium	2.12E+00	4.31E-03	9.75E-02	1.35E-01	2.37E-01	5.07E-02	5E+00	1
Silver	5.80E+00	1.18E-02	6.80E-03	9.93E-01	1.01E+00	1.06E+01	1E-01	1
Thallium	1.52E+01	3.09E-02	3.18E-01	5.73E-01	9.22E-01	5.16E-01	2E+00	1
Vanadium	1.47E+01	2.99E-02	5.98E-03	5.18E-02	8.77E-02	1.06E+00	8E-02	1
Zinc	1.56E+03	3.16E+00	2.37E+01	7.98E+01	1.07E+02	9.76E+00	1E+01	1
2-Methylnaphthalene	2.70E+02	5.49E-01	1.51E+01	8.18E+01	9.75E+01	5.86E+01	2E+00	1
Naphthalene	1.28E+02	2.60E-01	1.31E+02	4.72E+01	1.78E+02	5.86E+01	3E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	8.54E-04	3.05E-03	5.66E+00	5.67E+00	2.38E+01	2E-01	1
Di-n-butylphthalate	2.21E+01	4.50E-02	6.36E-01	3.50E+00	4.18E+00	5.64E+02	7E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	4.47E-04	2.03E-03	2.78E-01	2.81E-01	2.38E+00	1E-01	1
N-Nitrosodiphenylamine	6.67E+01	1.36E-01	5.51E+01	1.52E+01	7.04E+01	2.38E+02	3E-01	1
Acetone	8.70E+00	1.77E-02	1.84E+01	2.81E+00	2.13E+01	5.94E+01	4E-01	1

Attachment H 8-3. Long-tailed Weasel Soil Pathway, EOD Site 1, Tier 2, Step 3A-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Ethylbenzene	1.40E+01	1.10E-02	0.00E+00	0.00E+00	4.62E-06	2.93E-06	1.10E-02	9.86E+01	1E-04	1
Toluene	1.83E+00	1.44E-03	0.00E+00	0.00E+00	9.69E-07	2.39E-07	1.44E-03	2.28E+01	6E-05	1
Xylenes, Total	9.80E+01	7.72E-02	0.00E+00	0.00E+00	7.09E-05	2.43E-05	7.73E-02	1.84E+00	4E-02	1
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	5.30E-09	0.00E+00	0.00E+00	8.41E-11	6.51E-11	5.45E-09	1.02E-06	5E-03	1
1,3-Dinitrobenzene	6.30E-01	4.96E-04	0.00E+00	0.00E+00	1.86E-08	2.03E-09	4.96E-04	4.07E-02	1E-02	1
2,4,6-Trinitrotoluene	7.86E+00	6.19E-03	0.00E+00	0.00E+00	1.87E-07	1.12E-08	6.19E-03	8.77E+00	7E-04	1
2,4-Dinitrotoluene	7.00E+00	5.51E-03	0.00E+00	0.00E+00	2.33E-06	1.16E-07	5.52E-03	3.97E+00	1E-03	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.44E-04	0.00E+00	0.00E+00	1.05E-07	6.94E-09	2.44E-04	7.90E+00	3E-05	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.10E-02	0.00E+00	0.00E+00	1.76E-08	3.00E-09	1.10E-02	2.78E+00	4E-03	1
HMX	1.40E+00	1.10E-03	0.00E+00	0.00E+00	4.15E-07	1.42E-08	1.10E-03	3.42E+00	3E-04	1
Antimony	1.30E+02	1.02E-01	0.00E+00	0.00E+00	6.30E-05	3.88E-05	1.03E-01	5.90E-02	2E+00	1
Barium	7.73E+01	6.09E-02	0.00E+00	0.00E+00	1.61E-06	4.14E-07	6.09E-02	5.18E+01	1E-03	1
Beryllium	1.10E+00	8.67E-04	0.00E+00	0.00E+00	2.34E-07	1.24E-08	8.67E-04	5.32E-01	2E-03	1
Cadmium	9.15E+00	7.21E-03	0.00E+00	0.00E+00	1.24E-04	4.26E-05	7.37E-03	7.70E-01	1E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Chromium	6.49E+00	5.11E-03	0.00E+00	0.00E+00	8.87E-07	4.87E-07	5.11E-03	2.40E+00	2E-03	1
Copper	8.62E+02	6.79E-01	0.00E+00	0.00E+00	7.56E-04	4.45E-04	6.80E-01	2.34E+00	3E-01	1
Lead	9.33E+01	7.35E-02	0.00E+00	0.00E+00	1.64E-06	5.44E-07	7.35E-02	4.70E+00	2E-02	1
Manganese	1.05E+02	8.25E-02	0.00E+00	0.00E+00	1.65E-05	3.55E-06	8.26E-02	1.20E+01	7E-03	1
Mercury	5.07E-01	3.99E-04	0.00E+00	0.00E+00	1.16E-05	4.88E-06	4.16E-04	2.54E-01	2E-03	1
Nickel	1.25E+01	9.85E-03	0.00E+00	0.00E+00	2.19E-06	1.32E-06	9.86E-03	1.33E-01	7E-02	1
Perchlorate	8.70E-02	6.85E-05	0.00E+00	0.00E+00	3.78E-03	1.37E-04	3.98E-03	6.40E-01	6E-03	1
Selenium	2.12E+00	1.67E-03	0.00E+00	0.00E+00	4.33E-04	1.37E-04	2.24E-03	4.34E-02	5E-02	1
Silver	5.80E+00	4.57E-03	0.00E+00	0.00E+00	3.15E-05	1.99E-05	4.62E-03	9.05E+00	5E-04	1
Thallium	1.52E+01	1.20E-02	0.00E+00	0.00E+00	6.75E-05	2.83E-05	1.21E-02	4.41E-01	3E-02	1
Vanadium	1.47E+01	1.16E-02	0.00E+00	0.00E+00	3.69E-07	1.73E-07	1.16E-02	9.05E-01	1E-02	1
Zinc	1.56E+03	1.23E+00	0.00E+00	0.00E+00	9.77E-03	7.48E-04	1.24E+00	8.35E+00	1E-01	1
2-Methylnaphthalene	2.70E+02	2.13E-01	0.00E+00	0.00E+00	9.82E-05	5.36E-05	2.13E-01	5.01E+01	4E-03	1
Naphthalene	1.28E+02	1.01E-01	0.00E+00	0.00E+00	9.76E-05	1.90E-05	1.01E-01	5.01E+01	2E-03	1
Bis (2-ethylhexyl) phthalate	4.20E-01	3.31E-04	0.00E+00	0.00E+00	3.80E-04	2.44E-04	9.54E-04	2.03E+01	5E-05	1
Di-n-butylphthalate	2.21E+01	1.74E-02	0.00E+00	0.00E+00	1.05E-05	5.72E-06	1.74E-02	4.83E+02	4E-05	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	1.73E-04	0.00E+00	0.00E+00	3.37E-06	2.14E-06	1.79E-04	2.03E+00	9E-05	1
N-Nitrosodiphenylamine	6.67E+01	5.25E-02	0.00E+00	0.00E+00	3.02E-05	5.00E-06	5.26E-02	2.03E+01	3E-03	1
Acetone	8.70E+00	6.85E-03	0.00E+00	0.00E+00	1.44E-07	1.65E-08	6.85E-03	5.08E+01	1E-04	1

Table H 8-4. Western Meadowlark Soil Pathway, EOD Site 1, Tier 2, Step 3a-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Ethylbenzene	1.40E+01	1.34E-01	7.24E-02	1.15E+01	1.17E+01	9.70E+00	1E+00	1
Toluene	1.83E+00	1.75E-02	1.48E+00	1.37E+00	2.87E+00	2.50E+02	1E-02	1
Xylenes, Total	9.80E+01	9.36E-01	4.72E+01	8.44E+01	1.33E+02	2.06E-01	6E+02	1
2,3,7,8-TCDD TEQ - Bird	1.28E-05	1.23E-07	1.01E-07	5.00E-06	5.23E-06	1.43E-05	4E-01	1
1,3-Dinitrobenzene	6.30E-01	6.02E-03	1.71E-01	4.12E-02	2.18E-01	8.40E-02	3E+00	1
2,4,6-Trinitrotoluene	7.86E+00	7.50E-02	1.70E+00	1.25E-01	1.90E+00	7.00E-01	3E+00	1
2,4-Dinitrotoluene	7.00E+00	6.68E-02	1.31E+01	5.94E-01	1.38E+01	1.30E-01	1E+02	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.96E-03	7.07E-01	6.80E-02	7.78E-01	7.00E-01	1E+00	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.34E-01	3.08E-01	1.49E-01	5.90E-01	8.14E-01	7E-01	1
HMX	1.40E+00	1.34E-02	1.02E+01	2.48E-03	1.03E+01	3.00E+00	3E+00	1
Antimony	1.30E+02	1.24E+00	1.94E-01	1.15E+01	1.29E+01	5.90E-03	2E+03	1
Barium	7.73E+01	7.38E-01	6.17E-01	6.22E-01	1.98E+00	2.08E+01	1E-01	1
Beryllium	1.10E+00	1.05E-02	9.38E-02	4.38E-03	1.09E-01	5.32E-02	2E+00	1
Cadmium	9.15E+00	8.74E-02	1.07E-01	4.26E+00	4.45E+00	1.47E+00	3E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Chromium	6.49E+00	6.20E-02	1.36E-02	1.76E-01	2.51E-01	2.66E+00	9E-02	1
Copper	8.62E+02	8.23E+00	1.43E+00	3.93E+01	4.89E+01	2.30E+00	2E+01	1
Lead	9.33E+01	8.91E-01	1.73E-01	2.77E+00	3.83E+00	1.63E+00	2E+00	1
Manganese	1.05E+02	1.00E+00	4.24E-01	9.40E-01	2.36E+00	7.76E+01	3E-02	1
Mercury	5.07E-01	4.84E-03	1.31E-02	4.31E-02	6.10E-02	3.90E-02	2E+00	1
Nickel	1.25E+01	1.19E-01	3.67E-02	1.17E+00	1.33E+00	1.38E+00	1E+00	1
Perchlorate	8.70E-02	8.31E-04	1.26E+00	7.70E-03	1.26E+00	1.30E+00	1E+00	1
Selenium	2.12E+00	2.02E-02	5.96E-02	1.42E-01	2.22E-01	2.30E-01	1E+00	1
Silver	5.80E+00	5.54E-02	4.15E-03	1.05E+00	1.11E+00	8.90E-01	1E+00	1
Thallium	1.52E+01	1.45E-01	1.94E-01	6.05E-01	9.45E-01	2.56E-01	4E+00	1
Vanadium	1.47E+01	1.41E-01	3.65E-03	5.47E-02	1.99E-01	1.14E+01	2E-02	1
Zinc	1.56E+03	1.48E+01	1.45E+01	8.43E+01	1.14E+02	1.72E+01	7E+00	1
2-Methylnaphthalene	2.70E+02	2.58E+00	9.22E+00	8.65E+01	9.83E+01	2.25E+01	4E+00	1
Naphthalene	1.28E+02	1.22E+00	7.99E+01	4.98E+01	1.31E+02	2.25E+01	6E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	4.01E-03	1.87E-03	5.98E+00	5.99E+00	1.10E+00	5E+00	1
Di-n-butylphthalate	2.21E+01	2.11E-01	3.88E-01	3.70E+00	4.30E+00	1.10E-01	4E+01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	2.10E-03	1.24E-03	2.94E-01	2.97E-01	4.32E-01	7E-01	1
N-Nitrosodiphenylamine	6.67E+01	6.37E-01	3.37E+01	1.60E+01	5.03E+01	2.00E+01	3E+00	1
Acetone	8.70E+00	8.31E-02	1.13E+01	2.97E+00	1.43E+01	1.00E+01	1E+00	1

Table H 8-5. Mourning Dove Soil Pathway, EOD Site 1, Tier 2, Step 3A-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Ethylbenzene	1.40E+01	1.18E-01	1.84E-01	0.00E+00	3.02E-01	9.70E+00	3E-02	1
Toluene	1.83E+00	1.55E-02	3.76E+00	0.00E+00	3.78E+00	2.50E+02	2E-02	1
Xylenes, Total	9.80E+01	8.28E-01	1.20E+02	0.00E+00	1.21E+02	2.06E-01	6E+02	1
2,3,7,8-TCDD TEQ - Bird	1.28E-05	1.08E-07	2.57E-07	0.00E+00	3.65E-07	1.43E-05	3E-02	1
1,3-Dinitrobenzene	6.30E-01	5.32E-03	4.35E-01	0.00E+00	4.40E-01	8.40E-02	5E+00	1
2,4,6-Trinitrotoluene	7.86E+00	6.64E-02	4.32E+00	0.00E+00	4.39E+00	7.00E-01	6E+00	1
2,4-Dinitrotoluene	7.00E+00	5.91E-02	3.34E+01	0.00E+00	3.35E+01	1.30E-01	3E+02	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.62E-03	1.80E+00	0.00E+00	1.80E+00	7.00E-01	3E+00	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	1.18E-01	7.83E-01	0.00E+00	9.01E-01	8.14E-01	1E+00	1
HMX	1.40E+00	1.18E-02	2.60E+01	0.00E+00	2.60E+01	3.00E+00	9E+00	1
Antimony	1.30E+02	1.10E+00	4.93E-01	0.00E+00	1.59E+00	5.90E-03	3E+02	1
Barium	7.73E+01	6.53E-01	1.57E+00	0.00E+00	2.22E+00	2.08E+01	1E-01	1
Beryllium	1.10E+00	9.29E-03	2.38E-01	0.00E+00	2.48E-01	5.32E-02	5E+00	1
Cadmium	9.15E+00	7.73E-02	2.71E-01	0.00E+00	3.48E-01	1.47E+00	2E-01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Chromium	6.49E+00	5.48E-02	3.46E-02	0.00E+00	8.94E-02	2.66E+00	3E-02	1
Copper	8.62E+02	7.28E+00	3.64E+00	0.00E+00	1.09E+01	2.30E+00	5E+00	1
Lead	9.33E+01	7.88E-01	4.39E-01	0.00E+00	1.23E+00	1.63E+00	8E-01	1
Manganese	1.05E+02	8.85E-01	1.08E+00	0.00E+00	1.96E+00	7.76E+01	3E-02	1
Mercury	5.07E-01	4.28E-03	3.32E-02	0.00E+00	3.75E-02	3.90E-02	1E+00	1
Nickel	1.25E+01	1.06E-01	9.32E-02	0.00E+00	1.99E-01	1.38E+00	1E-01	1
Perchlorate	8.70E-02	7.35E-04	3.19E+00	0.00E+00	3.19E+00	1.30E+00	2E+00	1
Selenium	2.12E+00	1.79E-02	1.51E-01	0.00E+00	1.69E-01	2.30E-01	7E-01	1
Silver	5.80E+00	4.90E-02	1.06E-02	0.00E+00	5.96E-02	8.90E-01	7E-02	1
Thallium	1.52E+01	1.28E-01	4.94E-01	0.00E+00	6.23E-01	2.56E-01	2E+00	1
Vanadium	1.47E+01	1.24E-01	9.28E-03	0.00E+00	1.34E-01	1.14E+01	1E-02	1
Zinc	1.56E+03	1.31E+01	3.68E+01	0.00E+00	5.00E+01	1.72E+01	3E+00	1
2-Methylnaphthalene	2.70E+02	2.28E+00	2.34E+01	0.00E+00	2.57E+01	2.25E+01	1E+00	1
Naphthalene	1.28E+02	1.08E+00	2.03E+02	0.00E+00	2.04E+02	2.25E+01	9E+00	1
Bis (2-ethylhexyl) phthalate	4.20E-01	3.55E-03	4.74E-03	0.00E+00	8.29E-03	1.10E+00	8E-03	1
Di-n-butylphthalate	2.21E+01	1.87E-01	9.87E-01	0.00E+00	1.17E+00	1.10E-01	1E+01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	1.86E-03	3.15E-03	0.00E+00	5.01E-03	4.32E-01	1E-02	1
N-Nitrosodiphenylamine	6.67E+01	5.63E-01	8.55E+01	0.00E+00	8.61E+01	2.00E+00	4E+01	1
Acetone	8.70E+00	7.35E-02	2.86E+01	0.00E+00	2.87E+01	1.00E+01	3E+00	1

Table H8-6. Loggerhead Shrike Soil Pathway, EOD Site 1, Tier 2, Step 3A-NOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Ethylbenzene	1.40E+01	6.03E-02	0.00E+00	0.00E+00	2.25E-06	6.90E-05	6.04E-02	9.70E+00	6E-03	1
Toluene	1.83E+00	7.88E-03	0.00E+00	0.00E+00	1.75E-05	1.05E-05	7.91E-03	2.50E+02	3E-05	1
Xylenes, Total	9.80E+01	4.22E-01	0.00E+00	0.00E+00	9.68E-04	8.40E-04	4.24E-01	2.06E-01	2E+00	1
2,3,7,8-TCDD TEQ - Bird	1.28E-05	5.53E-08	0.00E+00	0.00E+00	2.37E-10	2.68E-09	5.82E-08	1.43E-05	4E-03	1
1,3-Dinitrobenzene	6.30E-01	2.71E-03	0.00E+00	0.00E+00	4.55E-07	1.78E-07	2.71E-03	8.40E-02	3E-02	1
2,4,6-Trinitrotoluene	7.86E+00	3.39E-02	0.00E+00	0.00E+00	4.99E-06	1.71E-06	3.39E-02	7.00E-01	5E-02	1
2,4-Dinitrotoluene	7.00E+00	3.01E-02	0.00E+00	0.00E+00	6.28E-05	2.05E-05	3.02E-02	1.30E-01	2E-01	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	1.34E-03	0.00E+00	0.00E+00	2.74E-06	9.38E-07	1.34E-03	7.00E-01	2E-03	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	6.03E-02	0.00E+00	0.00E+00	4.20E-07	2.17E-07	6.03E-02	8.14E-01	7E-02	1
HMX	1.40E+00	6.03E-03	0.00E+00	0.00E+00	1.14E-05	3.57E-06	6.04E-03	3.00E+00	2E-03	1
Antimony	1.30E+02	5.60E-01	0.00E+00	0.00E+00	1.55E-04	9.99E-04	5.61E-01	5.90E-03	1E+02	1
Barium	7.73E+01	3.33E-01	0.00E+00	0.00E+00	3.61E-05	2.54E-05	3.33E-01	2.08E+01	2E-02	1
Beryllium	1.10E+00	4.74E-03	0.00E+00	0.00E+00	6.45E-06	2.24E-06	4.75E-03	5.32E-02	9E-02	1
Cadmium	9.15E+00	3.94E-02	0.00E+00	0.00E+00	1.81E-04	1.83E-03	4.14E-02	1.47E+00	3E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Chromium	6.49E+00	2.80E-02	0.00E+00	0.00E+00	6.99E-06	1.55E-05	2.80E-02	2.66E+00	1E-02	1
Copper	8.62E+02	3.71E+00	0.00E+00	0.00E+00	3.56E-03	1.26E-02	3.73E+00	2.30E+00	2E+00	1
Lead	9.33E+01	4.02E-01	0.00E+00	0.00E+00	1.16E-05	2.86E-05	4.02E-01	1.63E+00	2E-01	1
Manganese	1.05E+02	4.51E-01	0.00E+00	0.00E+00	3.19E-04	3.04E-04	4.52E-01	7.76E+01	6E-03	1
Mercury	5.07E-01	2.18E-03	0.00E+00	0.00E+00	1.22E-04	1.57E-04	2.46E-03	3.90E-02	6E-02	1
Nickel	1.25E+01	5.39E-02	0.00E+00	0.00E+00	6.48E-06	3.42E-05	5.39E-02	1.38E+00	4E-02	1
Perchlorate	8.70E-02	3.75E-04	0.00E+00	0.00E+00	1.04E-01	3.25E-02	1.37E-01	1.30E+00	1E-01	1
Selenium	2.12E+00	9.13E-03	0.00E+00	0.00E+00	5.52E-03	5.72E-03	2.04E-02	2.30E-01	9E-02	1
Silver	5.80E+00	2.50E-02	0.00E+00	0.00E+00	3.30E-05	4.85E-04	2.55E-02	8.90E-01	3E-02	1
Thallium	1.52E+01	6.55E-02	0.00E+00	0.00E+00	8.11E-04	9.73E-04	6.72E-02	2.56E-01	3E-01	1
Vanadium	1.47E+01	6.34E-02	0.00E+00	0.00E+00	1.00E-05	1.18E-05	6.34E-02	1.14E+01	6E-03	1
Zinc	1.56E+03	6.70E+00	0.00E+00	0.00E+00	8.14E-02	1.46E-01	6.93E+00	1.72E+01	4E-01	1
2-Methylnaphthalene	2.70E+02	1.16E+00	0.00E+00	0.00E+00	4.60E-04	1.39E-03	1.16E+00	2.25E+01	5E-02	1
Naphthalene	1.28E+02	5.51E-01	0.00E+00	0.00E+00	1.99E-03	1.01E-03	5.54E-01	2.25E+01	2E-02	1
Bis (2-ethylhexyl) phthalate	4.20E-01	1.81E-03	0.00E+00	0.00E+00	9.88E-06	5.64E-03	7.46E-03	1.10E+00	7E-03	1
Di-n-butylphthalate	2.21E+01	9.53E-02	0.00E+00	0.00E+00	5.24E-05	1.52E-04	9.55E-02	1.10E-01	9E-01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Hexachlorobenzene	2.20E-01	9.47E-04	0.00E+00	0.00E+00	1.07E-06	5.01E-05	9.99E-04	4.32E-01	2E-03	1
N-Nitrosodiphenylamine	6.67E+01	2.87E-01	0.00E+00	0.00E+00	6.56E-04	3.03E-04	2.88E-01	2.00E+01	1E-02	1
Acetone	8.70E+00	3.75E-02	0.00E+00	0.00E+00	3.46E-06	1.36E-06	3.75E-02	1.00E+01	4E-03	1

Table H 8-7. Ornate Shrew Soil Pathway, EOD Site 1, Tier 2, Step 3a-LOAELs

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAE-TRV	HQ	Site Use Factor
Xylenes, Total	9.80E+01	1.69E-01	8.83E+00	1.72E+02	1.81E+02	2.32E+01	8E+00	1
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	1.16E-08	9.91E-09	5.97E-06	5.99E-06	1.28E-05	5E-01	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	5.34E-04	1.32E-01	1.38E-01	2.71E-01	9.93E+01	3E-03	1
1,3-Dinitrobenzene	6.30E-01	1.08E-03	3.20E-02	8.39E-02	1.17E-01	2.56E-01	5E-01	1
HMX	1.40E+00	2.41E-03	1.91E+00	5.04E-03	1.92E+00	4.30E+01	4E-02	1
2,4-Dinitrotoluene	7.00E+00	1.21E-02	2.46E+00	1.21E+00	3.68E+00	4.99E+01	7E-02	1
2,4,6-Trinitrotoluene	7.86E+00	1.35E-02	3.18E-01	2.55E-01	5.86E-01	1.10E+02	5E-03	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	2.41E-02	5.76E-02	3.02E-01	3.84E-01	3.49E+01	1E-02	1
Perchlorate	8.76E-02	1.51E-04	2.36E-01	1.58E-02	2.52E-01	6.40E+00	4E-02	1
Mercury	5.07E-01	8.73E-04	7.33E-04	8.76E-02	8.92E-02	3.20E+00	3E-02	1
Beryllium	1.30E+00	2.24E-03	2.07E-02	1.05E-02	3.35E-02	5.32E+00	6E-03	1
Selenium	2.12E+00	3.65E-03	1.21E-02	2.34E-01	2.50E-01	5.46E-01	5E-01	1
Silver	5.80E+00	9.98E-03	7.77E-04	2.13E+00	2.15E+00	1.14E+02	2E-02	1
Cadmium	9.16E+00	1.58E-02	5.50E-03	4.85E+00	4.87E+00	7.70E+00	6E-01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAE-TRV	HQ	Site Use Factor
Nickel	1.25E+01	2.15E-02	3.95E-03	2.38E+00	2.41E+00	1.67E+00	1E+00	1
Thallium	1.52E+01	2.62E-02	3.63E-02	1.23E+00	1.29E+00	5.55E+00	2E-01	1
Lead	9.33E+01	1.61E-01	9.32E-03	3.26E+00	3.43E+00	4.70E+01	7E-02	1
Antimony	1.03E+02	1.77E-01	2.91E-02	1.85E+01	1.87E+01	5.90E-01	3E+01	1
Copper	8.62E+02	1.48E+00	4.44E-02	7.99E+01	8.14E+01	2.95E+01	3E+00	1
Zinc	1.56E+03	2.68E+00	7.34E-01	2.40E+01	2.74E+01	1.05E+02	3E-01	1
Naphthalene	1.28E+02	2.20E-01	1.49E+01	1.01E+02	1.17E+02	6.30E+02	2E-01	1
2-Methylnaphthalene	2.70E+02	4.65E-01	1.72E+00	1.76E+02	1.78E+02	6.30E+02	3E-01	1
Bis (2-ethylhexyl) phthalate	4.20E-01	7.23E-04	3.49E-04	1.22E+01	1.22E+01	2.56E+02	5E-02	1
Di-n-butylphthalate	2.21E+01	3.80E-02	7.25E-02	7.52E+00	7.63E+00	6.07E+03	1E-03	1
N-Nitrosodiphenylamine	6.67E+01	1.15E-01	6.29E+00	3.27E+01	3.91E+01	2.56E+02	2E-01	1
Acetone	8.70E+00	1.50E-02	2.11E+00	6.04E+00	8.16E+00	6.39E+02	1E-02	1

Table H 8-8. Deer Mouse Soil Pathway, EOD Site 1, Tier 2, Step 3a-LOAEL

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Xylenes, Total	9.80E+01	1.99E-01	7.73E+01	7.99E+01	1.57E+02	2.15E+01	7E+00	1
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	1.37E-08	8.68E-08	2.21E-06	2.31E-06	1.19E-05	2E-01	1
1,3-Dinitrobenzene	6.30E-01	1.28E-03	2.80E-01	3.90E-02	3.20E-01	2.38E-01	1E+00	1
2,4,6-Trinitrotoluene	7.86E+00	1.60E-02	2.78E+00	1.18E-01	2.92E+00	1.03E+02	3E-02	1
2,4-Dinitrotoluene	7.00E+00	1.42E-02	2.15E+01	5.63E-01	2.21E+01	4.64E+01	5E-01	1
2-Amino-4,6-Dinitrotoluene	3.10E-01	6.31E-04	1.16E+00	6.44E-02	1.22E+00	9.23E+01	1E-02	1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	2.85E-02	5.04E-01	1.41E-01	6.73E-01	3.25E+01	2E-02	1
HMX	1.40E+00	2.85E-03	1.68E+01	2.34E-03	1.68E+01	4.00E+01	4E-01	1
Antimony	1.03E+02	2.09E-01	3.19E-01	8.62E+00	9.15E+00	5.90E-01	2E+01	1
Beryllium	1.30E+00	2.64E-03	1.74E-01	4.90E-03	1.81E-01	5.32E+00	3E-02	1
Cadmium	9.16E+00	1.86E-02	1.74E-01	4.03E+00	4.23E+00	7.70E+00	5E-01	1
Copper	8.62E+02	1.75E+00	2.34E+00	3.72E+01	4.13E+01	2.74E+01	2E+00	1
Lead	9.33E+01	1.90E-01	2.83E-01	2.62E+00	3.09E+00	4.70E+01	7E-02	1
Mercury	5.07E-01	1.03E-03	2.14E-02	4.08E-02	6.32E-02	2.97E+00	2E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Nickel	1.25E+01	2.54E-02	6.00E-02	1.11E+00	1.19E+00	1.55E+00	8E-01	1
Perchlorate	8.76E-02	1.78E-04	2.07E+00	7.34E-03	2.08E+00	6.40E+00	3E-01	1
Selenium	2.12E+00	4.31E-03	9.75E-02	1.35E-01	2.37E-01	5.07E-01	5E-01	1
Silver	5.80E+00	1.18E-02	6.80E-03	9.93E-01	1.01E+00	1.06E+02	1E-02	1
Thallium	1.52E+01	3.09E-02	3.18E-01	5.73E-01	9.22E-01	5.16E+00	2E-01	1
Zinc	1.56E+03	3.16E+00	2.37E+01	7.98E+01	1.07E+02	9.76E+01	1E+00	1
2-Methylnaphthalene	2.70E+02	5.49E-01	1.51E+01	8.18E+01	9.75E+01	5.86E+02	2E-01	1
Naphthalene	1.28E+02	2.60E-01	1.31E+02	4.72E+01	1.78E+02	5.86E+02	3E-01	1
Bis (2-ethylhexyl) phthalate	4.20E-01	8.54E-04	3.05E-03	5.66E+00	5.67E+00	2.38E+02	2E-02	1
Di-n-butylphthalate	2.21E+01	4.49E-02	6.35E-01	3.50E+00	4.18E+00	5.64E+03	7E-04	1
N-Nitrosodiphenylamine	6.67E+01	1.36E-01	5.51E+01	1.52E+01	7.04E+01	2.38E+02	3E-01	1
Acetone	8.70E+00	1.77E-02	1.84E+01	2.81E+00	2.13E+01	5.94E+02	4E-02	1

Attachment H 8-9. Long-tailed Weasel Soil Pathway, EOD Site 1, Tier 2, Step 3a-LOAEL

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Xylenes, Total	9.80E+01	1.96E-03	0.00E+00	0.00E+00	1.80E-06	6.16E-07	1.96E-03	2.15E+01	9E-05	0.0253
2,3,7,8-TCDD TEQ - Mammal	6.73E-06	1.34E-10	0.00E+00	0.00E+00	2.13E-12	1.65E-12	1.38E-10	1.19E-05	1E-05	0.0253
1,3-Dinitrobenzene	6.30E-01	1.26E-05	0.00E+00	0.00E+00	4.71E-10	5.14E-11	1.26E-05	2.38E-01	5E-05	0.0253
2,4,6-Trinitrotoluene	7.86E+00	1.57E-04	0.00E+00	0.00E+00	4.73E-09	2.83E-10	1.57E-04	1.03E+02	2E-06	0.0253
2,4-Dinitrotoluene	7.00E+00	1.40E-04	0.00E+00	0.00E+00	5.90E-08	2.93E-09	1.40E-04	4.64E+01	3E-06	0.0253
2-Amino-4,6-Dinitrotoluene	3.10E-01	6.19E-06	0.00E+00	0.00E+00	2.66E-09	1.76E-10	6.19E-06	9.23E+01	7E-08	0.0253
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	2.79E-04	0.00E+00	0.00E+00	4.47E-10	7.61E-11	2.79E-04	3.25E+01	9E-06	0.0253
HMX	1.40E+00	2.79E-05	0.00E+00	0.00E+00	1.05E-08	3.59E-10	2.79E-05	4.00E+01	7E-07	0.0253
Antimony	1.03E+02	2.06E-03	0.00E+00	0.00E+00	1.27E-06	7.79E-07	2.06E-03	5.90E-01	3E-03	0.0253
Beryllium	1.30E+00	2.59E-05	0.00E+00	0.00E+00	6.72E-09	3.71E-10	2.60E-05	5.32E+00	5E-06	0.0253
Cadmium	9.16E+00	1.83E-04	0.00E+00	0.00E+00	3.14E-06	1.08E-06	1.87E-04	7.70E+00	2E-05	0.0253
Copper	8.62E+02	1.72E-02	0.00E+00	0.00E+00	1.91E-05	1.13E-05	1.72E-02	2.74E+01	6E-04	0.0253
Lead	9.33E+01	1.86E-03	0.00E+00	0.00E+00	4.16E-08	1.38E-08	1.86E-03	4.70E+01	4E-05	0.0253
Mercury	5.07E-01	1.01E-05	0.00E+00	0.00E+00	2.93E-07	1.24E-07	1.05E-05	2.97E+00	4E-06	0.0253

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Nickel	1.25E+01	2.50E-04	0.00E+00	0.00E+00	5.54E-08	3.34E-08	2.50E-04	1.55E+00	2E-04	0.0253
Perchlorate	8.76E-02	1.75E-06	0.00E+00	0.00E+00	9.64E-05	3.49E-06	1.02E-04	6.40E+00	2E-05	0.0253
Selenium	2.12E+00	4.23E-05	0.00E+00	0.00E+00	1.10E-05	3.46E-06	5.67E-05	5.07E-01	1E-04	0.0253
Silver	5.80E+00	1.16E-04	0.00E+00	0.00E+00	7.98E-07	5.05E-07	1.17E-04	1.06E+02	1E-06	0.0253
Thallium	1.52E+01	3.03E-04	0.00E+00	0.00E+00	1.71E-06	7.17E-07	3.06E-04	5.16E+00	6E-05	0.0253
Zinc	1.56E+03	3.10E-02	0.00E+00	0.00E+00	2.47E-04	1.90E-05	3.13E-02	9.76E+01	3E-04	0.0253
2-Methylnaphthalene	2.70E+02	5.39E-03	0.00E+00	0.00E+00	2.49E-06	1.36E-06	5.39E-03	5.86E+02	9E-06	0.0253
Naphthalene	1.28E+02	2.55E-03	0.00E+00	0.00E+00	2.47E-06	4.83E-07	2.56E-03	5.86E+02	4E-06	0.0253
Bis (2-ethylhexyl) phthalate	4.20E-01	8.38E-06	0.00E+00	0.00E+00	9.62E-06	6.17E-06	2.42E-05	2.38E+02	1E-07	0.0253
Di-n-butylphthalate	2.21E+01	4.41E-04	0.00E+00	0.00E+00	2.66E-07	1.45E-07	4.41E-04	5.64E+03	8E-08	0.0253
N-Nitrosodiphenylamine	6.67E+01	1.33E-03	0.00E+00	0.00E+00	7.64E-07	1.27E-07	1.33E-03	2.38E+02	6E-06	0.0253
Acetone	8.70E+00	1.74E-04	0.00E+00	0.00E+00	3.65E-09	4.18E-10	1.74E-04	5.94E+02	3E-07	0.0253

Table H 8-10. Western Meadowlark Soil Pathway, EOD Site 1, Tier 2, Step3a-LOAEL

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Xylenes, Total	9.80E+01	6.77E-01	3.42E+01	6.11E+01	9.60E+01	2.06E+00	5E+01	0.724
1,3-Dinitrobenzene	6.30E-01	4.35E-03	1.24E-01	2.99E-02	1.58E-01	8.40E-01	2E-01	0.724
2,4,6-Trinitrotoluene	7.86E+00	5.43E-02	1.23E+00	9.06E-02	1.38E+00	7.00E+00	2E-01	0.724
2,4-Dinitrotoluene	7.00E+00	4.84E-02	9.51E+00	4.30E-01	9.99E+00	1.30E+00	8E+00	0.724
2-Amino-4,6-Dinitrotoluene	3.10E-01	2.14E-03	5.12E-01	4.92E-02	5.63E-01	7.00E+00	8E-02	0.724
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	9.67E-02	2.23E-01	1.08E-01	4.27E-01	8.14E+01	5E-03	0.724
HMX	1.40E+00	9.67E-03	7.41E+00	1.79E-03	7.43E+00	3.00E+01	2E-01	0.724
Antimony	1.03E+02	7.12E-01	1.41E-01	6.60E+00	7.45E+00	5.90E-02	1E+02	0.724
Beryllium	1.30E+00	8.98E-03	7.68E-02	3.75E-03	8.95E-02	5.32E-01	2E-01	0.724
Cadmium	9.16E+00	6.33E-02	7.72E-02	3.08E+00	3.23E+00	1.47E+01	2E-01	0.724
Copper	8.62E+02	5.96E+00	1.04E+00	2.84E+01	3.54E+01	2.30E+01	2E+00	0.724
Lead	9.33E+01	6.45E-01	1.25E-01	2.00E+00	2.77E+00	1.63E+01	2E-01	0.724
Mercury	5.07E-01	3.50E-03	9.45E-03	3.12E-02	4.41E-02	3.90E-01	1E-01	0.724
Nickel	1.25E+01	8.65E-02	2.65E-02	8.48E-01	9.61E-01	1.38E+01	7E-02	0.724

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.76E-02	6.06E-04	9.15E-01	5.61E-03	9.21E-01	1.30E+01	7E-02	0.724
Selenium	2.12E+00	1.47E-02	4.31E-02	1.03E-01	1.61E-01	2.30E+00	7E-02	0.724
Silver	5.80E+00	4.01E-02	3.01E-03	7.59E-01	8.03E-01	8.90E+00	9E-02	0.724
Thallium	1.52E+01	1.05E-01	1.41E-01	4.38E-01	6.84E-01	2.56E+00	3E-01	0.724
Zinc	1.56E+03	1.07E+01	1.05E+01	6.10E+01	8.23E+01	1.72E+02	5E-01	0.724
2-Methylnaphthalene	2.70E+02	1.87E+00	6.67E+00	6.26E+01	7.11E+01	2.25E+02	3E-01	0.724
Naphthalene	1.28E+02	8.85E-01	5.78E+01	3.61E+01	9.48E+01	2.25E+02	4E-01	0.724
Bis (2-ethylhexyl) phthalate	4.20E-01	2.90E-03	1.35E-03	4.33E+00	4.33E+00	1.10E+01	4E-01	0.724
Di-n-butylphthalate	2.21E+01	1.53E-01	2.81E-01	2.67E+00	3.11E+00	1.10E+00	3E+00	0.724
N-Nitrosodiphenylamine	6.67E+01	4.61E-01	2.44E+01	1.16E+01	3.64E+01	2.00E+02	2E-01	0.724
Acetone	8.70E+00	6.01E-02	8.15E+00	2.15E+00	1.04E+01	1.00E+02	1E-01	0.724

Table H 8-11. Mourning Dove Soil Pathway, EOD Site 1, Tier 2, Step 3a-LOAEL

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Xylenes, Total	9.80E+01	4.75E-01	6.89E+01	0.00E+00	6.93E+01	2.06E+00	3E+01	5.74E-01
1,3-Dinitrobenzene	6.30E-01	3.05E-03	2.50E-01	0.00E+00	2.53E-01	8.40E-01	3E-01	5.74E-01
2,4,6-Trinitrotoluene	7.86E+00	3.81E-02	2.48E+00	0.00E+00	2.52E+00	7.00E+00	4E-01	5.74E-01
2,4-Dinitrotoluene	7.00E+00	3.39E-02	1.92E+01	0.00E+00	1.92E+01	1.30E+00	1E+01	5.74E-01
2-Amino-4,6-Dinitrotoluene	3.10E-01	1.50E-03	1.03E+00	0.00E+00	1.03E+00	7.00E+00	1E-01	5.74E-01
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	6.78E-02	4.49E-01	0.00E+00	5.17E-01	8.14E+01	6E-03	5.74E-01
HMX	1.40E+00	6.78E-03	1.49E+01	0.00E+00	1.49E+01	3.00E+01	5E-01	5.74E-01
Antimony	1.03E+02	4.99E-01	2.84E-01	0.00E+00	7.83E-01	5.90E-02	1E+01	5.74E-01
Beryllium	1.30E+00	6.30E-03	1.55E-01	0.00E+00	1.61E-01	5.32E-01	3E-01	5.74E-01
Cadmium	9.16E+00	4.44E-02	1.55E-01	0.00E+00	2.00E-01	1.47E+01	1E-02	5.74E-01
Copper	8.62E+02	4.18E+00	2.09E+00	0.00E+00	6.26E+00	2.30E+01	3E-01	5.74E-01
Lead	9.33E+01	4.52E-01	2.52E-01	0.00E+00	7.04E-01	1.63E+01	4E-02	5.74E-01
Mercury	5.07E-01	2.46E-03	1.90E-02	0.00E+00	2.15E-02	3.90E-01	6E-02	5.74E-01
Nickel	1.25E+01	6.06E-02	5.35E-02	0.00E+00	1.14E-01	1.38E+01	8E-03	5.74E-01

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.76E-02	4.25E-04	1.84E+00	0.00E+00	1.84E+00	1.30E+01	1E-01	5.74E-01
Selenium	2.12E+00	1.03E-02	8.69E-02	0.00E+00	9.71E-02	2.30E+00	4E-02	5.74E-01
Silver	5.80E+00	2.81E-02	6.06E-03	0.00E+00	3.42E-02	8.90E+00	4E-03	5.74E-01
Thallium	1.52E+01	7.36E-02	2.83E-01	0.00E+00	3.57E-01	2.56E+00	1E-01	5.74E-01
Zinc	1.56E+03	7.53E+00	2.11E+01	0.00E+00	2.87E+01	1.72E+02	2E-01	5.74E-01
2-Methylnaphthalene	2.70E+02	1.31E+00	1.34E+01	0.00E+00	1.47E+01	2.25E+02	7E-02	5.74E-01
Naphthalene	1.28E+02	6.20E-01	1.16E+02	0.00E+00	1.17E+02	2.25E+02	5E-01	5.74E-01
Bis (2-ethylhexyl) phthalate	4.20E-01	2.03E-03	2.72E-03	0.00E+00	4.75E-03	1.10E+01	4E-04	5.74E-01
Di-n-butylphthalate	2.21E+01	1.07E-01	5.65E-01	0.00E+00	6.72E-01	1.10E+00	6E-01	5.74E-01
N-Nitrosodiphenylamine	6.67E+01	3.23E-01	4.91E+01	0.00E+00	4.94E+01	2.00E+02	2E-01	5.74E-01
Acetone	8.70E+00	4.22E-02	1.64E+01	0.00E+00	1.65E+01	1.00E+02	2E-01	5.74E-01

Table H8-12. Loggerhead Shrike Soil Pathway, EOD Site 1, Tier 2, Step 3A-LOAEL

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Xylenes, Total	9.80E+01	3.21E-02	0.00E+00	0.00E+00	4.22E-05	4.62E-05	3.22E-02	2.06E+00	2E-02	0.08
1,3-Dinitrobenzene	6.30E-01	2.06E-04	0.00E+00	0.00E+00	1.98E-08	9.81E-09	2.06E-04	8.40E-01	2E-04	0.08
2,4,6-Trinitrotoluene	7.86E+00	2.57E-03	0.00E+00	0.00E+00	2.17E-07	9.40E-08	2.57E-03	7.00E+00	4E-04	0.08
2,4-Dinitrotoluene	7.00E+00	2.29E-03	0.00E+00	0.00E+00	2.74E-06	1.13E-06	2.30E-03	1.30E+00	2E-03	0.08
2-Amino-4,6-Dinitrotoluene	3.10E-01	1.01E-04	0.00E+00	0.00E+00	1.20E-07	5.16E-08	1.02E-04	7.00E+00	1E-05	0.08
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.40E+01	4.58E-03	0.00E+00	0.00E+00	1.83E-08	1.20E-08	4.58E-03	8.14E+01	6E-05	0.08
HMX	1.40E+00	4.58E-04	0.00E+00	0.00E+00	4.99E-07	1.96E-07	4.59E-04	3.00E+01	2E-05	0.08
Antimony	1.03E+02	3.37E-02	0.00E+00	0.00E+00	5.82E-06	4.37E-05	3.38E-02	5.90E-02	6E-01	0.08
Beryllium	1.30E+00	4.26E-04	0.00E+00	0.00E+00	3.19E-07	1.40E-07	4.26E-04	5.32E-01	8E-04	0.08
Cadmium	9.16E+00	3.00E-03	0.00E+00	0.00E+00	7.91E-06	1.01E-04	3.11E-03	1.47E+01	2E-04	0.08
Copper	8.62E+02	2.82E-01	0.00E+00	0.00E+00	1.55E-04	6.93E-04	2.83E-01	2.30E+01	1E-02	0.08
Lead	9.33E+01	3.05E-02	0.00E+00	0.00E+00	5.05E-07	1.57E-06	3.05E-02	1.63E+01	2E-03	0.08
Mercury	5.07E-01	1.66E-04	0.00E+00	0.00E+00	5.32E-06	8.64E-06	1.80E-04	3.90E-01	5E-04	0.08
Nickel	1.25E+01	4.09E-03	0.00E+00	0.00E+00	2.82E-07	1.88E-06	4.10E-03	1.38E+01	3E-04	0.08

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Dove Ingestion (mg/kg-day)	M. Lark Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	LOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.76E-02	2.87E-05	0.00E+00	0.00E+00	4.56E-03	1.80E-03	6.39E-03	1.30E+01	5E-04	0.08
Selenium	2.12E+00	6.94E-04	0.00E+00	0.00E+00	2.40E-04	3.15E-04	1.25E-03	2.30E+00	5E-04	0.08
Silver	5.80E+00	1.90E-03	0.00E+00	0.00E+00	1.44E-06	2.67E-05	1.93E-03	8.90E+00	2E-04	0.08
Thallium	1.52E+01	4.98E-03	0.00E+00	0.00E+00	3.53E-05	5.35E-05	5.06E-03	2.56E+00	2E-03	0.08
Zinc	1.56E+03	5.09E-01	0.00E+00	0.00E+00	3.55E-03	8.05E-03	5.21E-01	1.72E+02	3E-03	0.08
2-Methylnaphthalene	2.70E+02	8.84E-02	0.00E+00	0.00E+00	2.01E-05	7.66E-05	8.85E-02	2.25E+02	4E-04	0.08
Naphthalene	1.28E+02	4.19E-02	0.00E+00	0.00E+00	8.66E-05	5.55E-05	4.20E-02	2.25E+02	2E-04	0.08
Bis (2-ethylhexyl) phthalate	4.20E-01	1.37E-04	0.00E+00	0.00E+00	4.31E-07	3.10E-04	4.48E-04	1.10E+01	4E-05	0.08
Di-n-butylphthalate	2.21E+01	7.23E-03	0.00E+00	0.00E+00	2.28E-06	8.33E-06	7.24E-03	1.10E+00	7E-03	0.08
N-Nitrosodiphenylamine	6.67E+01	2.18E-02	0.00E+00	0.00E+00	2.86E-05	1.67E-05	2.19E-02	2.00E+02	1E-04	0.08
Acetone	8.70E+00	2.85E-03	0.00E+00	0.00E+00	1.51E-07	7.50E-08	2.85E-03	1.00E+02	3E-05	0.08

Attachment H-9
Dioxin TEQ Calculations

Table H-9. Site 1 Dioxin TEQ Calculations, 0 to 6 feet bgs

Analyte	Analytical Method	Units	TEF Value Human/Mammal	TEF Value Bird	01-HA01 1 to 1.5 feet bgs LD110 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-HA09 1 to 1.5 feet bgs LD129 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-HA09 1 to 1.5 feet bgs (dup) LD130 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-HA14 1 to 1.5 feet bgs LD141 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird
Dioxins																				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0001	3.5 J	3.5	0.00035	0.00035	11.1	11.1	0.00111	0.00111	32.4	32.4	0.00324	0.00324	1.5 U	0.75	0.000075	0.000075
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	0.0001	113	113	0.0113	0.0113	297	297	0.0297	0.0297	426	426	0.0426	0.0426	1.8 U	0.9	0.00009	0.00009
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	2.1 J	2.1	0.021	0.021	6.2	6.2	0.062	0.062	16.2	16.2	0.162	0.162	0.5 U	0.25	0.0025	0.0025
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.0009	8.5	8.5	0.085	0.00765	14	14	0.14	0.0126	34.5	34.5	0.345	0.03105	0.8 U	0.4	0.004	0.00036
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	0.4 U	0.2	0.002	0.002	0.7 U	0.35	0.0035	0.0035	0.9 U	0.45	0.0045	0.0045	0.7 U	0.35	0.0035	0.0035
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.36 J	0.36	0.036	0.036	0.76 J	0.76	0.076	0.076	3.1 J	3.1	0.31	0.31	0.3 U	0.15	0.015	0.015
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.05	0.3 U	0.15	0.015	0.0075	0.5 U	0.25	0.025	0.0125	0.7 U	0.35	0.035	0.0175	0.5 U	0.25	0.025	0.0125
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.2 U	0.1	0.01	0.01	0.3 U	0.15	0.015	0.015	1.4 J	1.4	0.14	0.14	0.3 U	0.15	0.015	0.015
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.01	0.41 J	0.41	0.041	0.0041	0.5 U	0.25	0.025	0.0025	0.6 U	0.3	0.03	0.003	0.5 U	0.25	0.025	0.0025
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.2 U	0.1	0.01	0.01	0.4 U	0.2	0.02	0.02	0.5 U	0.25	0.025	0.025	0.4 U	0.2	0.02	0.02
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.1	0.3 U	0.15	0.015	0.015	0.5 U	0.25	0.025	0.025	2.4 J	2.4	0.24	0.24	0.5 U	0.25	0.025	0.025
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.1	0.3 U	0.15	0.0075	0.015	0.4 U	0.2	0.01	0.02	0.4 U	0.2	0.01	0.02	0.3 U	0.15	0.0075	0.015
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.3 U	0.15	0.15	0.15	0.5 U	0.25	0.25	0.25	0.6 U	0.3	0.3	0.3	0.3 U	0.15	0.15	0.15
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.2 U	0.1	0.01	0.01	0.3 U	0.15	0.015	0.015	1.3 J	1.3	0.13	0.13	0.3 U	0.15	0.015	0.015
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	1	0.2 U	0.1	0.05	0.1	0.4 U	0.2	0.1	0.2	0.5 U	0.25	0.125	0.25	0.3 U	0.15	0.075	0.15
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	1	0.2 U	0.1	0.01	0.1	0.4 U	0.2	0.02	0.2	0.71 J	0.71	0.071	0.71	0.3 U	0.15	0.015	0.15
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.2 U	0.2	0.2	0.2	0.5 U	0.25	0.25	0.25	0.5 U	0.25	0.25	0.25	0.4 U	0.2	0.2	0.2
Heptachlorodibenzofurans	8290	ng/kg	NA	NA	7.2	7.2	NA	NA	18.6	18.6	NA	NA	36.6	36.6	NA	NA	0.6 U	0.3	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	15.1	15.1	NA	NA	38	38	NA	NA	119	119	NA	NA	0.8 U	0.4	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	NA	2.6	2.6	NA	NA	9.5	9.5	NA	NA	12.2	12.2	NA	NA	0.3 U	0.15	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	1.7	1.7	NA	NA	4.1	4.1	NA	NA	10.9	10.9	NA	NA	0.5 U	0.25	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	NA	0.2 U	0.1	NA	NA	0.75	0.75	NA	NA	2	2	NA	NA	0.3 U	0.15	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.3 U	0.15	NA	NA	0.5 U	0.25	NA	NA	0.6 U	0.3	NA	NA	0.4 U	0.2	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	NA	0.2 U	0.1	NA	NA	0.4 U	0.2	NA	NA	1.5	1.5	NA	NA	0.3 U	0.15	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.2 U	0.1	NA	NA	0.5 U	0.25	NA	NA	0.5 U	0.25	NA	NA	0.4 U	0.2	NA	NA
Total 2,3,7,8-TCDD TEQ							**0.7**	**0.7**			**1.1**	**1.2**			**2.2**	**2.6**			**0.6**	**0.8**

Notes:

TEQ = Toxicity Equivalent Quotient

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table H-9. Site 1 Dioxin TEQ Calculations, 0 to 6 feet bgs

Analyte	Analytical Method	Units	TEF Value Human/Mammal	TEF Value Bird	01-DP02 1 to 1.5 feet bgs LE003 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-DP05 1 to 1.5 feet bgs LE009 Original Data	Transformed Data	TEQ Value Human/Mamma	TEQ Value Bird	01-DP05 1 to 1.5 feet bgs LE010 (dup) Original Data	Transformed Data	TEQ Value Human/Mamma	TEQ Value Bird	01-DP11 1 to 1.5 feet bgs LE025 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird
Dioxins																				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0001	0.905	0.905	0.0000905	0.0000905	0.179	0.179	0.0000179	1.79E-05	2.42	2.42	0.000242	0.000242	0.595 UJ	0.2975	0.00002975	2.98E-05
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	0.0001	18.5	18.5	0.00185	0.00185	2.12	2.12	0.000212	0.000212	30.5	30.5	0.00305	0.00305	4.6 UJ	2.3	0.00023	0.00023
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	0.454	0.454	0.00454	0.00454	0.107	0.107	0.00107	0.00107	0.816	0.816	0.00816	0.00816	0.138 UJ	0.069	0.00069	0.00069
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.0009	2.3	2.3	0.023	0.00207	0.423	0.423	0.00423	0.000381	4.55	4.55	0.0455	0.004095	0.556 UJ	0.278	0.00278	0.00025
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	0.169	0.169	0.00169	0.00169	0.0668	0.0668	0.000668	0.000668	0.0937 U	0.04685	0.0004685	0.000469	0.0477 U	0.02385	0.0002385	0.000239
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.309	0.309	0.0309	0.0309	0.0854	0.0854	0.00854	0.00854	0.107 U	0.0535	0.00535	0.00535	0.0472	0.0472	0.00472	0.00472
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.05	0.0751	0.0751	0.00751	0.003755	0.0644	0.0644	0.00644	0.00322	0.11 U	0.055	0.0055	0.00275	0.0415 U	0.02075	0.002075	0.001038
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.201	0.201	0.0201	0.0201	0.0775	0.0775	0.00775	0.00775	0.103 U	0.0515	0.00515	0.00515	0.0472	0.0472	0.00472	0.00472
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.01	0.143	0.143	0.0143	0.00143	0.0678	0.0678	0.00678	0.000678	0.254	0.254	0.0254	0.00254	0.0438 U	0.0219	0.00219	0.000219
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.11	0.11	0.011	0.011	0.057	0.057	0.0057	0.0057	0.125 U	0.0625	0.00625	0.00625	0.0368 U	0.0184	0.00184	0.00184
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.1	0.0711	0.0711	0.00711	0.00711	0.061	0.061	0.0061	0.0061	0.236	0.236	0.0236	0.0236	0.0393 U	0.01965	0.001965	0.001965
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.1	0.0783	0.0783	0.003915	0.00783	0.0517	0.0517	0.002585	0.00517	0.0566 U	0.0283	0.001415	0.00283	0.0346	0.0346	0.00173	0.00346
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.0506	0.0506	0.0506	0.0506	0.0483	0.0483	0.0483	0.0483	0.135 U	0.0675	0.0675	0.0675	0.0337 U	0.01685	0.01685	0.01685
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.106	0.106	0.0106	0.0106	0.0521	0.0521	0.00521	0.00521	0.114 U	0.057	0.0057	0.0057	0.0335 U	0.01675	0.001675	0.001675
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	1	0.139	0.139	0.0695	0.139	0.0556	0.0556	0.0278	0.0556	0.0818 UJ	0.0409	0.02045	0.0409	0.0409 UJ	0.02045	0.010225	0.02045
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	1	0.0622	0.0622	0.00622	0.0622	0.0743	0.0743	0.00743	0.0743	0.0838 U	0.0419	0.00419	0.0419	0.0464 U	0.0232	0.00232	0.0232
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.0759	0.0759	0.0759	0.0759	0.0884	0.0884	0.0884	0.0884	0.114 U	0.057	0.057	0.057	0.0556 U	0.0278	0.0278	0.0278
Heptachlorodibenzofurans	8290	ng/kg	NA	NA	1.23	1.23	NA	NA	0.195	0.195	NA	NA	2.14	2.14	NA	NA	0.305 UJ	0.1525	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	2.3	2.3	NA	NA	0.761	0.761	NA	NA	8.51	8.51	NA	NA	0.946 UJ	0.473	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	NA	0.851	0.851	NA	NA	0.163	0.163	NA	NA	0.778	0.778	NA	NA	0.253	0.253	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.363	0.363	NA	NA	0.474855	0.474855	NA	NA	0.749	0.749	NA	NA	0.31317 9 U	0.1565895	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	NA	0.49	0.49	NA	NA	0.173	0.173	NA	NA	0.0818 UJ	0.0409	NA	NA	0.153 UJ	0.0765	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.413583	0.413583	NA	NA	0.399355	0.399355	NA	NA	0.43983 2 U	0.21991	NA	NA	0.29901 5 U	0.1495075	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	NA	0.06525	0.06525	NA	NA	0.074308	0.074308	NA	NA	0.08376 7 U	0.0418835	NA	NA	0.04642 6 U	0.023213	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.299145	0.299145	NA	NA	0.278158	0.278158	NA	NA	0.11448 9 U	0.0572445	NA	NA	0.25022 8 U	0.125114	NA	NA
Total 2,3,7,8-TCDD TEQ							**0.3**	**0.4**			**0.2**	**0.3**			**0.3**	**0.3**			**0.1**	**0.1**

Notes:

TEQ = Toxicity Equivalent Quotient

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table H-9. Site 1 Dioxin TEQ Calculations, 0 to 6 feet bgs

Analyte	Analytical Method	Units	TEF Value Human/Mammal	TEF Value Bird	01-DP12 1 to 1.5 feet bgs LE027 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-T05 0.5 feet bgs LE172 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-T5S 0.5 feet bgs LE173 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-T23 3 feet bgs LE176 Original Data	Transformed Data	TEQ Value Human/Mamma	TEQ Value Bird
Dioxins																				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0001	0.0889 U	0.04445	0.000004445	0.000004445	4.6 J	4.6	0.00046	0.00046	3.2 J	3.2	0.00032	0.00032	4.15 J	4.15	0.000415	0.00042
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	0.0001	1.54 UJ	0.77	0.000077	0.000077	31.4	31.4	0.00314	0.00314	24	24	0.0024	0.0024	90.5	90.5	0.00905	0.00905
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	0.101	0.101	0.00101	0.00101	8.19	8.19	0.0819	0.0819	2.18 J	2.18	0.0218	0.0218	5.09	5.09	0.0509	0.0509
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.0009	0.396 UJ	0.198	0.00198	0.0001782	4.66	4.66	0.0466	0.004194	2.61 J	2.61	0.0261	0.00235	19.9	19.9	0.199	0.01791
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	0.0721 U	0.03605	0.0003605	0.0003605	0.528 J	0.528	0.00528	0.00528	0.183 J	0.183	0.00183	0.00183	0.522 J	0.522	0.00522	0.00522
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.0422 U	0.0211	0.00211	0.00211	2.03 J	2.03	0.203	0.203	0.375 J	0.375	0.0375	0.0375	1.53 J	1.53	0.153	0.153
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.05	0.0638 U	0.0319	0.00319	0.001595	0.434 J	0.434	0.0434	0.0217	0.269 U	0.1345	0.01345	0.00673	1.01 J	1.01	0.101	0.0505
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.044	0.044	0.0044	0.0044	2.04 J	2.04	0.204	0.204	0.437 J	0.437	0.0437	0.0437	1.47 J	1.47	0.147	0.147
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.01	0.0671 U	0.03355	0.003355	0.0003355	0.548 J	0.548	0.0548	0.00548	0.248 J	0.248	0.0248	0.00248	1.92 J	1.92	0.192	0.0192
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.0491 U	0.02455	0.002455	0.002455	0.481	0.481	0.0481	0.0481	0.149 J	0.149	0.0149	0.0149	0.496 J	0.496	0.0496	0.0496
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.1	0.0603 U	0.03015	0.003015	0.003015	0.501 J	0.501	0.0501	0.0501	0.161 J	0.161	0.0161	0.0161	1.78 J	1.78	0.178	0.178
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.1	0.0403	0.0403	0.002015	0.00403	1.24 J	1.24	0.062	0.124	0.267 J	0.267	0.01335	0.0267	0.925 J	0.925	0.04625	0.0925
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.0436 U	0.0218	0.0218	0.0218	0.449 J	0.449	0.449	0.449	0.269 U	0.1345	0.1345	0.1345	0.904 J	0.904	0.904	0.904
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	0.0447 U	0.02235	0.002235	0.002235	2.11 J	2.11	0.211	0.211	0.556 J	0.556	0.0556	0.0556	2.11 J	2.11	0.211	0.211
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	1	0.0367 UJ	0.01835	0.009175	0.01835	1.83 J	1.83	0.915	1.83	0.487 J	0.487	0.2435	0.487	1.85 J	1.85	0.925	1.85
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	1	0.0493 U	0.02465	0.002465	0.02465	1.04	1.04	0.104	1.04	0.624	0.624	0.0624	0.624	1.34	1.34	0.134	1.34
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	0.0585 U	0.02925	0.02925	0.02925	0.424 U	0.212	0.212	0.212	0.364 U	0.182	0.182	0.182	0.394 J	0.394	0.394	0.394
Heptachlorodibenzofurans	8290	ng/kg	NA	NA	0.064917 U	0.0324585	NA	NA	11.8	11.8	NA	NA	3.45	3.45	NA	NA	8.8	8.8	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.64 UJ	0.32	NA	NA	13	13	NA	NA	8.23	8.23	NA	NA	39.9	39.9	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	NA	0.044	0.044	NA	NA	20.6	20.6	NA	NA	4.18	4.18	NA	NA	16.8	16.8	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.42178 U	0.21089	NA	NA	4.68	4.68	NA	NA	1.34	1.34	NA	NA	23.3	23.3	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	NA	0.077 UJ	0.0385	NA	NA	29.2	29.2	NA	NA	5.54	5.54	NA	NA	21.4	21.4	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.379602 U	0.189801	NA	NA	4.18	4.18	NA	NA	0.902	0.902	NA	NA	10.9	10.9	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	NA	0.04933 U	0.024665	NA	NA	39	39	NA	NA	7.58	7.58	NA	NA	28.8	28.8	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	0.306249 U	0.1531245	NA	NA	1.6	1.6	NA	NA	0.364097 U	0.1820485	NA	NA	7.25	7.25	NA	NA
Total 2,3,7,8-TCDD TEQ							**0.1**	**0.1**			**2.7**	**4.5**			**0.9**	**1.7**			**3.7**	**5.5**

Notes:

TEQ = Toxicity Equivalent Quotient

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Table H-9. Site 1 Dioxin TEQ Calculations, 0 to 6 feet bgs

Analyte	Analytical Method	Units	TEF Value Human/Mammal	TEF Value Bird	01-T33 3 feet bgs LE177 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-T34 2 feet bgs LE181 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird	01-T34 6 feet bgs LE182 Original Data	Transformed Data	TEQ Value Human/Mammal	TEQ Value Bird
Dioxins																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	ng/kg	0.0001	0.0001	21.1	21.1	0.00211	0.00211	2.37 J	2.37	0.000237	0.000237	0.525 U	0.2625	0.00002625	0.00002625
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	8290	ng/kg	0.0001	0.0001	568	568	0.0568	0.0568	98.3	98.3	0.00983	0.00983	4.27 UJ	2.135	0.0002135	0.0002135
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	29.1	29.1	0.291	0.291	2.33 J	2.33	0.0233	0.0233	0.262 U	0.131	0.00131	0.00131
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	8290	ng/kg	0.01	0.0009	96.2	96.2	0.962	0.08658	14.4	14.4	0.144	0.01296	0.676 UJ	0.338	0.00338	0.0003042
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	ng/kg	0.01	0.01	2.39 J	2.39	0.0239	0.0239	0.183 J	0.183	0.00183	0.00183	0.262 U	0.131	0.00131	0.00131
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	9.91	9.91	0.991	0.991	0.481 J	0.481	0.0481	0.0481	0.262 U	0.131	0.0131	0.0131
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.05	4.87	4.87	0.487	0.2435	2.31 J	2.31	0.231	0.1155	0.398 U	0.199	0.0199	0.00995
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	8.22	8.22	0.822	0.822	0.365 J	0.365	0.0365	0.0365	0.262 U	0.131	0.0131	0.0131
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.01	9.4	9.4	0.94	0.094	1.63 J	1.63	0.163	0.0163	0.32 U	0.16	0.016	0.0016
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	2.88 J	2.88	0.288	0.288	0.24 J	0.24	0.024	0.024	0.262 U	0.131	0.0131	0.0131
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	8290	ng/kg	0.1	0.1	8.53	8.53	0.853	0.853	1.81 J	1.81	0.181	0.181	0.335 U	0.1675	0.01675	0.01675
1,2,3,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.05	0.1	7.7	7.7	0.385	0.77	0.261 J	0.261	0.01305	0.0261	0.262 U	0.131	0.00655	0.0131
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	5.69	5.69	5.69	5.69	1.19 J	1.19	1.19	1.19	0.262 U	0.131	0.131	0.131
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	ng/kg	0.1	0.1	13.5	13.5	1.35	1.35	0.411 J	0.411	0.0411	0.0411	0.262 U	0.131	0.0131	0.0131
2,3,4,7,8-Pentachlorodibenzofuran	8290	ng/kg	0.5	1	13.7	13.7	6.85	13.7	0.462 J	0.462	0.231	0.462	0.262 U	0.131	0.0655	0.131
2,3,7,8-Tetrachlorodibenzofuran	8290	ng/kg	0.1	1	11.5	11.5	1.15	11.5	0.536 J	0.536	0.0536	0.536	0.233 J	0.1165	0.01165	0.1165
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	8290	ng/kg	1	1	2.51	2.51	2.51	2.51	0.277 U	0.1385	0.1385	0.1385	0.242 U	0.121	0.121	0.121
Heptachlorodibenzofurans	8290	ng/kg	NA	NA	47.3	47.3	NA	NA	7.21	7.21	NA	NA	0.262417 U	0.1312085	NA	NA
Heptachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	176	176	NA	NA	61.5	61.5	NA	NA	0.676 UJ	0.338	NA	NA
Hexachlorodibenzofurans	8290	ng/kg	NA	NA	97.5	97.5	NA	NA	7.96	7.96	NA	NA	0.262417 U	0.1312085	NA	NA
Hexachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	102	102	NA	NA	45.6	45.6	NA	NA	0.34807 U	0.174035	NA	NA
Pentachlorodibenzofurans	8290	ng/kg	NA	NA	148	148	NA	NA	4.06	4.06	NA	NA	0.262417 U	0.1312085	NA	NA
Pentachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	54.4	54.4	NA	NA	20.3	20.3	NA	NA	0.344291 U	0.1721455	NA	NA
Tetrachlorodibenzofurans	8290	ng/kg	NA	NA	249	249	NA	NA	3.78	3.78	NA	NA	0.137087 U	0.0685435	NA	NA
Tetrachlorodibenzo-P-Dioxins	8290	ng/kg	NA	NA	43.4	43.4	NA	NA	11.7	11.7	NA	NA	0.242053 U	0.1210265	NA	NA
Total 2,3,7,8-TCDD TEQ							**23.7**	**39.3**			**2.5**	**2.9**			**0.4**	**0.6**

Notes:

TEQ = Toxicity Equivalent Quotient

NA indicates that no TEF value is associated with the analyte and thus the analyte does not contribute to the TEQ.

Attachment H-10
Natural History Profiles of Representative Species

Name: Ornate Shrew (*Sorex ornatus*)

Taxonomy: *Sorex ornatus* is a rare species of shrew located only in coastal marshes and riparian communities of California and Baja California. Nine subspecies have been described, two of which were widely distributed in past history while seven others were found in small patches along coastal marshes, inland valleys, and montane meadows (Maldonado et al., 2001). Differentiation of Ornate Shrews into subspecies is largely based on body size and pelage coloration of a small number of specimens, and while this species shows a large degree of variation in size and pelage color, and many exhibit different degrees of melanism, genetic differences between the subspecies are few. Therefore, "splitting" the species into subspecies based on these phenotypic variations may not be reliable (Maldonado et al., 2001).

Most of the available information on the Ornate Shrew pertains to two subspecies. The Suisun Shrew (*Sorex ornatus sinuosus*) is a Federal Species of Concern and a California Species of Special Concern. This subspecies is now restricted to remnants of natural tidal and brackish marshes along the northern borders of San Pablo and Suisun bays in California (WESCO, 1986). The Buena Vista Lake Shrew (*Sorex ornatus relictus*) is one of two subspecies of the Ornate Shrew that occur in the San Joaquin Valley, and has been listed as an Endangered Species by the U.S. Fish and Wildlife Service (DOI, 2002). The species profile that follows is therefore comprised of information taken from separate sources pertaining to different subspecies.

Size: Ornate Shrews range in length from 9.8 to 10.5 cm. Their body weights range from 4.1 to 7.6 grams, with a mean weight of 5.85 grams (Brown et al., 1996). In most shrews, winter weight is 70% of their first-year weight, and 50% of their second-year weight (Hays, 1990).

Foraging Area: Data regarding the foraging area or territory size of the Ornate Shrew are unavailable. The short-tailed shrew has an approximate foraging area of 0.22 ha (Platt, 1976).

Density: A favorable habitat should support densities of 111 individual shrews per hectare, according to estimations by Newman (1970). Suisun shrews exist in aggregations that consist of one dominant male and several females. In between the aggregations are young and/or subdominant males that were dispersed from the groups (Hays, 1990).

Habitat: Ornate Shrews prefer mesophytic communities with dense cover and an abundant litter layer. Typical plants found in these communities are Fremont cottonwood, willows, alkali heath, wild rye grass, and Baltic rush (Brown et al., 1996). Suisun Shrews tend to inhabit tidal marshes that can be characterized in order of their decreasing tolerance to inundation: *Spartina foliosa* (cordgrass), *Salicornia ambigua, Salicornia virginica* (pickleweed), and *Grindelia cuneifolia* and *humulis* (gumplant), and brackish marshes dominated by *Scirpus californicus* (California bulrush) and *Typha latifolia* (cattail) (Rudd 1955).

Ornate Shrews build dome-shaped nests made of dead plant material and paper scraps, usually on top of the soil surface below driftwood or planks situated above the high tide line (WESCO, 1986).

Ornate Shrews are active day and night but are rarely observed due to their small size and cryptic behavior. They do not hibernate, but can enter a daily state of inactivity (called torpor) to survive extreme environmental conditions (DOI, 2002).

Reproduction: Breeding typically occurs February through early October (Brown et al., 1996) and peaks in May (Newman and Rudd, 1978). Litter size ranges from 4 to 7 young, with a mean of 5.2.

Gestation typically lasts 21 days (Cal/Ecotox, 2000). After breeding occurs, each aggregation is left with one dominant male and several breeding and immature females. Young, subdominant males leave the aggregations but do return in early spring to compete with resident males during the next breeding season (Hays, 1990). The longevity of Ornate Shrews is only 16 – 18 months (Cal/Ecotox, 2000) and deaths tend to occur shortly after the breeding season (Rudd, 1955).

Feeding: Ornate Shrews will feed indiscriminately on available larvae and adults of several species of aquatic and terrestrial insects, and are also known to consume spiders, centipedes, slugs, snails, and earthworms on a seasonally available basis (DOI, 2002). They have a very high body metabolism and are therefore able to eat between 60 and 200% of their body mass daily, and lactating females can eat up to 300% of their body mass (Genoud and Vogel, 1989). For the short-tailed shrew, the standard metabolic rate is approximately 190% the rate predicted from body weight (Deavers and Hudson, 1981). This risk assessment will use the allometric equation of Nagy (2001) developed for insectivores, to estimate food intake of the shrew: mean = 1.119 grams (range = 0.897 to 1.317 grams).

Predators: Shrews are seldom preyed upon, possibly because they tend to stay deeply under vegetation (Pearson, 1946, Crowcroft, 1957) or because they are unpalatable due to the distasteful secretions and offensive odor from their flank glands and feces (DOI, 2002).

Exposure Factors:

Feeding Rate: Mean: 1.119 grams/day (DW) Max: 1.317 grams/day (DW) (derived using Nagy, 2001 allometric equation for mammal food intake) (Deavers and Hudson, 1981; Nagy, 2001).

Drinking Rate: Mean: 0.001 L/day; Max: 0.0012 L/day (derived using allometric equation for drinking water from EPA, 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.03 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 1.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.009 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.05
Animals: 0.941 (Derived from DOI, 2002)

References:

Beyer, W.N., E.E. Connor, S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife, J. Wildl. Manage., 58(2):375-382.

Brown, N.L., Johnson, C.D., and D.F. Williams. 1996. Buena Vista Lake shrew, *Sorex ornatus relictus*. *Available at:* http://arnica.csustan.edu/esrpp/bvls.htm

California Wildlife Biology, Exposure Factor, and Toxicity Database (Cal/Ecotox). 2000. Cal/Ecotox species exposure factor reports; Exposure factors for Ornate Shrew (*Sorex ornatus*). State of California OEHHA. *Available at:* http://www.oehha.org/cal_ecotox/species_reports.htm

Crowcroft, P. 1957. The life of the shrew. Max Reinhardt, London, England.

Deavers, D.R., and Hudson, J.W. 1981. Temperature regulation in two rodents (*Clethrionomys gapperi* and *Peromyscus leucopus*) and a shrew (*Glarina brevicauda*) inhabiting the same environment. Physiol. Zool. 54:94-108.

Department of Interior (DOI). 2002. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Endangered Status for the Buena Vista Lake Shrew (*Sorex ornatus relictus*). U.S. Fish and Wildlife Service. *In:* Federal Register 67(44):10101-10113.

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Genoud, M. and P. Vogel. 1989. Energy requirements during reproduction and reproductive effort in shrews (Soricidae). Journal of Zoology 220:41-60.

Hays, W.S. 1990. Population ecology of ornate shrews, *Sorex ornatus*. Unpub. M.A. dissertation in zoology, University of California, Berkely, California.

Maldonado, J.E., Vila, C., and R.K. Wayne. 2001. Tripartite genetic subdivisions in the ornate shrew (*Sorex ornatus*). Molecular Ecology 10:127-147.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Newman, J.R. 1970. Energy flow of a secondary consumer (*Sorex sinuosus*) in a salt marsh community. Dissertation Abstract, 32B:883.

Newman, J.R. and R.L. Rudd. 1978. Minimum and maximum metabolic rates of *Sorex sinuosus*. Acta Theriologica 23(23):371-380.

Pearson, O.P. 1946. Scent glands of the short-tailed shrew. Anatomical Record 94:615-620.

Platt, W. J., 1976. The Social Organization and Territoriality of Short-tailed Shrew (Blarina brevicauda) Populations in Old Field Habitats. Animal Behavior 24: 305-318.

Rudd, R.L. 1955. Age, sex and weight comparisons in three species of shrews. J. Mammology 36:323-338.

Western Ecological Services (WESCO). 1986. A review of the population status of the Suisun shrew (*Sorex ornatus sinuosus*). Final Report for U.S. Fish and Wildlife Service, Sacramento, California. 59 pp.

Name: Deer Mouse (*Peromyscus maniculatus*)

Size: Deer mice range from 7.1 to 10.2 cm in length, with a 5.1 to 13 cm tail (Burt and Grossenheider, 1980). Schlesinger and Potter (1974) reported a mean weight of 22 grams for adult females and 20 grams for adult males. Minimum, mean, and maximum weights of 18.25, 19.6, and 20.9 grams, respectively, were derived from Schlesinger and Potter's data and will be used in this risk assessment.

Foraging Area: The deer mouse nests in burrows in the ground, in trees, stumps, and buildings. Bowers and Smith (1979) report mean home ranges of 0.128 and 0.094 ha for male and female deer mice, respectively, for the Idaho high desert. This is most similar to site habitat, so as a conservative exposure estimate, a foraging area of 0.1 ha is assumed for the purposes of this assessment.

Density: Population densities vary over space and time and are often positively correlated with food abundance (Taitt, 1981; Wolff, 1989), moisture contents of plants (Bowers and Smith, 1979), and vegetative cover (van Horne, 1982). Population density can range from 3.9 to 28 per hectare (Metzgar, 1979).

Habitat: The deer mouse inhabit nearly all types of dry-land habitats within their range: short- grass prairies, grass-sage communities, coastal sage scrub, sand dunes, wet prairies, upland mixed and cedar forests, deciduous forests, ponderosa pine forests, other habitats (Holbrook, 1979; Kaufman and Kaufman, 1989; Ribble and Samson, 1987; Wolff and Hurlbutt, 1982).

Reproduction: The breeding season of the deer mouse is normally from February to November; the duration of reproductive season varies with latitude (Burt and Grossenheider, 1980). The deer mouse produces 2 to 4 litters per year; 3 to 5 pups per litter (Burt and Grossenheider, 1980). In Alberta, Canada, deer mice reach sexual maturity 35 days after birth (Millar, 1985).

Feeding: Deer mice eat seeds, arthropods, some green vegetation, roots, fruits, and fungi as available (Johnson, 1961; Menhusen, 1963; Whitaker, 1966).

Predators: House cat, hawks, fox, coyote, and snakes.

Exposure Factors:

Feeding Rate: Mean is 3.322 grams/day dry weight and maximum is 3.491 grams (derived using allometric equation for rodent food ingestion, Nagy, 2001).

Drinking Rate: Mean is 0.003 L/day (derived using allometric equation for drinking water, EPA, 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.032 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 1.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.012 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.494

Animals: 0.494 (Derived from Whitaker 1966)

References:

Bowers, M.A. and Smith, H.D. 1979. Differential habitat utilization by sexes of the deer mouse, *Peromyscus maniculatus*. Ecology 60: 869-875.

Burt, W. H. and R. P. Grossenheider, 1976. A Field Guide to the Mammals, 3rd. edition, Houghton Mifflin Company, Boston, MA.

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Holbrook, S.J. 1979. Habitat utilization, competitive interactions, and coexistence of three species of cricetine rodents in east-central Arizona. Ecology 60: 758-769.

Johnson, D.R. 1961. The food habits of rodents in range lands of southern Idaho. Ecology 42: 407-410.

Kaufman, D.W. and Kaufman, G.A. 1989. Population biology. In: Kirkland, G.L.; Lane, J.N., eds. Advances in the study of *Peromyscus* (Rodentia). Lubbock, TX: Texas Tech University Press.

Menhusen, B.R. 1963. An investigation on the food habits of four species of rodents in captivity. Trans. Kansas Acad. Sci. 66: 107-112.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Metzgar, L.H. 1979. Dispersion patterns in a *Peromyscus* population. J. Mammal. 60: 129-145.

Millar, J.S. 1985. Life cycle characteristics of *Peromyscus maniculatus nebrascensis*. Can. J. Zool. 63: 1280-1284.

Ribble, D.O. and Samson, F.B. 1987. Microhabitat associations of small mammals in southeastern Colorado, with special emphasis on *Peromyscus* (Rodentia). Southwest. Nat. 32: 291-303.

Taitt, M.J. 1981. The effect of extra food on small rodents populations: deer mice (*Peromyscus maniculatus)*. J. Anim. Ecol. 50: 111-124.

van Horne, B. 1982. Niches of adult and juvenile deer mice (*Peromyscus maniculatus)* in seral stages of coniferous forest. Ecology 63: 992-1003.

Whitaker, J. O. 1966. Food of *Mus musculus*, *Peromyscus maniculatus bairdi*, and *Peromyscus leucopus* in Vigo County, Indiana, J. Mammal. 47: 473-486.

Wolff, J.O. 1989. Social behavior. In. Kirkland, G.L. and Lane, J.N., eds. Advances in the study of *Peromyscus* (Rodentia). Lubbock, TX: Texas Tech University Press; pp. 271-291.

Name: Long-tailed Weasel (*Mustela frenata*)

Size: Males of this species tend to be somewhat larger than females, with head and body lengths of 22.8 – 26.6 cm (males) and 20.3 – 22.8 cm (females) (Burt and Grossenheider, 1976). Tails of both sexes are about 50% of their total body length (Baker, 1983). Given the range of adult weasel weights is 80 to 450 grams (Baker, 1983) we might assume that a mean weight for risk assessment purposes is 265 grams.

Foraging Area: The home range for the long-tailed weasel is 12 to 16 ha (Burt and Grossenheider, 1976). As a conservative exposure estimate, a foraging area of 12 ha is assumed for the purposes of this assessment.

Density: The density of weasel populations is estimated at 15 to 20 per 259 ha (Burt and Grossenheider, 1976).

Habitat: Weasels are found in temperate and tropical habitats in North and Central America. They inhabit crop fields and small wooded areas and will burrow and nest in hollow logs, rock piles, and under barns. Weasels sometimes take over the burrow of one of their prey (Baker, 1983).

Reproduction: The long-tailed weasel mates in July or August. Four to eight young are born in late April or early May after a gestation period of 2.5 to 337 days. Their eyes open at 35 days. Males reach sexual maturity at one year, while females are capable of reproducing at 3 – 4 months (Baker, 1983).

Feeding: Weasels are strictly carnivorous but may ingest some soil while feeding. They prey on mammals up to rabbit size, and also take a few birds and other animals by piercing the prey's skull with its canines and killing it (Burt and Grossenheider, 1976).

Predators: Man

Exposure Factors:

Feeding Rate: Mean: 16.058 grams (DW) /day; Max: 24.973 grams (DW)/ day (derived using allometric equation for food ingestion for all mammals, Nagy, 2001).

Drinking Rate: Mean: 0.030 L/day; Max: 0.048 L/day (derived using allometric equation for drinking water, EPA, 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.043 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 1.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.013 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 0.987 (Derived from Burt and Grossenheider, 1976)

References:

Baker, R.H., 1983. Michigan Mammals. Michigan State University Press. USA.

Beyer, W.N., E.E. Connor, S. Gerould, 1994. Estimates of Soil Ingestion by Wildlife, J. Wildl. Manage., 58(2):375-382.

Burt, W. H. and R. P. Grossenheider, 1976. A Field Guide to the Mammals, 3rd. edition, Houghton Mifflin Company, Boston, MA.

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Knable, A.E., 1974. Seasonal trends in the utilization of major food groups by the red fox (*Vulpes fulva*) in Union County, IL. Trans. III. State Acad. Sci. 66: 113-115.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Name: Western Meadowlark (*Sturnella neglecta)*

Size: The western meadowlark measures about 28 cm long with a 13 cm tail, thick stout body, large legs, and a long, straight bill (Dunn 1998). The minimum and maximum weight of the adult western meadowlark has been reported as 74.1 and 114 grams, respectively (Lanyon, 1962). From those data a mean weight of approximately 94.05 grams can be derived. A unique foot structure allows the meadowlark to walk about on the ground, instead of hopping like other birds.

Foraging Area: The foraging area of the western meadowlark is approximately 3.0 ha (Schoener 1968).

Density: The density of western meadowlarks ranges from 0.1-1.0 birds/acre (Bryant 1914).

Habitat: The western meadowlark habitats include meadows, plains and prairies.

Reproduction: In California, the western meadowlark nests between March and August (Bryant 1914). The female builds a nest on the ground, hidden in a clump of grass and domed with grass and weed fibers. A small hole on the side, and a hidden runway up to four feet long, allows the meadowlark an entrance to the nest. The female lays one whitish pink egg, speckled with lavender and brown, each day for five days. The female incubates for 14 days and only leaves the nest for brief periods, while the male searches for food (Dunn 1998).

Feeding: The western meadowlark feeding habits are marked by seasonal differences in their main staples. They eat grain during winter and early spring, insects late spring and summer, and weed seeds in fall. (Lanyon 1994). It is a powerful flyer that eats insects, making it an asset to landowners (Dunn 1998).

Predators: Cats, dogs, hawks, owls, foxes and skunks.

Exposure Factors:

Feeding Rate: Mean: 14.038 grams/day (DW); Min: 13.555 grams/day (DW); Max: 16.003 grams/day (derived using passerine allometric equation, Nagy, 2001).

Drinking Rate: 12 ml/day (derived using passerine allometric equation EPA 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.164 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 1.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.064 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.343
Animals: 0.593(Derived from Lanyon, 1994)

References:

Beyer, W.N., E.E. Connor, S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife, J. Wildl. Manage., 58(2):375-382.

Bryant, Harold C. 1914. A determination of the economic status of the western meadowlark (*Sturnella neglecta*) in California. Univ. of Calif. Publ. Zool. 11(14):377-510.

Dunn, Ann Bailey. 1998. A closer look: The Western Meadowlark. North Dakota Outdoors 60(8)9. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/1998/westlark/westlark.htm (Version 15MAY98).

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Lanyon, Wesley E. 1994. "Western Meadowlark." In *The Birds of North America No. 104.* A. Pool, P. Stettenheim, and F. Gill, eds. The Academy of Natural Sciences, Philadelphia, and the American Ornithologists Union, Washington, D.C.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Schoener, T., 1968. Sizes of Feeding Territories Among Birds, Ecology, Vol. 49, Harvard University, Cambridge, Massachusetts.

Name: Mourning Dove (*Zenaida macroura*)

Size: The average size of a mourning dove is 30.5 cm; its weight ranges from 115-140 grams with a mean weight of 119 grams (Dunning, 1993).

Foraging Area: A search for the foraging area of the Mourning dove was unsuccessful. A calculation involving the relationship of daily food consumption to body weight for the Mourning dove was used to estimate a foraging area of 0.53 (ha) (Schoener, 1966). The herbivore relationship was assumed to best apply to the Mourning dove because seeds and vegetable matter comprises over 90 percent of its diet.

Density: Population densities range from 1 to 5 per 2.02 ha in California (Garber, 1955).

Habitat: Mourning doves can be found in the desert (near water) to open woodland, agricultural areas with scattered trees, and suburbs. They will nest in the fork of a horizontal tree branch, on ground, on deserted nest of other species, or anywhere else providing solid support (Ehrlich et al., 1988).

Reproduction: Mourning doves generally nest between mid-March and mid-September and produce 2-3, but occasionally 3-6 clutches per year (Ehrlich et al., 1988). Mourning doves almost always lay two eggs (Brown, 1989; Verner, 1980); gestation period is approximately 15 days (Ehrlich et al., 1988).

Feeding: Since the mourning dove's diet consists of seeds, including waste grain from cultivated fields (Ehrlich et al., 1988), incidental ingestion of soil will occur. Since the Mourning dove feeds on the ground, it is assumed that at least a minimal amount of incidental soil ingestion occurs.

Predators: Humans, hawks, owls, cats, dogs, blue jays, and squirrels (Assoc. of Game and Fish, 1957).

Exposure Factors:

Feeding Rate:	Mean is 16.479 grams (dw)/day with a maximum of 18.414 grams (dw)/day (derived using allometric equation for food ingestion for passerine birds, Nagy, 2001).
Drinking Rate:	Mean is .0142 L/day (derived using allometric equation for drinking water, EPA, 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.139 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 1.00
Animals: 0.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.061 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.939 (Derived from Ehrlich et al., 1988)
Animals: 0.00

References:

Brown, David E. 1989. Arizona game birds. Tucson, AZ: The University of Arizona Press. 307 p. [19900].

Beyer, W.N., E.E. Connor, S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife, J. Wildl. Manage., 58(2):375-382.

Dunning, J. B. 1993. Body Weights of 686 Species of North American Birds. Monograph No. 1., Western Bird Banding Association, May 1984, International Wildlife Rehabilitation Council, Reprint, Suisun, CA.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye, 1988. The Birder's Handbook, Simon and Schuster, Inc., New York, NY.

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Garber, R.R, 1955. Artificial incubation of some non-galliform eggs. Wilson Bull. 67(2): 100-109.

Journal of Wildlife Management, 1988. Apparent metabolizable energy content of foods used by mourning doves. 52(3): 481-483.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Southeastern Association of Game and Fish Commissioners, 1957. Mourning dove investigations: 1948-1956. Columbia, SC. 166 p. [19911].

Verner, Jared; Boss, Allan S., tech. coords. 1980. California wildlife and their habitats: western Sierra Nevada. Gen. Tech. Rep. PSW-37. Berkeley, CA: U.S. Depart. Of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 439 p. [10237].

Name: **Loggerhead Shrike (*Lanius ludovicianus*)**

Size: The adult loggerhead shrike is approximately 8.27 inches in length with an approximate weight of 47.5 grams (Campbell, 1998). Minimum and maximum body weights of 44 to 61.10 grams have been reported by Graber et al., 1973 and Terres, 1980. An average adult body weight of 52.55 grams will be used for the baseline risk assessment. The average body weight of nestlings ranged from 28.5 grams to 37.1 grams (Yosef and Grubb, 1994).

Foraging Area: Foraging usually occurs in early morning or at dusk (Miller, 1931), using perches to spot prey. Food is captured by swooping down from these perches or from foraging on the ground (Anderson, 1980; Bent, 1950; Miller, 1931). Territory size is 4 hectares (Scott and Morrison, 1990).

Density: Anecdotal evidence exists that sufficiently dense nest sites at appropriate heights may limit the loggerhead shrike's occurrence in the desert areas during breeding (Yosef, 1996; Campbell, 1998).

Habitat: The chief requirements for the loggerhead shrike are open terrain with well-spaced lookout posts, that are at least two feet high, from which moving animals, like insects or small vertebrates may be seen on the bare ground below or in short, sparse grasses (Grinnell and Miller, 1944). Brooks and Temple (1990) and Yosef and Grubb (1994) found that suitable hunting perches were very important.

Reproduction: The loggerhead shrike is generally monogamous, with minor exceptions (Verner and Wilson, 1969; Haas and Sloan, 1989; Yosef, 1996). Females lay their eggs from early February through June, with a peak in April (Kiff and Irwin, 1987; Yosef, 1996). Clutch size is typically 5 or 6 eggs, based on data sets from several large samples over a large area.

Feeding: Loggerhead shrikes are opportunistic and generalist in diet, with prey items including primarily arthropods and if available, a variety of small to medium-sized vertebrates (Miller, 1931; Yosef, 1992; Chapman and Castro, 1972; Reid and Fulbright, 1981; Scott and Morrison, 1995; Yosef, 1996). The majority of their diet in all or nearly all areas is invertebrates. The loggerhead shrike is known to occasionally forage on carrion, including road kills (Anderson, 1976; Hayes and Baker, 1987).

Predators: American kestrel, common raven, raptors, native predatory mammals, and feral cats.

Exposure Factors:

Respiratory Rate: Not available.

Feeding Rate: Mean is 9.43 grams/day dry weight. The maximum is 10.452 grams/day dry weight (derived using allometric equation for passerine food intake, Nagy, 2001).

Drinking Rate: Mean is 0.0082 L/day. The maximum is 0.0082 L/day (derived using allometric equation for drinking water, EPA, 1993).

Diet Partitioning Factor (for SRA):

Soil: 0.057 (90th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.00
Animals: 1.00 (assumed for SRA)

Diet Partitioning Factor (for BERA):

Soil: 0.024 (50th Percentile, Table 3. Estimated Distribution of P_s Values. EPA 2005).
Plants: 0.000
Animals: 0.976 (Derived from Yosef et al., 1993)

References:

Anderson, R. M. 1976. Shrikes feed on prey remains left by hawks. Condor 78: 269.

Anderson, G. 1980. The butcher. Kansas Fish and Game 37(6): 13-16.

Bent, A. C. 1950. *Lanius ludovicianus excubitorides* Swainson: White-rumped Shrike. pp 155-157 *In:* A. C. Bent (ed.), Life Histories of North American Wagtails, Shrikes, Vireos, and Their Allies. U. S. Natl. Mus. Bull. 197.

Brooks, B. L. and S. A. Temple. 1990. Habitat availability and suitability for loggerhead shrikes in the upper Midwest. Am. Midl. Nat. 123:75-83.

Campbell, K. F. 1998. Loggerhead Shrike-*Lanius ludovicianus*. California: Species of Special Concern. Campbell BioConsulting, 40950 Via Media, Temecula, CA.

Chapman, B. R. and S. D. Castro. 1972. Additional vertebrae prey of the loggerhead shrike in southeastern Alberta. Master's thesis, Univ. of Calgary, Calgary, Alberta.

Environmental Protection Agency, United States (EPA), 1993. Wildlife Exposure Factors Handbook, Volume 1, EPA/600/R-93/187a, December 1993.

———. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Graber, R. R., J. W. Graber, and E. L. Kirk. 1973. Illinois Birds: Laaniidae. Illinois. Natural History Survey Biological Notes No. 83.

Grinnell, J. and A. H. Miller. 1944. The Distribution of the Birds of California. Pacific Coast Avifauna 27.

Haas, C. A. and S. A. Sloan. 1989. Low return of migratory loggerhead shrikes: winter mortality of low site fidelity. Wilson Bull. 101: 458-460.

Hayes, F. E. and W. S. Baker. 1987. Loggerhead shrike feeds on dead American coot. W. Birds 18: 133-134.

Kiff, l. and D. Irwin. 1987. The breeding season of Los Angelas County birds. W. Tanager 53(7): 4-5.

Miller, A. H. 1931. Systematic revision and natural history of the American shrikes (*Lanius*). Univ. of Calif. Pub, in Zool. 38: 11-242.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. In: Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding. Vol. 71, No. 10. pp. 1R – 12R.

Reid, W. H. and A. J. Fulbright. 1981. Impaled prey of the loggerhead shrike in the northern Chihuahua Desert, New Mexico, Texas, USA. Southwest Nat. 26: 204-205.

Scott, T. A. and M. L. Morrison. 1990. Natural history and management of the San Clemente loggerhead shrike. Proc. West. Found. Vert. Zool. 4: 23-57.

Scott, T. A. and M. L. Morrison. 1995. Opportunistic foraging behavior of loggerhead shrikes. Shrikes (Laniidae) of the World: Biology and Conservation. Proc. West. Found. Vert. Zool. 6: 117-121.

Terres, J.K. 1980. The Audubon Society Encyclopedia Of North American Birds. Alfred A. Knoph, Inc., N.Y. 1109 pp.

Verner, J. and M. F. Wilson. 1969. Mating systems, sexual dimorphism, and the role of male North American passerine birds in the nesting cycle. Ornithol. Monogr. No. 9.

Yosef, R. 1992. Loggerhead shrikes eat crayfish. Florida Field Nat. 20: 75-76.

Yosef, R., Reuven, and T. C. Grubb, Jr. 1993. Effect of vegetation height on hunting behavior and diet of loggerhead shrikes. Condor. 95: 127-131.

Yosef, R. and T. C. Grubb, Jr. 1994. Resource dependence and territory size in loggerhead shrikes (*Lanius ludovicianus*). Auk 111: 465-469.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In:* A. Poole and F. Gill (eds.), The Birds of North America, No. 231. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Attachment H-11
Toxicological review of perchlorate

Attachment H-11 Toxicological Review of Perchlorate

Introduction

Perchlorate is a very stable anion that is associated with a cation to form an inorganic salt. Perchlorate anion consists of a chlorine (oxidation number of +7) surrounded by four oxygen (oxidation number of -2) atoms to form an oxychlorine anion (-1 charge). Perchlorates are inorganic salts with high melting points as defined in Table 1 and are soluble in water. There are five perchlorate salts that are manufactured in substantial amounts: magnesium, potassium, ammonium, sodium, and lithium perchlorate (ATSDR 2005).

Physical/chemical properties

Salts of perchlorates have high solubility in non-aqueous and aqueous environments (EPA 2002; Table 1). Although no specific information on degradation rates (half-lives) was located in the literature, ionic perchlorate reportedly can persist in surface water and groundwater for more than a decade (Callahan and Sprenger 1998). This is because of the high kinetic barrier for perchlorate to react with other constituents in water (Callahan and Sprenger 1998). Perchlorate salts, although relatively stable, are powerful oxidants when concentrated. It is for this reason that ammonium and other perchlorate salts are used in rocket propellants, fireworks, and munitions. Perchlorates are also present in fertilizers that were made with Chilean saltpeter. There is increasing evidence that low levels of perchlorate salts may occur naturally (ATSDR, 2005).

In water, perchlorates will rapidly dissolve and completely dissociate into the perchlorate anion and the corresponding cation. The cations of the solid perchlorate salts listed above are naturally occurring and ubiquitous in the environment. It is the perchlorate anion that is responsible for the potential adverse effects to ecological receptors. In the remainder of this document, perchlorates will be used to refer to the solid salts and perchlorate anion (or simply perchlorate) will be used to refer to the anionic species that is monitored in the environment.

In soils, perchlorate ions do not bind well to soil particles and are easily leached through soil by infiltrating water. The perchlorate ions (and associated cations) tend to accumulate in the saturated zone and move with the groundwater flow. Perchlorate may also be leached into surface water

bodies directly via surface water runoff or by discharge of contaminated groundwater to the surface and be carried far from their source. The detection of the perchlorate anion far from its source of production and use may seem to be at odds with the explosive reactivity of the solid perchlorate salts. This is because perchlorates have a large energetic barrier that must be overcome before they begin reacting and, therefore, they are relatively stable at moderate temperatures. Moreover, dilute aqueous solutions of the perchlorate salts, typical of those found in the environment, have almost no oxidizing power (ATSDR, 2005).

Although experimental studies detailing the environmental fate of perchlorates are limited, the current consensus indicates that they are persistent. Laboratory studies indicate that perchlorate undergoes biodegradation by a wide variety of microorganisms under anaerobic conditions. There is also a growing body of evidence that the perchlorate anion may be reduced to chloride by plants.

The perchlorate anion is highly mobile in wet soil and it is expected to ultimately partition to surface water and groundwater. On dry soil, it is immobile. It will not volatilize to the atmosphere, although perchlorates may be present in wind-borne dusts, especially near hazardous waste sites. Few studies were located that discuss bioaccumulation of perchlorates. Based on existing data, bioconcentration of perchlorate has been detected in plants, mammals, amphibians, fish, and insects near sites of known contamination.

Although perchlorate is not actively transported across cell membranes, it has been found at elevated concentrations in some plants, especially in areas of high evapotranspiration such as the desert southwest of the United States. Apparently the perchlorate ions are taken into the plant passively with the uptake of water and are moved into the leaves with the flow of water. As water is lost to evapotranspiration the perchlorate apparently accumulates in the leaves. The available data set is not yet sufficient to predict which plants are capable of accumulating and/or reducing perchlorate (ATSDR 2005).

Key physico-chemical properties of the three most common perchlorate salts, estimated using EPI 2000 Software (developed by the United States Environmental Protection Agency [EPA]), are provided in Table 1. Because the three perchlorate salts are estimated to have low vapor pressures (3.96×10^{-26} to 4.34×10^{-18} mm Hg at 25 °C; [EPA 2000]), partitioning to air will be limited. Additionally, all are highly soluble in water (0.15×10^{5} to 21×10^{5} mg/L at 25 °C) and have been identified in both surface and groundwater.

Table 9. Summary of Physical-Chemical Properties of Perchlorate

Physical Property	Cations Associated with Perchlorate Anion		
	$NH_4(ClO_4)$	$Na(ClO_4)$	$K(ClO_4)$
CAS No.	7790-98-9	7601-89-0	7778-74-7
Percent Perchlorate Ion by Weight	84.67%	81.22%	71.8%
Molecular weight	117.49	122.44	138.54
Color	White	White	White
Physical state	Crystalline solid	Crystalline solid	Powder
Melting point [a]	266.8 °C	302.6 °C	302.6 °C
Boiling point [a]	616.0 °C	692.7 °C	692.7 °C
Odor	No data	Odorless	Odorless
Solubility in water at 25 °C (mg/L) [a]	2.0×10^5	21×10^5	0.15×10^5
Partition coefficients [a]:			
Log K_{ow}	-5.84	-7.18	-7.18
Log K_{oc}	1.985	1.687	1.687
Henry's Law constant at 25 °C (atm-m^3/mole) [a]	2.8×10^{-11}	9.15×10^{-19}	2.17×10^{-19}
Vapor pressure at 25 °C (mm Hg) [a]	4.34×10^{-18}	1.47×10^{-25}	3.96×10^{-26}
Conversion factors	1 ppm = 4.80 mg/m^3 1 mg/m^3 = 0.208ppm	1 ppm = 5.0 mg/m^3 1 mg/m^3 = 0.20ppm	1 ppm = 5.66 mg/m^3 1 mg/m^3 = 0.177ppm

[a]Values estimated using EPA EPI Software (EPA 2000)

Toxicity of Perchlorate

The primary target of the perchlorate anion (perchlorate) in vertebrates such as birds and mammals is the thyroid gland. Perchlorate inhibits the transport of iodide (I-) from the blood into the thyroid follicle cells. The inhibition is thought to be accomplished by perchlorate competitively blocking iodide binding to a carrier, or sodium/iodide symporter (NIS), which catalyzes the simultaneous transfer of Na+ and I- across the basolateral membrane of thyroid follicle cells. Perchlorate inhibition of the NIS can limit the availability of iodide needed for the production of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which in turn, may affect the circulating levels of T4 and T3. All toxic effects of perchlorate on the thyroid hormone system derive directly or secondarily from the inhibition of the NIS. The competitive inhibition is completely reversible. If perchlorate exposure is removed, the perchlorate is lost from the thyroid and the blocking effect on the iodine binding site is lost (ATSDR, 2005).

A component of ecological risk assessment is translating effects on the thyroid and circulating thyroid hormones into ecologically relevant endpoints such as survival, growth and reproduction. Measurable effects on thyroid function can be seen at relatively low levels of perchlorate in the blood. However, adverse effects on survival, growth or reproduction may not be measurable until perchlorate levels are much greater.

TRVs for Ingestion Exposures for Wildlife

The ecotoxicologists for the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) have been reviewing the perchlorate toxicology literature to develop mammalian and avian toxicity reference values (TRV) for use in ecological risk assessments at Army sites (USACHPPM 2005). The following toxicity assessment is based on the draft USACHPPM document (USACHPPM, 2005), which has recently been released for public review. Sections 2.3 and 2.4 below are quoted from the draft USACHPPM document.

TRVs for Ingestion Exposures for the Class Mammalia

> "The toxicological database for perchlorate is extensive, and includes chronic as well as reproductive and developmental data. More than three species of two orders are represented, as well as chronic No-Observed-Adverse-Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values. Interpretation of these data in an ecological context is challenging; few adverse effects have been identified, yet the database is comprehensive. There is a general lack of adverse effects. Changes in thyroid structure and function (systemic hormone levels) have been found; however, the relevance of these endpoints to wildlife at the individual or population level of organization is questionable. Mortality is particularly relevant, but occurs only at relatively high exposures.
>
> In the companion studies by York et al. (2001a and 2001b), the authors have stated the LOAEL for rats and rabbits based on structural histological changes to the thyroid were 2.54 and 8.81 mg/kg/d, respectively; species comparable NOAELs were 0.254 and 0.762. York et al. (2004) used slightly different doses than the prior studies resulting in reported LOAEL and NOAEL for rats based on similar histological changes to the thyroid of 2.54 and 0.847 mg/kg/d, respectively. Similar effects on the thyroid gland were reported in studies using deer mice (Thuett et al., 2002b). None of these histological changes in themselves suggest organ failure, merely adaptation (e.g. changes in the size or number of follicular cells, changes in lumen shape, etc.) No evidence of cellular necrosis has been reported, and no other adverse effects (other than changes in T3 and T4 levels) have been linked to these findings.
>
> Available studies on rats indicate that a change in thyroid and pituitary hormone levels (T4, T3, and Thyroid-Stimulating Hormone [TSH]) is a more sensitive endpoint than observable histological changes to the thyroid gland (i.e., the lowest LOAEL reported for the rat is

0.0423 mg/kg/d, where Crofton (1998) reported decreased T4 thyroid hormone levels). The results of Crofton (1998) and King (1995) reveal a significant and rapid response in thyroid hormone levels to low concentrations of perchlorate. However, at higher doses with longer exposure durations or during a critical life stage, adverse whole body responses (e.g., reproduction, fetal development, and growth) have not been observed (York et al. 2001a and 2001b). It should be noted that EPA (2002) considers a dose level of 25.4 mg/kg/d perchlorate ion to be a developmental LOAEL for the rat based on data reported in Argus 2000 (as cited in EPA 2002), but not considered biologically relevant by the Argus study authors and therefore, not reported in the peer reviewed publication (i.e., York et al. 2001a).

The effects of pathologic changes in the thyroid gland to the health and ecology of the whole organism are not well understood. However, adverse effects to this organ may result in abnormalities in development or growth. Due to the lack of definitive correlations between thyroid pathology (indirect endpoint) and more ecologically relevant effects, it is reasonable to consider pathologic changes in the thyroid as nearly equivalent to an adverse effect on development or growth (the direct endpoints; USACHPPM 2000). Although the York et al. and Thuett et al. studies meet the minimum data set requirement of the Standard Practice (USACHPPM 2000), the data for deer mice was equivocal in nature and not considered sufficient for TRV derivation.

The only marked adverse effect from perchlorate exposure founding the literature is death. Von Burg (1995) reported the results of a 3 month rabbit study where nervous system effects were reported from exposures of 190 mg/kg-d; however, few details were provided and no original data could be found. If the approximation method is used to extrapolate a TRV from the most sensitive LD50 data (rabbit; using an uncertainty factor [UF] of 100), it results in a NOAEL-based TRV of 0.64 mg/kg-d and a LOAEL-based TRV of 6.4 mg/kg-d. This is comparable to a NOAEL and LOAEL-based TRV values using the data from the most sensitive species (rat) in the York et al. studies (0.847 and 2.54 mg/kg/d, respectively) using histological changes in thyroid (i.e., thyroid hyperplasia) as an endpoint. Since these changes were reported as hyperplasia (increases in the number of normal cells), this finding is of uncertain biological significance for ecological receptors and not conducive for TRV derivation. These values are also protective of the only other non-confirmed report of adverse effects (i.e. nervous system effects) in rabbits from exposures of 3 months in duration (Von Burg 1995). Together, these relationships provide a weight of evidence that shows the approximation approach is reasonable when applied to the acute mortality data. Therefore, the TRVs for the Class Mammalia were derived from the LD50 for the rabbit (most sensitive for lethality) using an UF of 100 for the NOAEL-based value and a UF of 20 for the LOAEL-based value.

Table 2 presents the selected TRVs. A medium level of confidence has been given to these TRVs because, though much data are available, there is considerable uncertainty regarding the relevance of thyroid structural and functional changes in wildlife" (USACHPPM, 2005)."

Table 10. Selected Ingestion TRVs for the Class Mammalia

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	0.64	Medium
LOAEL-based	6.4	Medium

TRVs for Ingestion Exposures for the Class Aves

"Three avian studies were evaluated, with two (McNabb et al. 2004a and 2004b) important in TRV derivation. McNabb et al. (2004a) evaluated the effects of perchlorate on thyroid hormone levels (2- and 8-week study) and growth parameters (8-week study) in 3- to 4-day post-hatch bobwhite quail. In the 2-week study, there was a decrease in thyroidal T4 hormone levels in the 0.0326 mg/kg/d perchlorate ion dose group, while T4 levels were unchanged in the 0.00326 mg/kg/d perchlorate ion dose group. In the 8-week study, all dose groups experienced impacts to thyroid hormone levels. A NOAEL and LOAEL were determined in the 8-week study using thyroid weight and tibia length as endpoints. Thyroid weight was significantly increased at dose levels of greater than or equal to 65 mg/kg/d perchlorate ion and similar to controls at less than or equal to 33 mg/kg/d perchlorate ion. Tibia length was significantly decreased at 261 mg/kg/d, but similar to controls at 130 mg/kg/d. Changes in tibia length have been widely used as an indicator of growth rates in birds, though it is recognized that changes in thyroid weight are on uncertain significance.

In the second study (McNabb et al. 2004b), results from a series of experiments, including those reported in McNabb et al. (2004a), are presented. It was found that reduced thyroidal T4 levels observed after 2 weeks exposure to 0.5 to 5 mg/L ammonium perchlorate were restored to control levels by week 4 and 8 of exposure. Exposure to concentrations of 50 mg/L ammonium perchlorate or greater continued to result in a significant decrease in thyroidal T4 levels. Therefore, the 8-week NOAEL and LOAEL for thyroidal T4 levels are 0.326 (5 mg/L dose group) and 3.26 mg/kg/d (50 mg/L dose group) perchlorate ion., respectively. As presented in McNabb et al. 2004a, the NOAEL and LOAEL for thyroid weight are 33 (500 mg/L dose group) and 65 mg/kg/d (1000 mg/L dose group) perchlorate ion, respectively.

As with mammals, a significant and rapid response in thyroid hormone levels was observed at low doses of perchlorate. Additionally, the McNabb et al. (2004a and 2004b) studies indicate that developing quail chicks appear to have the ability to compensate for early thyroidal hormone effects resulting from exposure to low doses of ammonium perchlorate. Effects on growth parameters (thyroid weight and tibia length) were only observed at higher levels of exposure. Growth inhibition may be relevant to the health and ecology of the species within the class and thus constitutes data from which a TRV could be derived. Therefore, the data from McNabb et al (2004a) were used to derive the avian TRVs where growth rates (indicated by changes in tibia length) were used.

Because the avian toxicity database for perchlorate lack in meeting the minimum data set requirements of the Standard Practice (USACHPPM 2000), TRVs based on an approximation of the NOAEL and LOAEL were developed for Class Aves using UFs. Since these growth changes were evaluated in a sensitive life stage in birds for growth parameters (chicks), these data are considered equivalent in value to chronic data (130 mg/kg-d and 261 mg/kg/d). An UF of 10 was applied to the NOAEL and LOAEL to account for differences between species because a single species and taxonomic order are represented. Table 3 presents the selected TRVs. A medium level of confidence has been given to these TRVs because these studies were of high quality, but lacking in regards to data from other species and lack of other developmental and reproductive data."

Table 11. Selected Ingestion TRVs for the Class Aves

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	1.3	Medium
LOAEL-based	2.6	Medium

Uncertainties in Perchlorate Ecological Risk Assessment

The major uncertainty in assessing the risk to wildlife from exposure to perchlorate in the soil is in selection of an appropriate TRV. The Draft Site 1 RI Report uses adverse effects on the thyroid gland and the thyroid hormones it produces. The connection of these effects to ecologically relevant toxicity endpoints is problematic. Preferred endpoints for ecological risk assessments include survival, growth and reproduction. These endpoints are relevant to the ongoing survival of local populations. The risk assessment to be included in the Draft Final Site 1 RI Report uses TRVs selected by U.S. Army ecotoxicologists for use at Army sites. The TRVs are based on survival (mammals) and growth (birds) and are considered ecologically relevant.

The water solubility also introduces uncertainty in estimating the chronic daily intake (chronic applied dose). Perchlorate is a small anion that is easily absorbed in the stomach and intestines of birds and mammals. However, it is also easily flushed from the system because of its solubility. It is generally not accumulated because it is not actively transported across cell membranes. Since its toxic action is to competitively compete with iodine for binding sites in the thyroid, as exposure drops, perchlorate blood levels drop and iodine binding sites on the thyroid become available. Therefore, the adverse effects of perchlorate are reversible and depend heavily on current exposure.

The uptake of perchlorate by plants also contributes to the uncertainty of food chain exposure for herbivores. A wide range of concentrations of perchlorate have been measured in plants. The highest levels of perchlorate ion in plants appear to be associated with regions of high evapotranspiration. The high level of variability in perchlorates in various plants and plant parts from different regions of the country contributes to uncertainty in estimating exposure and thus estimating risk to plant eaters.

Some of the higher detections of perchlorate at Site 1 are more than 2 feet below the soil surface. The California risk assessment guidance (DTSC 1998) requires that all chemicals found in the soil to a depth of six feet be assessed. This definition of the soil exposure zone is proposed to include exposure to burrowing mammals. However, over 95 percent of the exposure of most birds and mammals come through the ingestion of food. Only 3 or 4 percent of food chain exposure comes from the incidental ingestion of soil that may come from depths below two feet. The plants and soil invertebrates that make up the bulk of the wildlife diet are, for the most part, in contact with the top 2 feet of soil. The assumption that birds and mammals get significant exposure from chemicals below 2 feet in depth overestimates risk and contributes to uncertainty in the risk assessment. Table 4 summarizes these sources of uncertainty in the perchlorate risk assessment.

Table 12: Sources of Uncertainty in Estimating risks to Wildlife from Perchlorate exposure

Source of Uncertainty	Effect
Perchlorate Toxicity	The major adverse effect of perchlorate on wildlife is through altering the production of hormones by the thyroid gland. The relationship of thyroid hormones to ecologically relevant toxicity endpoints in wildlife is unclear.
Perchlorate water solubility	Perchlorate salts released to surface soils are subject to leaching through the soil with the infiltration of rainwater. It may not persist in the surface soils for extended periods, especially in rainy areas or seasons. This is a source of uncertainty in estimating exposure and thus risk.
Perchlorate uptake	Perchlorate ion does not appear to be actively transported in or out of cells. It is easily absorbed through the stomach and intestine of mammals and birds. It is also easily flushed from the system because of its solubility.
Perchlorate accessibility to wildlife	The California risk assessment guidance requires that all chemicals found in the soil to a depth of six feet be assessed. The plants and soil invertebrates that make up the bulk of the wildlife diet are, for the most part, in contact with the top 2 feet of soil. The assumption that birds and mammals get significant exposure from chemicals below 2 feet in depth overestimates risk and contributes to uncertainty in the risk assessment.

References

Agency for Toxic Substances and Disease Registry (ATSDR), 2005. *Draft Toxicological Profile for Perchlorates*, US Department of Health and Human Services, September.

California Department of Toxic Substances Control (DTSC), Human and Ecological Risk Division (HERD). 1998. HERD Ecological Risk Assessment Note Number 1. Sacramento, CA. http://www.dtsc.ca.gov/ScienceTechnology/ftp/econote1.pdf.

Callahan, C., and M. Sprenger, 1998. Perchlorate Ecological Risk Studies-A Report on Literature Reviews and Studies Conducted by the Ecological Impact/ transport and Transformation Subcommittee of the Interagency Perchlorate Steering Committee. US Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis. Risk Analysis Directorate, Risk Assessment Division. Brooks Air Force Base, Texas IERA-RS-BR-TR-2001-0004.

Crofton, K., 1998. *Reanalysis of Thyroid Hormone Data from the Subchronic Perchlorate Study Submitted by Springborn Laboratories SLI study no. 3455.1) [memorandum with attachment to Annie Jarabeck].* Research Triangle park, NC: US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory; July 21 (revised October 12 and November 18).

King,J. Jr., 1995. *Effects of Ammonium Perchlorate on Thyroid Hormone Levels of the Sprague-Dawley Rat [thesis],* Air Force Institute of Technology, AFIT/GEE/ENV/95D-09.

McNabb, F., C. Larsen, and P. Pooler , 2004a. *Ammonium Perchlorate Effects on Thyroid Function and Growth in Bobwhite Quail Chicks.* Environ. Toxicol. and Chem. 23(4):997-1003.

McNabb, F., D. Jang and C. Larsen, 2004b. *Does Thyroid Function in Developing Birds Adapt to Sustained Ammonium Perchlorate Exposure?*, Toxicol. Sci. 82: 106-113.

Thuett, K, E. Roots, L. Mitchell, B. Gentles, T. Anderson, R. Kendall, and E. Smith, 2002. *Effects of In Utero and Lactational Ammonium Perchlorate Exposure on Thyroid Gland Histology and Thyroid and Sex Hormones in Developing Deer Mice (Peromyscus maniculatus) Through Postnatal Day 21.* J. Toxicol. Environ. Health Part A., 65(24):2119-2130.

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), 2000. *Standard Practice for Wildlife Toxicity Reference Values*, Technical Guide254, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, October

_____ 2005. *Wildlife ToxicityAssessment for Perchlorate, External Review Draft*, USACHPPM Doc. No. 87-MA02T6-05D, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, November.

U.S. Environmental Protection Agency (EPA), 2002. *Perchlorate Environmental contamination: Toxicological Review and Risk Characterization. External Review Draft,* NCEA-1-0503. US Environmental Protection Agency, Office of Research and Development, January.

_____, 2000. EPI Suite Software. Available at:

htpp://www.epa.gov/opt/exposure/docs/episuited1.htm

Attachment H-12
Food Chain Intake Calculations and Decision Point Concentration Methodology

1. Food Chain Pathway Exposure Equations

Soil-to-Plant Exposure Pathway. Plant contaminant concentrations for food plants were estimated from site soil COPC concentrations in the 0-6 foot or 0–2-foot soil interval using the BCF_p. Equation 1 describes this pathway.

Equation 1: Model for Estimating Plant Uptake of COPCs from Soil, El Toro Site 1

$$C_p = C_s \times BCF_p$$

Where:

C_p	=	COPC concentration in plant (mg/kg)
C_s	=	COPC concentration in surface soil/sediment (mg/kg)
BCF_p	=	soil-to-plant bioconcentration factor (unitless)

Assumptions:

- Concentrations of COPCs in surface soil (C_s) are represented by the maximum in the Tier 1 process.
- BCF_p—chemical-specific factor relating soil concentration to plant tissue equilibrium concentration on a dry-weight basis.

Soil-to-Soil Invertebrate Exposure Pathway. Soil invertebrate tissue burden for each contaminant was estimated using BCF_i because exposure of soil invertebrates such as the earthworm via ingestion and sorption through the integument cannot be separated. Equation 2 describes this pathway.

Equation 2: Model for Estimating Soil Invertebrate Uptake of COPCs from Soil, El Toro Site 1

$$C_e = CS_BCFi$$

Where:

C_e = COPC concentration in earthworm (mg/kg)
C_s = COPC concentration in surface soil/sediment (mg/kg)
BCF_i = soil-to-invertebrate bioconcentration factor (unitless)

Assumptions:

- Concentrations of COPCs in surface soil (C_s) are represented by the maximum in the Tier 1 process.
- BCF_i—chemical-specific factor relating soil concentration to soil invertebrate tissue equilibrium concentration on a dry-weight basis.

Soil-to-Animal Diet Exposure Pathway. A major source of exposure to soil contaminants for many small birds and mammals is assumed to be via direct soil ingestion. This occurs as a result of preening by birds, grooming of the pelt by mammals, deliberate soil ingestion (e.g., to aid in digestion and as a source of nutrients), and accidental soil ingestion while feeding (Kreulen and Jager 1984).

Exposure to contaminants by animals on site is also influenced by the amount of time they spend at the site, as defined by the site use factor.

The percentage of soil in the diet and the site use factor were incorporated into an equation to estimate contaminant intake concentrations in milligram of contaminant per kilogram of body weight per day (mg/kg-day). Equation 3 presents the model used to estimate exposure by soil ingestion.

Equation 3: Model for Estimating Animal Intake of COPCs from Ingestion of Soil, El Toro Site 1

$$CDI\ (mg/kgday) = \frac{CS \times FI \times SI \times CF \times SUF}{BW}$$

Where:

CDI	=	chronic daily intake (mg/kg-day)
C_s	=	COPC concentration in surface soil or sediment (mg/kg)
FI	=	total food intake (mg/day)
SI	=	soil ingestion expressed as fraction of total food intake (unitless)
CF	=	conversion factor (10^{-6} kg/mg)
SUF	=	site use factor (unitless)
BW	=	body weight (kg)

Assumptions:

- Concentrations of COPCs in surface soil (C_s) are represented by the maximum in the Tier 1 process.
- SI, FI, and BW are values obtained from peer-reviewed literature.
- SUF is calculated as the ratio of the area of suitable habitat available at each site to the animal site use area. Thus, the SUF is both species- and site-specific. The maximum value for SUF is 1.

Soil-to-Plant-to-Animal Exposure Pathway. The model used to estimate the contaminant intake concentration resulting from this pathway is presented in Equation 4. This model pertains both to ingestion of vegetation and seeds by the house mouse and to ingestion of seeds and berries by the northern cardinal.

Equation 4: Model for Estimating Animal Intake of COPCs from Ingestion of Plants, El Toro Site 1

$$CDI\ (mg/kg\text{-}day) = \frac{C_s \times BCF_p \times CF \times FI \times PI \times SUF}{BW}$$

Where:

CDI	=	chronic daily intake (mg/kg-day)
C_s	=	COPC concentration in surface soil (mg/kg)
BCF_p	=	soil-to-plant bioconcentration factor (unitless)
CF	=	conversion factor (10^{-6} kg/mg)
FI	=	total food intake (mg/day)
PI	=	plant ingestion expressed as fraction of total food intake (unitless)
SUF	=	site use factor (unitless)
BW	=	body weight (kg)

Assumptions:

- Concentrations of COPCs in surface soil (C_s) are represented by the maximum in the Tier 1 process.
- SUF is calculated as the ratio of the area of suitable habitat available at each site to the animal site use area. Thus, the SUF is both species- and site-specific.

Soil-to-Earthworm-to-Predator Exposure Pathway. This pathway is analogous to the soil-to-plant-to-herbivore pathway in that it represents a feeding relationship. In both cases, the animal ingests tissue with a contaminant concentration expressed in milligram of chemical/kilogram of tissue (dry weight). Equation 5 presents the model used to estimate exposure via this pathway.

Equation 5: Model for Estimating Animal Intake of COPCs from Ingestion of Soil Invertebrates, El Toro Site 1

$$CDI = \frac{CSs \; x \; BCF_i \; x \; CF \; x \; FI \; x \; AI \; x \; SUF}{BW}$$

Where:

CDI = chronic daily intake (mg/kg-day)
C_s = COPC concentration in surface soil (mg/kg)
BCF_i = soil-to-invertebrate (earthworm) bioconcentration factor (unitless)
CF = conversion factor (10^{-6} kg/mg)
FI = total food intake (mg/day)
AI = animal earthworm ingestion expressed as a fraction of total food intake (unitless)
SUF = site use factor (unitless)
BW = body weight (kg)

Assumptions:

- Concentrations of COPCs in surface soil (C_s) are represented by the maximum in the Tier 1 process.
- SUF is calculated as the ratio of the area of suitable habitat available at each site to the animal site use area. Thus, the SUF is both species- and site-specific.

Total exposure for each species at each site is equal to the sum of exposure from all appropriate pathways.

2. Calculation of Soil Decision Point Concentrations (DPCs)

Eco-DPC = (TRV*WT*CF)/((INT*SF)+(BCF_p*INT*PF)+(BCF_i*INT*IF))*SUF

Where:

CF = Conversion factor (1,000,000 mg/Kg)
TRV = Toxicity Reference Value (mg/Kg-day) (NOAEL- or LOAEL-based)
INT = Daily food intake (maximum for screening) (mg/Kg [dry weight])
SF = Diet soil fraction (unitless) (zero for screening)
PF = Diet plant fraction (unitless) (zero for screening)
IF = Diet invertebrate fraction (unitless) (one for screening)
BCF_p = Bioconcentration factor from soil to plants (not used in screening)
BCF_i = Bioconcentration factor from soil to invertebrates
WT = Weight (wet) of representative species (minimum for screening)
SUF = Site use factor

Table 1 below is a copy of Table 3-1 from the ERA listing the species-specific exposure assumptions used in the Tier 2 exposure equations. Table 2 presents the DPCs used to plot soil sample exceedances in Figure 3.1 in the ERA (Attachment H).

Table 1: Summary of Species-Specific Exposure Assumptions Used for Tier 2, Step 3a (From Table 3-1 of ERA*)

Factor	Value	Reference
Deer mouse		
Mean body weight (BW) (kg)	0.0196	Derived from Schlesinger and Potter (1974)
Mean food intake (mg/day, dry weight)	3,322 [a]	Nagy (2001)
Mean Water Intake (mL/day)	2.9 [b]	EPA (1993)
Diet partition factor	1.2% (soil)	EPA (2005) using vole as surrogate [d]
	49.4% (plant) 49.4% (invertebrates)	EPA, 1993 [c]
Ornate Shrew		
Mean body weight (BW) (kg)	0.00585	Brown et al. (1996)
Mean food intake (mg/day, dry weight)	1,119	Deavers and Hudson (1981); Nagy (2001)
Mean Water Intake (mL/day)	1.0	EPA (1993)
Diet partition factor	0.9% (soil)	EPA (2005) [d]
	5% (plant) 94.1% (invertebrates)	Derived from DOI (2002)
Mourning dove		
Mean body weight (BW) (kg)	0.119	Dunning (1993)
Mean food intake (mg/day, dry weight)	16,479 [a]	Nagy (2001)
Mean Water Intake (mL/day)	14.2 [b]	EPA (1993)
Diet partition factor	6.1% (soil)	EPA (2005) [d]
	93.9% (plants) 0% (animal)	Derived from Erlich et al. (1988)
Western Meadowlark		
Mean body weight (BW) (kg)	0.0941	Lanyon (1962)
Mean food intake (mg/day, dry weight)	14,038 [a]	Nagy (2001)
Mean Water Intake (mL/day)	12.1 [b]	EPA (1993)
Diet partition factor	6.4% (soil)	EPA (2005) using woodcock as surrogate [d]
	34.3% (plants) 59.3% (invertebrates)	Derived from Ehrlich et al. (1988 [c])

Notes:
* Predators were removed from the table because they do not drive risk.
kg = kilogram
ha = hectare
mg = milligram
[a] Dry-weight food intake estimated based on algorithm given in Nagy (2001).
[b] Water intake estimated based on algorithm given in EPA (1993).
[c] Conservative Tier I assumption of maximum food intake of the one food item with the highest contamination.
[d] From 50th Percentile of: Table 3. Estimated Distribution of P_s Values (EPA 2005).

Table 2: Tier II Soil DPCs For Determining Soil Sample Exceedance of HQ = 1

COPEC	Ornate shrew DPC (mg/kg)	Deer mouse DPC (mg/kg)	Mourning dove DPC (mg/kg)	Meadow lark DPC (mg/kg)	Minimum DPC	Species
Benzene	1.74E+01	8.16E+00	4.68E+00	8.42E+00	4.68E+00	MD
Ethylbenzene	7.41E+01	1.46E+02	4.49E+02	1.16E+01	1.16E+01	WM
Toluene	1.71E+01	1.31E+01	1.21E+02	1.59E+02	1.31E+01	DM
Xylenes, Total	1.26E+00	1.34E+00	1.67E-01	1.52E-01	1.52E-01	WM
2,3,7,8-TCDD TEQ - Mammal	1.80E-06	3.47E-06	5.02E-04	3.51E-05	1.80E-06	OS
1,3-Dinitrobenzene	5.51E-02	1.87E-02	1.20E-01	2.42E-01	1.87E-02	DM
2,4,6-Trinitrotoluene	1.48E+02	2.76E+01	1.25E-01	2.89E-01	1.25E-01	MD
2,4-Dinitrotoluene	9.49E+00	1.47E+00	8.16E-02	1.98E-01	8.16E-02	MD
2,6-Dinitrotoluene	9.20E+00	1.26E+00	6.95E-02	1.71E-01	6.95E-02	MD
2-Amino-4,6-Dinitrotoluene	1.13E+01	2.34E+00	1.21E-02	2.79E-02	1.21E-02	MD
4-Amino-2,6-Dinitrotoluene	1.17E+01	2.49E+00	1.29E-02	2.96E-02	1.29E-02	MD
RDX	1.27E+02	6.75E+01	1.26E+01	1.93E+01	1.26E+01	MD
HMX	2.41E+00	2.57E-01	1.61E-01	4.09E-01	1.61E-01	MD
Tetrachloroethene	3.26E-01	2.37E-01	2.21E-02	3.04E-02	2.21E-02	MD
Aluminum	3.38E+01	6.49E+01	1.30E+04	2.77E+03	3.38E+01	OS
Antimony	3.24E-01	6.69E-01	4.82E-01	5.93E-02	5.93E-02	WM
Arsenic	3.06E+01	5.19E+01	1.68E+02	8.25E+01	3.06E+01	OS
Barium	2.64E+03	2.28E+03	7.24E+02	8.13E+02	7.24E+02	MD
Beryllium	2.07E+01	3.66E+00	2.36E-01	5.38E-01	2.36E-01	MD
Cadmium	8.10E-01	1.67E+00	3.86E+01	3.02E+00	8.10E-01	OS
Chromium	4.20E+01	7.72E+01	1.93E+02	6.87E+01	4.20E+01	OS
Cobalt	3.09E+02	5.69E+02	8.08E+02	3.67E+02	3.09E+02	OS
Copper	3.11E+01	5.72E+01	1.82E+02	4.05E+01	3.11E+01	OS
Lead	7.53E+01	1.42E+02	1.24E+02	3.97E+01	3.97E+01	WM
Manganese	7.29E+02	8.20E+02	4.15E+03	3.44E+03	7.29E+02	OS
Mercury	1.78E+00	2.39E+00	5.28E-01	3.24E-01	3.24E-01	WM
Nickel	8.64E-01	1.62E+00	8.68E+01	1.30E+01	8.64E-01	OS
Perchlorate	2.22E-01	2.70E-02	3.54E-02	8.95E-02	2.70E-02	DM
Selenium	3.80E-01	4.55E-01	2.88E+00	2.19E+00	3.80E-01	OS
Silver	3.08E+01	6.07E+01	8.67E+01	4.66E+00	4.66E+00	WM
Thallium	6.52E+00	8.51E+00	6.24E+00	4.11E+00	4.11E+00	WM
Vanadium	1.22E+02	1.78E+02	1.26E+03	8.44E+02	1.22E+02	OS
Zinc	9.23E+01	1.42E+02	5.35E+02	2.35E+02	9.23E+01	OS
2-Methylnaphthalene	9.55E+01	1.62E+02	2.36E+02	6.17E+01	6.17E+01	WM
Fluoranthene	2.06E+02	3.20E+02	3.06E+02	1.23E+02	1.23E+02	WM
Naphthalene	6.92E+01	4.21E+01	1.41E+01	2.19E+01	1.41E+01	MD
Bis (2-ethylhexyl) phthalate	8.82E-01	1.76E+00	5.57E+01	7.72E-02	7.72E-02	WM
Diethylphthalate	1.91E+03	1.62E+03	4.02E-01	4.81E-01	4.02E-01	MD
Di-n-butylphthalate	1.76E+03	2.99E+03	2.07E+00	5.66E-01	5.66E-01	WM
Hexachlorobenzene	9.40E-01	1.86E+00	1.90E+01	3.20E-01	3.20E-01	WM
N-Nitrosodiphenylamine	4.37E+01	2.25E+01	1.55E+01	2.65E+01	1.55E+01	MD
Phenol	5.69E+02	1.41E+02	8.23E+00	1.83E+01	8.23E+00	MD

2-Butanone	3.05E-01	5.75E-01	5.08E-01	4.70E-02	4.70E-02	WM
2-Hexanone	2.91E+02	6.99E+01	4.07E+00	9.13E+00	4.07E+00	MD
4-Methyl-2-Pentanone	5.65E+01	2.79E+02	2.81E+01	2.84E+01	2.81E+01	MD
Acetone	1.36E+01	4.87E+00	3.03E+00	6.08E+00	3.03E+00	MD
Chloroform	3.98E+00	5.70E-01	4.20E-01	1.03E+00	4.20E-01	MD

Attachment H-13
Calculation of Risk-based Soil Decision Point Concentrations

Table H 13-1, Comparison Perchlorate Toxicity Values for Terrestrial Wildlife

Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Abbreviated Citation	Chemical Extrapolation	Taxonomic Extrapolation	Endpoint Extrapolation	Allometric Adjustment	TRV
Deer Mouse									
Rat	NOAEL	0.001	histopathology of thyroid	Smith et al., 2001	1	1	1	1.19E+00	1.19E-03
Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	1	1.00E+00	6.40E-01
Ornate Shrew									
Rat	NOAEL	0.001	histopathology of thyroid	Smith et al., 2001	1	1	1	1.28E+00	1.28E-03
Rat	NOAEL	0.64	Survival	USACHPPM, 2005	1	1	1	1.00E+00	6.40E-01
Birds									
Japanese Quail	NOAEL	1.62E-03	Thyroid function T4	McNabb et al., 2004	1	1	1	1.00E+00	1.62E-03
Japanese Quail	NOAEL	1.30E+00	Growth	McNabb et al., 2004	1	1	1	1.00E+00	1.30E+00

Attachment H 13-2. Ornate Shrew Soil Pathway, EOD Site 1, Tier 2, Step 3a

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.70E-02	1.50E-04	2.35E-01	1.57E-02	2.50E-01	1.28E-03	2E+02	1
Perchlorate	8.70E-02	1.50E-04	2.35E-01	1.57E-02	2.50E-01	6.40E-01	4E-01	1

Attachment H 13-3. Deer Mouse Soil Pathway, EOD Site 1, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.70E-02	1.77E-04	2.05E+00	7.28E-03	2.06E+00	1.19E-03	2E+03	1
Perchlorate	8.70E-02	1.77E-04	2.05E+00	7.28E-03	2.06E+00	6.40E-01	3E+00	1

Attachment H13-4. Western Meadowlark Soil Pathway, EOD Site 1, Tier 3

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.70E-02	8.31E-04	1.26E+00	7.70E-03	1.26E+00	1.62E-03	8E+02	1
Perchlorate	8.70E-02	8.31E-04	1.26E+00	7.70E-03	1.26E+00	1.30E+00	1E+00	1

Attachment H 13-5. Mourning Dove Soil Pathway, EOD Site 1, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	NOAEL-TRV (mg/kg-day)	HQ	Site Use Factor
Perchlorate	8.70E-02	7.35E-04	3.19E+00	0.00E+00	3.19E+00	1.62E-03	2E+03	1
Perchlorate	8.70E-02	7.35E-04	3.19E+00	0.00E+00	3.19E+00	1.30E+00	2E+00	1

Attachment H-14
Responses to Regulatory Comments on Draft SRA

Document Title:

(1) Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California, February 2003.

Reviewer: Andrew R. Yuen, Deputy Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, Memo received May 12, 2003

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENTS			
1.		Overall, we agree with the conclusions presented in the draft Screening Ecological Risk Assessment (SERA) that a baseline risk assessment is warranted for the Explosive Ordnance Disposal Range (EOD) Range, Site 1. Completeness of the document has been improved by including model assumptions and calculations to support the conclusions reached in the assessment. Our specific comments regarding the SERA are provided below.	Comment noted.
SPECIFIC COMMENTS			
1.	Page 2-9	The single midwinter survey conducted to determine the species inventory for Site 1 is not likely to have captured all of the ecological receptors and representative feeding guilds present on site. Migratory birds may not be present at the site, plants may not be identifiable, and animals may be inactive at this time of the year. For your reference, we have attached a list of species observed on the former MCAS El Toro during a 1993 survey effort by the Service (U.S. Fish and Wildlife Service 1993). As discussed later in this letter, this list includes species such as the loggerhead shrike (*Lanius ludovicianus*), which occupies a higher trophic level and should be evaluated as a potential receptor.	The FWS list is helpful in identifying species that may be present at the site at other times of the year than the mid-winter census. Current soil screening values are based on a hypothetical small meadowlark that forages on site year round, at the point of maximum contamination, with a diet that consists entirely of the potentially most contaminated diet fraction (soil invertebrates), at the feeding rate of a large individual. Incidental soil ingestion is added to the diet exposure. Since the loggerhead shrike is a partial year resident with a large home range that feeds mostly on insects, the screening values should adequately represent its exposure for screening purposes. The shrike will be included as a representative species in Tier II, where site-specific exposure factors are used to more accurately assess the potential for adverse effects from the those COPECs that failed the Tier I screen.

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(1) Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California, February 2003.

Reviewer: Andrew R. Yuen, Deputy Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, Memo received May 12, 2003

Comment No.	Section/ Page No.	Comment	Response
2.	Page 2-12	It is inappropriate to generalize that chemicals of potential ecological concern (COPECs) were selected from chemicals detected in surface soils as 0-2 feet bgs when all chemicals were not analyzed at the 0-15 cm depth profile. It should be clearly stated in the document which COPECS were analyzed at each soil depth interval. Likewise it is inappropriate to eliminate chemicals detected at depths greater than 2 feet bgs when evaluating COPECs for the SERA when ecological receptors occurring at Site 1 can burrow vertically to depths greater than two feet. In addition to subsurface depths, soils for SERAs should include analysis of soils at the surface, 0-15 cm depth profiles, the biotic zone, and the depth profile to which representative species utilizing the site may burrow. Please refer to the California Department of Toxic Substances Control's (DTSC) recommended depths for soil sampling to set exposure point concentration for burrowing mammals and burrow-dwelling birds in an ecological risk assessment (California DTSC 1998).	The 0 to 2 foot interval is the interval that contains most plant and soil invertebrate biomass. Only 2 to 3% of the ingested dose to terrestrial ecological receptors is assumed to come from incidental ingestion of soil. Burrowing animals may pick up soil in their pelage and ingest it while grooming. Some of the incidental ingestion of soil is associated with the food (which is gathered on the ground surface. The majority of the ingested dose (97 to 98 %) is obtained from the ingestion of food (i.e., seeds, vegetation, soil invertebrates and other prey). The tissue burden in the food is generally transferred from the soil in the biologically active zone (0 to 2 feet) through root absorption in plants and absorption and ingestion by soil invertebrates. The assumption that the tissue burden of the food chain species is derived from soil depths greater than 2 feet is not reasonable. Comparison of concentrations of detected chemicals in the 0 to 2 foot interval (Appendix A, Table A-1) with those from the 2 to 10 foot interval (Appendix A, Table A-2) shows that the concentrations of detected chemicals from below 2 feet are less than those in the surface interval (except trench samples 28, 32, and 33). This area with the maximum subsurface COPEC concentrations also coincides with the location of maximum surface COPEC concentrations. DTSC guidelines suggest that it is inappropriate to include subsurface samples if they would "dilute" the surface samples as is the case for most COPECs identified in this SERA.

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(1) Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California, February 2003.

Reviewer: Andrew R. Yuen, Deputy Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, Memo received May 12, 2003

Comment No.	Section/ Page No.	Comment	Response
3.	Page 1-2	As stated in the document, Site 1 was historically tilled twice a year resulting in a loose consistency of the surface soil (Earth Tech, Inc. 2003). The discing conducted on the EOD range occurred at a depth of "four – five inches" or approximately 10-13 cm (Wanyoike 2002). This soil depth interval should be analyzed for munitions of environmental concern (MECs) and all other analytes to characterize any potential contamination in the biotic zone, (0-15 cm). Surface samples for MECs should be collected as 4-5 sub sample composites within each grid in accordance with military guidance (Jenkins et al. 1996 and Thiboutot et al. 2002). The grid size should be based on the Conceptual Site Model (CSM) sampling design (Lantzer et al. 2001a and Lantzer et al. 2001b). Composite sampling is essential because in soils, munitions compounds are extremely heterogeneous in spatial distribution (EPA 1996 and Jenkins et al. 1996). Due to heterogeneity and spatial distribution of munitions compounds, concentrations can range from nondetectable levels (0.05 ppm) to percent levels (10,000 ppm) for samples collected within several feet of each other (EPA 1996). According to EPA (1996), these problems are exacerbated at open burn/open detonation (OB/OD) sites due to the disposal practices. Without surface soil data for munitions compounds, risk to ecological receptors may be underestimated.	Soil samples for this investigation were collected from depths ranging from six inches to two feet. This depth interval is consistent with previous Phase II Remedial Investigations ecological sampling activities at El Toro. In addition sampling was conducted in accordance with approved work plan. EOD Training activities by design typically placed ordnance in pits ranging in depth from 1 to 3 feet below the ground surface. These training residuals would be predominantly reside with the pit bottom and walls and not at the surface. Hence these areas were the focus of the RI investigation The geophysical survey identified these pit and soil sampling focused on the significant anomalies where most residuals would have a high likelihood to occur.
3.	Page 2-14	Table 2-3 shows the maximum concentration for Perchlorate as 320 µg/kg in soil. In the Interim Analytical Data Package, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, (MCAS), El Toro, Orange County, California on Page 17-18, the concentration for Perchlorate in soil is shown as 320 mg/kg. The unit (mg/kg) for Perchlorate is consistent through the tables in that document. Pleas clarify the apparent discrepancy between the units presented in the documents for Perchlorate concentrations.	In Table 1 of the Interim Analytical Data Package document, the concentrations were correct but units were incorrectly shown as mg/kg. This error was corrected to show the units as µg/kg in the Draft Screening Ecological Risk Assessment document. Risk calculations were made using the correct units (µg/kg).

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Reviewer: Andrew R. Yuen, Deputy Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, Memo received May 12, 2003

Comment No.	Section/ Page No.	Comment	Response
4.	Page 2-14	Table 2-3 shows the maximum concentration for mercury is 7.1 mg/kg. Sample Number HA09 on page 18 of 18 of the data package shows mercury concentration of 10.6 mg/kg. Please revise the table to reflect the maximum concentration.	The maximum concentration for mercury is indeed 10.6 mg/kg. However, that sample (LD-130) was a duplicate of sample LD-129 (which had a concentration of 3.6 mg/kg). For risk assessments, detected concentrations are averaged for samples with duplicate results. Therefore, the maximum concentration is 7.1 mg/kg (the average of 10.6 mg/kg and 3.1 mg/kg).

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(1) Draft Screening Ecological Risk Assessment, Phase II Remedial Investigation, IRP Site 1, Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California, February 2003.

Reviewer: Andrew R. Yuen, Deputy Field Supervisor, United States Department of the Interior, Fish and Wildlife Service, Memo received May 12, 2003

Comment No.	Section/ Page No.	Comment	Response
5.	Page 2-17	The following types of ecological receptors and feeding guilds are present at the former El Toro MCAS: terrestrial plants, soil invertebrates, reptiles, amphibians, terrestrial mammals (herbivores, omnivores, and carnivores) and terrestrial birds (herbivores, omnivores, and carnivores). Representative species or taxa should be evaluated as target receptors from each guild for the SERA. The Service agrees that the selected species for the SERA represent the two feeding guilds for omnivorous mammals and omnivorous birds for the site. We recommend that other target receptors be included to represent additional feeding guilds and higher trophic levels likely present at the site. For example, carnivorous birds, such as the logger head shrike (*Lanius ludovicianus*) present at El Toro MCAS likely inhabits the site and should be included as a representative receptor in the assessment. The shrike is a top predator and can devour large insects, reptiles, small mammals and birds and would be an appropriate representative species as an upper trophic receptor with regard to site fidelity and area usage. Territories for the shrike for mainland California ranges from approximately 11-40 acres (Yosef 1996). An area the size of the EOD Range (73.7) would provide adequate foraging on site for the shrike. Likewise, risk to other feeding guilds with a complete contaminant pathway of exposure such as herbivorous and carnivorous mammals should also be included in the SERA. The California ground squirrel (*Spermophilus beecheyi*) is primarily a herbivorous mammal that can burrow to a depth greater than six feet and should be evaluated as a target receptor because there is a complete pathway of exposure to chemicals at greater depths. Please consider expanding the target receptors to evaluate risk to all feeding guilds and higher trophic levels that have a complete pathway for exposure to contaminants present at the site.	Toxicity data for amphibians and reptiles are limited. The use of toxicity data from other species (such as mammals) with uncertainty factors does not provide risk managers with any more information about risk than the mammal risk assessment itself. For the SERA, the USEPA requires that the diet consist of 100% of the diet fraction that is assumed to be the most contaminated. The screening values are calculated assuming that the deer mouse and western meadowlark eat diets consisting of 100% soil invertebrates (plus incidental soil ingestion). Screening exposure assumptions such as minimum body weight and maximum food intake and a site use factor of 1add to the conservative nature of the SERA. The use of different feeding guilds is more appropriate in the BERA where diet fractions represent actual feeding relationships documented in the literature. The California ground squirrel and the loggerhead shrike can be included as receptors in the BERA.
6.	Page 2-3, Figure 2-3	Please revise the Conceptual Site Model for Site 1 to include subsurface soil (below 2 feet) as an exposure pathway to ecological receptors. The assumption that it is an incomplete pathway is invalid.	Although it is considered a complete pathway because burrowing mammals may contact the soil, exposure is considered insignificant for soils below two feet compared to those pathways included in the SERA.

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Comment No.	Section/ Page No.	Comment	Response
7.		The data package does not present any results for phosphorus. How has the white phosphorus spill at the EOD range described in geophysical survey report dated July 9, 1991, been addressed during the site assessment (Southwest NAVFAC et al. 1991)?	

Appendix I
Responses to Comments Received on Draft and Draft Final RI Report

Appendix I-1
Responses to Comments Received on Draft RI Report

Document Title:

Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, United States Environmental Protection Agency, Region IX, Federal Facility and Site Cleanup Branch. Letter dated 24 August 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review process. References to responses to comments dated 9 January 2006 on the same subject by the same reviewer are also added where applicable.			
SPECIFIC COMMENTS			
1.	General	There are numerous comments provided below regarding incorrect citations to tables and figures within the text of the Draft RI Report. It is recommended that a thorough edit of the draft final version be performed prior to submittal to the agencies for their review.	Comment noted. The document has received a thorough review in preparation of the Draft Final RI Report.
2.	Executive Summary, Page vii	"The location of the borehole B-1 is likely to be the only location where this contamination extends up to the depth of 20 feet bgs." What is this conclusion based on? If no other borings had detections of contaminants with depth, then it is recommended that this supporting data be mentioned here.	A phased approach was used for soil sampling in accordance with the agency-concurred-upon Phase II RI Work Plan (Earth Tech 2001a). Tier II sampling locations in which contamination extended to ten feet bgs were flagged for further investigation. At those locations, Tier III boreholes were to be advanced up to 50 feet bgs, based on detected contamination. If contamination extended to 50 feet bgs or more in Tier III sampling locations, then groundwater wells would be proposed if the existing wells were not adequate to evaluate impacts to groundwater. During Tier II sampling, 37 soil samples were collected from 29 trenches/potholes. Trench 34 was the only location that exhibited increasing concentrations (petroleum hydrocarbons and naphthalene) to a depth of 10 feet bgs (the bottom of the trench). At all other locations where surface and near-surface samples were collected, COPC concentrations indicated that

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Reviewer: Rich Muza, Remedial Project Manager, United States Environmental Protection Agency, Region IX, Federal Facility and Site Cleanup Branch. Letter dated 24 August 2005

Comment No.	Section/ Page No.	Comment	Response
			contamination was not present below 10 feet bgs. Subsequently, one borehole was advanced near Trench 34 (Borehole B-1), to a total depth of 35 feet bgs. An evaluation of the analytical results of Borehole B-1 reveals that COPC concentrations tend to increase from 0 feet to 20 feet bgs and then decrease to the total depth of 35 feet bgs. Text has been added to summarize the decision-making process and to discuss that there are no other locations where soil was collected deeper than 10 feet bgs.
3.	Executive Summary, Page vii	"It is likely that borehole B-1 is the only location where low concentrations of explosives and perchlorate exist up to the depth of 35 feet bgs." What is this conclusion based on? If no other borings had detections of contaminants with depth, then it is recommended that this supporting data be mentioned here.	See response to Comment #2 above.
4.	Executive Summary, Page ix	"Cumulative incremental cancer risks for future offsite residents potentially residing near Site 1 are necessarily less due to groundwater mixing and potential biodegradation." What is meant by this statement? As presented in this context, the statement does not fully explain the cause and effect described. It is recommended that further clarification be provided.	Attenuation processes including groundwater mixing and biodegradation reduce chemical concentrations in groundwater as it moves away from the Site 1 plume, beyond the Site 1 boundary. Where chemical concentrations are lower in groundwater moving away from the source area, risks associated with exposure to groundwater for potential future offsite residents are less. Clarification and rationale has been added to the appropriate sections of the report.

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Reviewer: Rich Muza, Remedial Project Manager, United States Environmental Protection Agency, Region IX, Federal Facility and Site Cleanup Branch. Letter dated 24 August 2005

Comment No.	Section/ Page No.	Comment	Response
5.	Executive Summary, Page xi	Under question 3 – does the contamination extend beyond 10 feet bgs – mention is made of the one location "which is likely to be the only location where contamination has affected deeper soil". What is this conclusion based on? If no other borings had detections of contaminants with depth, then it is recommended that this supporting data be mentioned here.	See response to Comment #2 above.
6.	Executive Summary, Page xi	Under question 5 – is surface-water runoff an exposure pathway – an answer of "yes" is given "based on observations made during the winter 2004-2005 season". However, within a number of discussions in Section 5 – Contaminant Fate and Transport – this pathway for migration is discredited due to the lack of detections of contaminants at levels of concern in this media. Which position is the Navy supporting regarding surface-water runoff as a potential exposure pathway? It is recommended that these discrepancies be addressed.	Due to the sheet flow observed during the unusually wet winter of 2004-2005, surface water runoff, as a mechanism unto itself, is a complete pathway during significant storm events. However, perchlorate was not detected in the surface water samples collected. Therefore, perchlorate as a COPC with surface water as a media of exposure is an incomplete pathway when evaluating perchlorate migration.
7.	Executive Summary, Page xii	Once again, mention is made of the one location cited in Comment 3 above "which is likely to be the only location where contamination has affected deep soil". What is this conclusion based on? If no other borings had detections of explosives and perchlorate with depth, then it is recommended that this supporting data be mentioned here.	See response to Comment #2 above.
8.	Section 1.4, Page 1-8 to 1-17	There appears to be some confusion within the text of this section regarding the tables. Table 1-2 is cited in the text here where it should be referring to Table 1-1	Text has been modified to indicate that Table 1-1 summarizes the studies conducted prior to the Phase II RI, Table 1-2 summarizes the studies associated with

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Comment No.	Section/ Page No.	Comment	Response
		and later in the text a non-existent Table 1-3 is mentioned instead of Table 1-2. It is recommended that these citations be corrected.	the Phase II RI, and Table 1-3 summarizes the studies conducted concurrently with, but not directly related to, the Phase II RI.
9.	Section 2.1, Page 2-1	The last statement on the page indicates that a listing of Field Change Requests will follow, however, no items are provided. It is recommended that this omission be addressed.	A listing of the field change requests is included in Section 2.1 of the Draft Final RI.
10.	Section 2.2.4, Page 2-25	Except for the general descriptions provided in the text, no locations are given for the surface-water samples collected during the Tier III-C investigations. In this section all other discussions of sampling approach for the various media include figures with sample locations depicted. It is recommended that a figure be included that shows the locations of the surface-water samples.	Locations of Tier III-C surface water sampling locations has been added to Figure 2-4.
11.	Section 3.2.1, Page 3-1	Figure 3-3 is cited in the first paragraph to identify the four stratigraphic units represented in the study area. However, as one continues with the geology discussion, it appears that Figure 3-1 should have been referred to here in the text as this figure has the four stratigraphic units being described highlighted. It is recommended that this discrepancy be addressed.	Text has modified to refer to Figure 3-2, as Figure 3-1 has been renumbered as Figure 3-2.
12.	Section 3.2.3	This section is to cover the site hydrogeology. However, in the later pages the discussion goes into a thorough fate and transport analysis for perchlorate, citing Figure 4-7 in many places. Using the perchlorate results (Figure 4-7) to augment the	Appropriate text has been moved to Section 5, Contaminant Fate and Transport.

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Comment No.	Section/ Page No.	Comment	Response
		discussion of the ground-water flow regime would be of value here but the full fate and transport evaluation is to be provided in a later section (Section 5) of the RI Report after the presentation of the analytical data results (Section 4). It is recommended that this section be editted to not include a full fate and transport discussion for perchlorate in ground water.	
13.	Figures 3-11 & 3-12	It is recommended that the ground-water elevations used to prepare these water-table maps be provided on the figures.	Table 3-1, which immediately precedes Figure 3-12, presents the groundwater elevations. This table has been moved to precede Figure 3-11. Figures 3-11 and 3-12 have been renumbered as Figure 3-4 and Figure 3-5, respectively Groundwater elevations have been added to Figures 3-4 and 3-5.
14.	Section 3.2.3, Page 3-14	Figure 3-12, the ground-water equipotential map from March 2005, is cited in the first full paragraph on this page. However, the discussion involves depth to bedrock and the slope within the bedrock surface. It seems that the figure that should be referred to here is Figure 3-10. It is recommended that this discrepancy be addressed.	Text has been modified to refer to Figure 3-13, which was previously shown as Figure 3-10. The discussion has been moved to Chapter 5, Section 5.1.4.2.
15.	Section 3.3.2, Page 3-36	The discussion here regarding the sampling for the Riverside fairy shrimp is confusing. Are the results provided based on work in 1998 or is this information based on the findings of the 2005 sampling? It is recommended that this discrepancy be addressed.	Text has been revised to more clearly describe the 2005 Riverside fairy shrimp wet season protocol survey results.
16.	Section 3.3.3,	Once again, the discussion here regarding the sampling for the Riverside fairy shrimp is confusing.	Text has been revised to more clearly describe the Riverside fairy shrimp wet season protocol survey

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Reviewer: Rich Muza, Remedial Project Manager, United States Environmental Protection Agency, Region IX, Federal Facility and Site Cleanup Branch. Letter dated 24 August 2005

Comment No.	Section/ Page No.	Comment	Response
	Page 3-36	The results and findings in the 2005 sampling should be presented. It is recommended that this discrepancy be addressed.	results.
17.	Section 4.3.2.1, Page 4-16	"2-Butanone was detected...(Table 4-15)." The citation here of Table 4-15 is incorrect as Table 4-15 provides results from the Tier II soil sampling. It is recommended that this error be corrected.	Text has been modified to refer to Table 4-12.
18.	Section 4.3.2.6, Page 4-51	"Twenty six soil samples and three duplicates...(Table 4-12)." The citation of Table 4-12 in this statement is incorrect as Table 4-12 provides results from the Tier I soil sampling. The correct reference here is Table 4-15. It is recommended that this error be corrected.	Text has been modified to refer to Table 4-15.
19.	Table 4-29	This table presents an analysis of detected metals for the Tier III-C investigation. However, no discussion of the Tier III-C efforts is provided anywhere within Section 4. It is recommended that this omission be corrected.	Table 4-29 has been moved to Section 4.4.7 and renumbered as Table 4-32 such that it occurs after discussion of Tier III-C metals results on Page 4-80.
20.	Section 4.3.2.9, Page 4-68	It is recommended that mention be made here to the fact that there are no preliminary remediation goals (PRGs) for the hydrocarbons that were detected at Site 1.	Text has been added as suggested.
21.	Section 4.3.2.9, Page 4-68	It is recommended that mention be made here to the fact that the industrial PRG for 2,3,7,8-TCDD was exceeded in one soil sample from Site 1.	Text has been added as suggested.

Document Title:

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Comment No.	Section/ Page No.	Comment	Response
22.	Section 4.4.7, Page 4-82 & Tables 4-31, 4-32, & 4-33	"Concentrations of most metals were less than background values,..." No background metals data are provided in any of the referenced tables of sediment sampling data. It is recommended that either the background metals values be added to one of the tables or reference be made to another location where this information is presented in the RI Report.	MCAS El Toro background concentrations (BNI 1996) are presented on Table 4-29, which has been moved and renumbered as Table 4-32 per response to Comment 19. Reference: Bechtel National, Inc. (BNI). 1996. *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations.* San Diego, CA.
23.	Section 4.5.1, Page 4-101 & Table 4-36	"Therefore, based on the results of confirmation sampling conducted in February 2002 and sampling conducted in June 2002, it can be concluded that no or negligible VOC contamination exists at Site 1." While no discernable TCE plume has been demonstrated at Site 1, a review of the data indicates that the detections of TCE exceeding the MCL occurred in January 2002 sampling and the confirmation sampling resulting in non-detections was conducted in February 2002. However, none of the monitoring wells that had the original detections of concern were sampled in the June 2002 monitoring round. Looking further at the data, it is apparent that no ground-water samples were collected from monitoring wells located downgradient of 01-MW207 in any of the sampling rounds cited above. If it is determined that TCE data do not definitively support the referenced statement, then additional sampling and analysis for TCE may be necessary. It is recommended that the issue of TCE detections in the January 2002 sampling be further clarified in the text	In January 2002, samples from wells 01-MW202, 01-MW207, and 01-DGMW57 had detections of TCE at concentrations of 19 ug/L, 10 ug/L, and 27 ug/L, respectively. Because the concentrations were inconsistent with previous data, an additional sample was collected from each well in February 2002 for verification purposes. Results of the February 2002 sample analysis indicated nondetect concentrations from all three wells. It was concluded that the January 2002 results were indeed anomalous, and no additional samples were collected from those wells for VOC analysis. In June 2002, three newly-installed wells were sampled for VOCs (01-MW208, 01-MW209, and 01-MW210), and TCE was not detected in any of the three wells. For these reasons, it is concluded that VOC contamination is negligible at the site, as well as downgradient from well 01-MW207. The above information has been added to Section 4.5.1.

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		based on the concerns raised above as this data leads to potential issues within the human health risk assessment.	
24.	Section 4.5.5, Page 4-105	"In the 1998 investigation (Column 1 of Table 4-42),..." The referenced table is incorrect and should be Table 4-41. It is recommended that this error be corrected.	Text has been modified to refer to Table 4-40, which was previously shown as Table 4-41.
25.	Section 4.5.7, Page 4-116	"Table 4-42 presents a summary for metals analyses during these sampling rounds." The referenced table is incorrect and should be Table 4-43. It is recommended that this error be corrected.	Text has been modified to refer to Table 4-43.
26.	Section 4.5.7, Page 4-116 & 4-43	"Metals that exceeded MCLs..." No maximum contaminant levels (MCLs) are provided in the text or on Table 4-43 for the metals. It is recommended that either MCLs for metals be added to the tables or reference be made to another location where this information is presented in the RI Report.	MCLs have been added to Table 4-43.
27.	Section 4.5.7, Page 4-117	"The metals detected in these samples include...(Table 4-43)." The data referred to in this discussion appears to be presented on Table 4-36 and the frequency of detections summary is presented on Table 4-44. It is recommended that this error be corrected.	Text has been modified to indicate that the data is presented in Table 4-35, which was previously shown as Table 4-36.
28.	Section 4.5.8, Page 4-117	A discussion of the results of analyses for general chemistry as part of the Stationwide Groundwater Sampling is provided here; however, none of the data is provided in a table nor is a reference given for the	Table 4-45 has been added to this section which presents a summary of the general chemistry results. Proper references have been added.

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		source of this data. It is recommended that either the background values be added to one of the tables or reference be made to another location where this information is presented in the RI Report.	
29.	Section 4.5.9, Page 4-117	The results and conclusions of radionuclide investigations is provided here; however, none of the data is provided in a table nor is a reference given for the source of this information. It is recommended that this omission be addressed.	Table 4-46 has been added to present a summary of the results. Additionally, proper references have been added.
30.	Section 4.6	Here and throughout the subsections the results of surface-water sampling at Site 1 are discussed. In a number of these discussions Table 4-44 is cited, while in Section 4.6.8, Table 4-41 is cited. However, the analytical data for surface water are included on Table 4-45. It is recommended that these errors be corrected.	The text has been modified to indicate that all surface water data is presented in Table 4-47, which was previously shown as Table 4-45.
31.	Figure 4-7	The text discusses a perchlorate concentration of 75 mg/l while the figure provides a concentration of 7.5 mg/l. It is recommended that this error be corrected.	Discussion was incorrect and after being corrected was deemed unnecessary. Has been removed entirely.
32.	Section 5.1.2, Page 5-2	"Additionally, limited historical information suggests that rocket motors or JATO units were disposed at Site 1." What was the ultimate fate of such materials as results of the geophysical investigations at the site do not suggest the presence of such objects? It is recommended that this issue be further clarified in the text.	As summarized in the report text, available information on the handling of the JATO units was very limited, primarily interviews with former base workers, as well as reviews of various Station documents. No JATO units were recovered during trenching activities conducted under Tier II of the RI, and there is no other evidence suggesting the final disposition of the units. This information has been added to Section 5.1.2 of the Draft Final RI Report.

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33.	Section 5.1.2.1	Due to the physical properties of perchlorate, it has been shown at other sites where its use was historical in time that little or no source area contamination remains. It has been a number of years since activities that would have led to the release of perchlorate at IRP Site 1 were terminated and soil sampling indicated that low levels persist at selected locations. However, perchlorate is still present at relatively high concentrations in a number of monitoring wells in the "potential perchlorate source area" depicted on Figure 5-2. What mechanism(s) would lead to the levels of perchlorate present in ground water in this area years after the historical activities by the Marines that led to perchlorate releases to the environment were terminated? Secondly, what condition(s) would allow for the existence of the extensive perchlorate plume that has been delineated downgradient from this area? It is recommended that potential hydrogeological scenarios that support these issues be further discussed in the text	Perchlorate persists in the bedrock at Site 1 appears to be due to either the immature nature of this sandstone (incomplete cementation) or to differential weathering, or both. It is hypothesized that perchlorate has become "lodged" in this differential porosity and is only able to escape slowly through mechanisms which are not yet fully understood. This property is demonstrated in three features: •Eighteen separate hydrogeologic zones (primarily within the bedrock) identified from the long-term aquifer stress tests performed at Site 2, which has hydrogeologic zones similar to those at Site 1, •The detailed continuous coring that was conducted at Site 1 under Tier III-C of the RI supports the current conceptual site model. The random appearance of gypsum (HCL reactive) cement, with non-reactive dry, moist and wet zones throughout these cores clearly demonstrates that there are immature, not fully cemented deposits; thereby implicating the variable nature of its hydrology, and •The aquifer stress tests conducted recently at Site 1 (June 2005) yielded a response to shallow aquifer stress at deep well 01-MW222 but not at shallow well 01-MW204 (see Figure 2-4 in the Draft RI Report). Considered together, perchlorate probably progressed by dissolution from the surface soil at Site 1 releases through the weathering profile within the bedrock to the less weathered bedrock where it became lodged in a complex matrix of hydraulically separate zones that are periodically, but only partially, "flushed" by significant

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			recharge events, such as occurred in early 2005. As perchlorate is gradually released during aquifer discharge, and more rapidly released during high recharge events, perchlorate is flushed from the bedrock/weathered bedrock to the saturated alluvium where it is believed to be following a paleochannel within the alluvium to the vicinity of Site 2.
34.	Section 5.1.4	An evaluation of the ground-water quality data presented here coupled with the ground-water quality data presented in the "Draft Technical Memorandum, Aquifer Test, IRP Site 2, Magazine Road Landfill" (November 2004) suggests that the source of the perchlorate present in ground water at Site 2 is the result of contaminant migration from Site 1. However, no compilation of the data from the field investigations for Sites 1 and 2 are provided in the RI. It is recommended that an additional subsection be added to address the perchlorate detections at Site 2 with respect to contaminant migration in the aquifer between Sites 1 and 2 and that a figure be developed to show the full extent of the perchlorate contamination in ground water at Sites 1 and 2.	Comment noted. An additional subsection has been added to Section 4 (within Section 4.5.5), which discusses the Site 2 perchlorate sampling results. Pertinent information has also been added to Section 5. Figures showing Site 1 groundwater perchlorate concentrations (4-7 and 5-2) have been revised to include Site 2 concentrations.
35.	Section 5.1.4.1, Page 5-6	"The piezometers 01-PZ01 and 01-PZ11, and borehole 01-HPA10..." The citation of 01-PZ01 in this statement is incorrect and should be 01-PZ10. It is recommended that this error be corrected.	Reference has been made to piezometer 01-PZ10 as suggested.
36.	Section 6.5 & Section 6.6 (MCL	The risk assessment does not present a discussion of the MCL exceedances for bis(2-ethylhexyl)phthalate and nitrate in groundwater. It is recommended that	The Navy acknowledges that both bis(2-ethylhexyl)phthalate (BEHP) and nitrate exceed their respective MCLs. The Navy has noted these

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	Exceedances)	this information be added to the risk assessment.	exceedances, but for the reasons noted below believes these exceedances to be of little significance. The following information has been added to Section 6.5.5.1: 1) BEPH contributes only 1%-2% of the total cancer risk estimate from potential exposure to groundwater and was detected in only one sample. Thus, the exceedance of the MCL by BEHP is less significant to the overall management decision for groundwater at the site. 2) Nitrate was detected above the MCL of 10 mg/L in only 2 of 16 groundwater samples collected from monitoring well 01-MW201 and 01-MW203. The 95% UCL of the onsite nitrate concentration was calculated to be 10.2 mg/L. Based on their relative contribution to risk and low occurrence, these constituents are not expected to trigger any response action. In addition, please see response to Comment #23 above.
37.	Section 6.5 & Section 6.6 (Arsenic Issues)	In the current draft, excess lifetime cancer risks due to exposure to arsenic are evaluated using only EPA toxicity factors. It is the policy of Region 9 to incorporate California EPA (Cal/EPA) toxicity values into risk assessments at Superfund sites for any contaminants where the Cal/EPA value is significantly more conservative (ie., predicts higher risks) than	Comment noted. Per United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (EPA 2003), the current hierarchy for human toxicity values is: Tier 1 – EPA's IRIS

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		corresponding EPA toxicity values. (In this context, "significantly" is functionally defined as greater than 4-fold.) This policy is reflected in the Region 9 PRG tables by incorporation of a "Cal-modified" PRG value for the appropriate contaminants. Accordingly, the Cal-modified PRGs (6.2E-2 mg/kg for residential soils and 7.1E-3 ug/l for drinking water) and Cal/EPA toxicity values (oral cancer slope factor {SFo} of 9.5 [mg/kg-d]-1 and inhalation slope factor {SFi} of 12 [mg/kg-d]-1) for arsenic should be incorporated into the screening and site-specific risk assessments for Site 1. Additionally, since background arsenic concentrations in western soils and ground water are often significantly greater than their residential PRG levels, a discussion of how site-related arsenic concentrations compare to background levels should also be included. It would be appropriate within that discussion to present site-related risk values both with and without the contribution of background arsenic. Finally, for arsenic in ground water it would also be appropriate to discuss concentrations observed in ground water at Site 1 in the context of the MCL for arsenic. It is recommended that these issues for arsenic be addressed in the draft final report.	Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values The Navy will continue to utilize the Tier 1 (IRIS) values where they exist. The Navy has included Cal-EPA toxicity values in risk calculations for comparison purposes only. The results have been discussed in the Uncertainty section of the Draft Final RI Report. The issue of background contribution to risk is presented in the site-specific risk-based evaluation (SSRBE) and is included in the risk tables for this section. However, since the SSBRE is conducted for the construction/ utility worker, casual trespasser, and EOD range supervisor, this medium was not further evaluated in the SSBRE. To illustrate the contribution of background to risks associated with groundwater exposure, the Navy has included a discussion in both the risk-based screening (RBS) (Section 6.5) and the uncertainty section (Section 6.6.5) and has included numerical estimates of risk from background concentrations. See additional response to the 9 January 2006 comment on the same subject.
38.	Section 6.5 & Section 6.6 (Dioxins Issues)	For risk assessment purposes, dioxins and furans are not single analytes but rather a suite of closely related congeners, many of which share a common mechanism of toxicity and carcinogenicity, albeit with	The Navy understands the rationale behind the derivation and application of the TEQ approach for dioxins. The Navy generally discourages the incorporation of TEQ estimates into final risk estimates,

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		varying potencies. The current draft risk assessment inherently makes the assumption that only one of the dioxin/furan congeners found at the site -- 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) -- contributes to cancer risk; this assumption is present in the risk assessment by virtue of the fact that only the 2,3,7,8-TCDD concentrations are compared to risk-based screening levels. This assumption is unreasonable and runs counter to the risk assessment guidance and standard of practice for both EPA and Cal/EPA. It is also counter to the policy of the World Health Organization (WHO) and the consensus of the global scientific community. Regarding assessment of risks from the full spectrum of dioxin-like compounds, the standard of practice for Superfund risk assessment is to calculate a 2,3,7,8-TCDD-equivalent concentration using the WHO Toxicity Equivalence (TEQ) Factors, as endorsed by EPA, and to use this "TEQ concentration" when assessing risks or making comparisons to the dioxin PRG. This approach should be incorporated into the screening and site-specific risk assessments for Site 1. Fortunately, the approach used in the current draft document does not materially affect the conclusions of the risk screening process. Dioxin/furan congeners other than 2,3,7,8-TCDD made a significant contribution to the overall dioxin TEQ concentration in a number of surface soil samples (eg., in some samples 2,3,7,8-TCDD accounted for less than 10% of the total dioxin exposure point concentration as determined by the TEQ concentration). However, even taking the additional congeners into consideration via the TEQ concentration, there was	such that the basis of a response decision does not rely on toxicity data other than Tier 1. Dioxin TEQs were presented in the risk tables, along with appropriate PRGs for comparison. No changes have been made with respect to incorporation of TEQ estimates into the cumulative risk estimates for Site 1. See additional response to the 9 January 2006 comment on the same subject.

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		only a single soil sample (ie., 01-T33, Table G-9) which exhibited a TEQ concentration (23.7 ng/kg) greater than the residential soil PRG of 3.9 ng/kg used for risk screening at the site; since this was a subsurface sample, it is not expected to indicate a potentially significant excess cancer risk. It is recommended that these issues be addressed for dioxins in revising the RI Report.	
39.	Section 6.5 (Lead Issues)	In accordance with the Region 9 policy on Cal/EPA toxicity values (see Comment 37 above), the screening assessment for lead at Site 1 should be based on the Cal-modified PRG value of 150 mg/kg for residential exposures, instead of the EPA value of 400 mg/kg. It would be appropriate to note that the surface soil exposure point concentration (EPC) for lead at the site only marginally exceeds the Cal-modified PRG and that the ground-water EPC is below the MCL of 15 ug/l. It is recommended that this issue for lead be addressed in the risk assessment.	Given the rationale presented in the response to Comment #37, above, and in combination with the fact that the maximum detected concentration of lead in surface soil is 88.5 mg/kg, which is below both the EPA screening value of 400 mg/kg and the Cal-EPA modified PRG of 150 mg/kg, there should not be concerns from a risk assessment perspective. The Navy has discussed this in detail in the Nature and Extent section of the document (Section 4.3.2.9). Information provided includes the fact that, for the subsurface soil interval of 0 – 10 feet, the maximum detection of 1,580 mg/kg exceeds both of these PRGs while the RME EPC value (a 95 percent UCL of 93.4 mg/kg) is below these values. Therefore, the inclusion of the Cal-EPA modified PRG for lead will not change the fact that lead is a COPC in subsurface soil and not a COPC in surface soil.
40.	Section 6.5 & Section 6.6 (Naphthalene	In accordance with the Region 9 policy on Cal/EPA toxicity values (see Comment 37 above), the screening and site-specific risk assessments for	Comment noted. Per United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53

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	Issues)	naphthalene at Site 1 should be based on the Cal-modified PRGs (1.7 mg/kg for residential soils and 4.2 mg/kg for industrial soils), which incorporate Cal/EPA's determination that naphthalene is a carcinogen. Also, in the risk characterization discussion, it would be appropriate to discuss the very low frequency of detection observed for naphthalene at Site 1. It is recommended that these issues be addressed for naphthalene in the draft final report.	(EPA 2003), the current hierarchy for human toxicity values is: Tier 1 – EPA's IRIS Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) Tier 3 – Other Toxicity Values Cal-EPA toxicity values fall under Tier 3. Therefore, the Navy will continue to utilize the Tier 1 (IRIS) values where they exist. In the case of naphthalene, the Cal-EPA value is carcinogenic rather than noncarcinogenic as is the case for the IRIS-based EPA Region IX PRG. For this reason, the Navy has utilized the Tier 3 (Cal-EPA) toxicity values. Additionally, see response to comment # 37, above. See additional response to the 9 January 2006 comment on the same subject.
41.	Section 6.5 & Section 6.6 (TCE Issues)	It is noted in the current draft that the TCE toxicity values developed by EPA in 2001, which have been reviewed and supported by the Science Advisory Board, are still considered provisional and are scheduled for further independent peer review. It should also be noted that Cal/EPA's Office of Environmental Health Hazard Assessment has developed cancer slope factors for use in assessing risks from TCE exposure. Rather than choose between the two sets of toxicity values, risk managers would be better informed by seeing a range of	Please see response to Comment #23, above, for a justification of the reasons for not collecting additional samples for TCE analysis. Additionally, please see response to Comment 37, above.

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		potential cancer risks calculated using both the provisional EPA values and the current Cal/EPA values. Relatively high TCE concentrations were observed in ground-water sampling during the mid-1990's (Table 4-35) and similar concentrations were observed again during Tier I sampling early in 2001 (Table 4-36). Sampling in between these periods and afterwards did not detect TCE, however, relatively few samples were analyzed for TCE at these times. It appears that the TCE in ground-water situation might deserve some additional investigation to clarify the extent of TCE contamination in ground water and to develop accurate ground-water concentration data. (See Comment 23 above.) Since the presence of TCE was demonstrated in two early rounds of sampling, TCE concentrations from subsequent sampling should, consistent with Superfund risk assessment guidance and the standard of practice, be assumed to equal one-half the appropriate detection limits. Thus TCE, at these levels, should be incorporated into the future residential scenario for the site-specific risk-based evaluation. In addition, the risk assessment should present a discussion of the MCL exceedances observed for TCE in ground water during the initial sampling event. It is recommended that these issues regarding TCE be addressed in revising the RI Report.	
42.	Section 6.6	The initial risk-based screening evaluation in the current draft is performed using PRGs developed to assess residential exposures; this is appropriate and consistent with EPA and Cal/EPA policy and guidance. However, the more detailed site-specific	The screening risk assessment procedure is an amalgamation of the Navy and EPA methods. The inclusion of the residents in the Site-Specific Risk-Based Evaluation (SSRBE) is considered redundant. The evaluation of residents (and industrial workers) is

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		risk-based evaluation, conducted on those contaminants remaining from the PRG screening, considered only construction worker, trespasser, and range officer exposure scenarios; it specifically did not address risks for any potential future residential exposures on the site. Due to the extreme population pressure and rapidly appreciating real estate values in this area, it is reasonable to assume that this property could eventually be considered for future residential development. In this respect the current draft itself notes that "continued urbanization has brought housing developments to within one-half mile to the northeast of the site." Therefore, a future residential exposure scenario should be included in the site-specific risk-based evaluation. Consistent with California water policy and Superfund risk assessment standard of practice and guidance, use of ground water as a potential future source of drinking water should be included in the future residential scenario risk assessment. Alternatively, since this property is a former EOD Range, if Department of Defense (DoD) regulations or policy prohibit future residential development this condition should be discussed within the risk assessment and DoD should assure that the proper land-use restrictions are in place to prevent consideration for future residential development (see Comment 46 below). It is recommended that these issues be addressed in a revised risk assessment.	already presented in the Risk-Based Screening (RBS) as a default exposure scenario. As such, the residential land use scenario (which is not likely based on future reuse plans) is more conservative than would be developed in the SSRBE. The text has been modified to clarify that a resident is a site-specific receptor, but for the aforementioned reason is not evaluated in the SSRBE. The Base Realignment and Closure (BRAC) process dictated that Site 1 was to be transferred to another federal agency. The premise for the approach for characterization (including determination of a baseline for COCs) and the ultimate disposition of the site was designated for a Fed to Fed transfer. The disposal of the property has not deviated from that plan.
43.	Section 6.6 (Perchlorate	The perchlorate ground-water plume extends downgradient beyond the boundaries of Site 1 to impact other areas of MCAS El Toro (see Comment	For the risk assessment at Site1, "off-site" refers to all locations beyond the Site 1 boundary. Potential risks for future offsite residents were qualitatively and

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	Issues)	34 above). The risk evaluation should discuss the possibility for "off-site" impacts and give some consideration to potential risks created by them. It is recommended that this issue be addressed in the Draft Final RI Report.	conservatively evaluated using risk information for future onsite residents because the perchlorate plume already extends beyond the Site 1 boundary with concentrations generally lower than those onsite due to attenuation and other processes. Quantitative estimates of risk, based on lower chemical concentrations beyond the boundary of Site 1, would not provide substantive information for site risk managers in determining management decisions for areas beyond the site.
44.	Section 6.6.2, Page 6-36	This site-specific risk evaluation makes the assumption that a construction/utility worker's exposure duration is 3 years for the reasonable maximum exposure (RME) scenario and 1 year for the central tendency exposure (CTE) scenario. By using these exposure duration values, the risk assessment inherently assumes that MCAS El Toro is the only contaminated property that a construction/utility worker receptor will ever work on; this assumption is unrealistic. Given the general paucity of previously undeveloped land in Southern California and the recent emphasis by municipalities and government agencies to redevelop brownfields-type properties, it would be more reasonable to assume that construction/utility workers routinely encounter contaminated properties. Therefore, in order to generate a soil PRG which achieves a given target risk level over a construction/utility worker's career it would be more appropriate to assume that 50% (RME) to 25% (CTE) of that career involves work at contaminated properties. Over a 25-year working career, the corresponding exposure durations would	The Navy acknowledges that a construction worker could encounter contamination at locations other than Site 1. However, the Navy disagrees that this information should be reflected in exposure assumptions for Site 1 because this risk assessment focuses on <u>incremental</u> risks posed by the Site 1 and does not attempt to estimate lifetime risks for construction workers (or other receptors) who, through exposure at other locations and lifestyle choices, are likely to have a significantly higher lifetime risk. No revisions have been made to the evaluation of the construction worker based on this comment.

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		be 12.5 years (RME) and 6.25 years (CTE). It is recommended that these issues be addressed in a revised risk assessment.	
45.	Section 7 & Appendix H	The Screening Ecological Risk Assessment (SERA) and Baseline Ecological Risk Assessment (BERA) presented in Appendix H and summarized in the main document text appear to be responsive to the major comments made by the agencies in 2003 in reviewing the "Draft SERA, Phase II RI, IRP Site 1, EOD Range, Former MCAS El Toro" (February 2003). EPA agrees with the Navy's conclusions that potential risk does exist to biota on site. However, as noted in the comments made on this draft SERA by Dr. Regina Donohoe, California Department of Fish and Game - Office of Spill Prevention and Response dated 11 August 2005, some of the methods used to assess the risk were not those suggested in her comments of 4 June 2005 on the February 2003 draft cited above. EPA concurs with her present comments and strongly recommends that the Navy make the changes that she suggests in a revision of the SERA.	The majority of the comments received on the February 2003 Draft SERA were incorporated in this draft of the SERA (Appendix H). Several suggestions were made by Dr. Donohoe regarding specific toxicity studies to be used in assessing risk to ecological receptors. The Navy incorporated several of the suggestions but consider several others as less applicable to this risk assessment. The suggestions made in the 2003 comments were brought up by Dr. Donohoe again in her 3 August 2005 comments on the Draft RI Report and have been specifically addressed in a separate set of responses to those comments. For further details, please see the responses to Dr. Donohoe's 3 August 2005 comments.
46.	Section 8.0	In reading the supporting documents related to Section 8 -- Munitions and Explosives of Concern Risk Assessment -- it was noted that IRP Site 1 does not meet the current DoD criteria for an EOD Proficiency Range, where munitions other than bare explosives are detonated/functioned. According to the first paragraph of Section 8, the EOD Range is to be transferred to another federal agency and will continue to be used in the same manner as it has previously been used. This transfer would, therefore,	Any prospective owner/operator will need to comply with the governing standards and regulations related to siting requirements. The Navy agrees that cased munitions were used for training at Site 1 and that DoD 6055.9-STD C9.8.4.1 applies to any future like use of the property. The minimum separation distance of 1250 feet established by DoD 6055.9-STD is the distance required for aboveground detonations on flat terrain and it can be

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		be conducted under the provisions of "Chapter 12 -- Real Property Contaminated with Ammunition, Explosives or Chemical Agents -- of DoD 6055.9-STD -- Department of Defense Ammunition and Explosives Safety Standards" (October 5, 2004). Section C12.3.2.5 of this standard reads as follows: "Limited use land transfers may be arranged with other federal agencies for compatible use of contaminated real property such as wildlife refuges, safety zones for federal power facilities, or other purposes not requiring entry except for personnel authorized by the DoD component concerned. These land transfers shall include all restrictions and prohibitions concerning use of the real property to ensure appropriate protection of both operating personnel and the general public." As "appropriate protection" within the DoD is defined in DoD 6055.9-STD, this appears to indicate that the explosives safety and quantity/distance provisions of DoD 6055.9-STD will continue to apply to the property after transfer. Section 1.3 of Appendix E -- Munitions and Explosives of Concern Range Evaluation -- states that "training for EOD and demolition of munitions has been conducted at Site 1 since 1952 (BNI 1995)". Review of Attachment C -- Munitions and Explosives of Concern Investigation Results -- of Appendix E reveals that munitions fragments were found on-site. This discovery confirms that fragment producing munitions items other than bare charges have been used or disposed of on the EOD Range. Paragraph C9.8.4.3.4 -- EOD Proficiency Training Ranges -- of DoD 6055.9-STD states the following in subparagraph C9.8.4.3.4.3: "EOD proficiency training ranges used	reduced by using engineering controls when required. These controls can either be natural or man made. Natural controls could include a valley surrounded by hills or mountains (such as the case of Site 1). Man-made controls would include burying demolition shots before initiating the energetic materials or using sandbags to mitigate the effects of both blast and fragments. One such control that is heavily used today is sandbags, detailed in the document, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions (HNC-ED-CS-S-98-7), August 1998. When employed, sandbags reduce the MSD to as little as 220 feet for a 155MM M107 HE round. This mitigation measure is used to conduct demolition operations at Formerly Used Defense Site (FUDS) MEC remediation sites in and around housing areas with great success. The data collected from the investigation along the eastern Site 1 fenceline verified the presence of MD. An additional offsite investigation followed. During this extensive investigation offsite to the east, only Munitions Debris (MD) was discovered, with a comparatively low density of 12.1 MD per acre. Judging by the MD located around the perimeter of the Site 1 range fence and the natural protection afforded by the hills around the demolition areas, the areas beyond the northern and western boundary would be less contaminated than areas beyond the eastern boundary and thus additional offsite assessment is not planned.

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		with other than bare charges or non-fragment producing items shall meet the requirements of subparagraph C9.8.4.1". That subparagraph contains the following requirement for separating nonessential personnel from intentional detonations which may produce fragments: "The distance determined from the equation d =328W1/3 but not less than 1,250 ft". This would require the installation boundary to be a minimum of 1,250 feet from any detonation on the range that produces fragments to ensure that any off-base individuals at or near the boundary were protected as nonessential personnel. As the northwestern boundary of the installation and the current northwestern boundary of the EOD range and its buffer area are the same, it is obvious from a review of Figure 1-2 of Appendix E that the required separation distance cannot be met for any off-base individuals in close proximity to the cited boundary fences. The requirements noted above should be understood by all involved in the transfer of the EOD Range and the receiving agency should be aware that compensatory measures are necessary to preclude undue risk to off-base personnel during range operations involving items which may produce fragments. In addition, there is a slight potential that munitions items may have been ejected (ie., kickouts) from the "demolition of munitions" activities noted in Section 1.3 of Appendix E. Some of these kickouts may have landed off the installation and this potential hazard should also be addressed. It is recommended that the Navy address these issues as applied to the transfer and future uses of IRP Site 1 in the Draft Final	

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		RI Report.	
47.	Section 8.0	The statement is made a number of times in Section 8 that the munitions and explosives of concern (MEC) items recovered on the EOD Range are unfuzed (low sensitivity). While this appears to be correct, this does not necessarily mean that all of the MEC potentially present and unrecovered on the EOD Range is unfuzed and, therefore, of low sensitivity. This is of concern because of the presence of a number of the items noted in Attachment C – Munitions and Explosives of Concern Investigation Results – of Appendix E which seems to indicate that the range was used to destroy unserviceable/hazardous munitions as well as to conduct EOD proficiency training. This activity could have resulted in fuzed munitions remaining on the EOD Range. In addition, with the continued use of the range for the same general purpose by another agency, the probability that fuzed MEC is present can only increase, unless periodic clearance is undertaken by its new tenants. While this potential does not require a revision of the risk assessment, it should be communicated to all future users of the EOD Range, unless it can be definitively stated that no destruction of unserviceable/hazardous munitions with fuzes was/will be done on the EOD Range. It is recommended that the Navy address these issues as applied to future uses of IRP Site 1 in revising the RI Report.	The types of munitions located during this investigation would be considered low-sensitivity, whether fuzed or unfuzed, as all munitions located were not fired or used as designed. Most of the munitions located during this investigation are manufactured, shipped, and handled as a complete projectile with fuze attached. The fuzes in the case of the located rounds were dislodged during the demolition or burn event. The DOD imposes rigid requirements on sites that are known to have been used for munitions related activities. The preparation of an Explosives Safety Submission (ESS) is required during the course of field activities and is a requirement before a given MEC site can be transferred to another entity. While the regulatory agencies deemed it was not expedient to review the ESS, it was generated for Site 1 in March of 2005 and the agencies were updated at BCT meetings. The document is entered into the Administrative Record as the Final Explosive Safety Submission, Environmental and Construction Support for Munitions and Explosives of Concern, Installation Restoration Program Site 1 Explosive Ordnance Disposal Range Former Marine Corps Air Station, El Toro, California, March 7, 2005. Upon transfer, the new owner/operator of this property, that will use the property for like use will establish a range Standard Operating Procedure (SOP), which will set their requirements for conducting range operations

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			and maintenance.
48.	Section 8.1, Page 8-1	Reference is made here to "...two 40mm cartridges with primer..." As the term "cartridge" refers to a complete round (ie., everything necessary to fire the related weapon one time), a 40mm cartridge would include the primer, propellant, cartridge case, projectile, fuze, and filler. It appears from a review of Attachment C of Appendix E that the item of concern should be described as two 40mm cartridge "cases" with primer. It is recommended that the text be revised to correct this discrepancy.	Text has been modified as suggested.
49.	Section 8.1, Page 8-1	It is stated here that "MD is inert (nonhazardous) and does not pose a safety risk". This may not be a valid assumption depending on the nonexplosive (physical and chemical) characteristics of the munitions debris (MD). This sentence would better express the relative hazard of MD if it were revised to read: "MD is inert (nonenergetic) and does not pose an explosives safety risk." It is recommended that the text be revised to correct this discrepancy.	Text has been revised as suggested.
50.	Section 8.1, Page 8-1	"The sensitivity of the types of MEC recovered is low (unfuzed) and the explosive fillers were in small quantities (less than 0.5-pound each). The hazard score, based on the explosives safety risk tool (Attachment E of Appendix E), is 5 on a scale of 1 to 5 (lowest to highest)." This is somewhat confusing as the statement emphasizes the low sensitivity and the small amount of explosive fillers but then states that the hazard score is the highest achievable. This would be better understood if the last sentence were	Text has been revised as suggested.

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		changed to read: "However, the hazard score, based on the explosives safety risk tool (Attachment E of Appendix E), is 5 on a scale of 1 to 5 (lowest to highest). This is due to the presence of a Class/Division 1.1 explosives (mass explosion)." It is recommended that the text be revised to either clarify the current statement or to correct the language as recommended.	
51.	Section 8.2, Page 8-2	Reference is made here to the presence of cartridges by the qualifying statement that reads "...(i.e., 20mm and 40mm cartridges)..." As the term "cartridge" refers to a complete round (ie., everything necessary to fire the related weapon one time), 20mm and 40mm cartridges would include the primer, propellant, cartridge case, projectile, fuze, and filler. It appears from a review of Attachment C of Appendix E that the items should be described as 20mm and 40mm expended cartridge "cases". It is recommended that the text be revised to correct this discrepancy.	See response to Comment #48 above.
52.	Section 8.3, Page 8-3	It is stated that "MD is inert (nonhazardous) and does not pose a safety risk". This may not be a valid assumption depending on the nonexplosive characteristics of the MD. This sentence would better express the relative hazard of MD if it were revised to read: "MD is inert (nonenergetic) and does not pose an explosives safety risk." It is recommended that the text be revised to correct this discrepancy.	See response to comment #49 above.
53.	Section 8.4, Page 8-4	The frequency of entry into the Range Perimeter (Outside the Fence) area is described as "occasional (2 to 8 entries per month)". This is the same entry	It is not likely that the frequency would be greater than 2 to 8 entries per month due to the extremely steep grade from the freeway to the site boundary and the

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		rate as the EOD Range itself, which has a fence to prevent or discourage entry along its perimeter. The EOD Range is also inside the installation fence as well on the east and south which further deters off-installation entry. The close proximity of what may be a major highway on the northeast boundary of the EOD Range would appear to provide easy access to that portion of the range perimeter outside of the range and installation fences (ie., up to 1,250 feet from the point of detonation). This area is where a potential residual hazard from kickouts and a potential continuing hazard from the similar use of munitions items by the new landowner/user may exist. It is recommended that the analysis of the frequency of entry be reviewed to determine either if it is appropriately estimated at 2 to 8 entries a month or if the estimate should be increased due to the potential for access to the hazard area in the north and western off-base quadrants. It is recommended that the Navy address these issues in a revising the RI Report.	lack of pedestrians on or near the freeway. To conduct investigation activities in the area, climbing ropes and safety harnesses would have to be utilized to provide safe access. This additional information has been added to Section 8.4 of the Draft Final RI Report.
54.	Section 9.1.1.2, Page 9-2	"It is likely that borehole B-1 is the only location where low concentrations of explosives and perchlorate exist up to the depth of 35 feet bgs." What is this conclusion based on? If no other borings had detections of explosives and perchlorate with depth, then it is recommended that this supporting data be mentioned here.	See response to Comment #2 above.
55.	Section 9.1.2.3, Page 9-4	"Cumulative incremental cancer risks for future offsite residents potentially residing near Site 1 are less due to groundwater mixing and potential biodegradation." What is meant by this statement? As presented in	See response to Comment #4, above.

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		this context, the statement does not fully explain the cause and effect described. It is recommended that further clarification be provided.	
56.	Section 9.1.2.5, Page 9-5	The citations for the tables in this summary are incorrect. The tables that should be referenced are Table 9-1 and Table 9-2. It is recommended that this error be corrected.	The tables have been removed from Section 9.2.1.5. Text now refers back to Tables 6-2 and 6-5.
57.	Section 9.2, Page 9-10	Under question 3 – does the contamination extend beyond 10 feet bgs – mention is made of the one location cited in Comment 54 above "which is likely to be the only location where contamination has affected deeper soil". What is this conclusion based on? If no other borings had detections of explosives and perchlorate with depth, then it is recommended that this supporting data be mentioned here.	See response to Comment #2 above.
58.	Section 9.2, Page 9-10	Under question 5 – is surface-water runoff an exposure pathway – an answer of "yes" is given "based on observations made during the winter 2004-2005 season". However, within a number of discussions in Section 5 – Contaminant Fate and Transport – this pathway for migration is discredited due to the lack of detections of contaminants at levels of concern in this media. Which position is the Navy supporting regarding surface-water runoff as a potential exposure pathway? It is recommended that these discrepancies be addressed.	Much of the Fate and Transport discussion focuses on perchlorate. Because perchlorate was not detected in surface water samples, surface water is an insignificant pathway for exposure to perchlorate. However, other COPCs including arsenic and RDX were detected in surface water samples and were evaluated in the risk assessment as surface water provides a potential exposure pathway for those constituents (Section 6).
59.	Section 9.2.1, Page 9-11	Once again, mention is made of the one location cited in Comment 54 above "which is likely to be the only location where contamination has affected deeper	See response to Comment #2 above.

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		soil". What is this conclusion based on? If no other borings had detections of explosives and perchlorate with depth, then it is recommended that this supporting data be mentioned here.	
60.	Appendix E, Figure 2-1, Figure 2-3, & Figure 2-5	Each of these figures has a box in the legend with solid lines making up all four sides of the box. The description of these boxes is similar on each of the figures and each reads as follows: "1-acre grid selected for intrusive investigation of all anomalies within grid (only grids shown with solid lines required to be intrusively sampled for MEC)" [Figure 2-1]; "1-acre grid selected for intrusive investigation of all anomalies within grid (only grids shown with solid lines were intrusively sampled for MEC)" [Figure 2-3]; and "1-acre grid selected for intrusive investigation of all anomalies within grid (only grids shown with solid lines were intrusively sampled for MEC)" [Figure 2-5]. Careful inspection of the three figures reveals: 1) no grid on Figure 2-1 with all sides constructed of solid lines, 2) what appears to be five grids on Figure 2-3 with all sides constructed of solid lines, and 3) only one grid which has all four sides constructed of solid lines on Figure 2-5. It is recommended that the figures be reviewed and revised as necessary to consistently display the correct number of intrusively sampled grids.	The figures have been modified to be consistent with pothole locations shown on Figure 2-3.
61.	Appendix E, Attachment A, Page 8	Photograph 11-OE and OE Scrap has a 3-inch naval projectile which is incorrectly labeled as a 3-inch naval round. Since it does not have a cartridge case attached, it cannot by definition be a 3-inch round. It is recommended that this erroneous labeling be	The item in the photograph has been re-labeled as a "3-inch naval projectile" as suggested.

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		corrected.	
62.	Appendix E, Attachment C, Page 1 of 3	In Table C-1, the line labeled PH015 describes the item as a "40mm casing (BOFERS)". The correct term is "Bofors". It is recommended that this erroneous labeling be corrected.	Text has been modified to read "40mm casing (Bofors)" as suggested.

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Reviewer: Frank Cheng, P.E., Remedial Project Manager, California Department of Toxic Substances Control, Office of Military Facilities, Southern California Operations Branch, Letter dated 2 September 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review process.			
SPECIFIC COMMENTS			
1.	Section 2.1, Page 2-1	Page 2-1 last paragraph refers to a list of Field Change Requests approved during the course of the remedial investigation. The list is missing from the report. Please add the list to the report.	A listing of the field change requests has been included in the Draft Final RI Report.
2.		The report concludes that the perchlorate plume at IRP Site 2 may have originated from IRP Site 1. The investigation at IRP Site 2 may not define the downgradient extent of the perchlorate plume. The Navy should propose additional investigation at and below the mouth of Borrego Canyon to characterize the downgradient toe of this contamination.	The perchlorate plume downgradient from Site 2 is defined to approximately 6 µg/L by off-Station wells 02NEW26 and 02NEW07. The Site 2 wells will continue to be monitored to establish downgradient perchlorate trends. If future sampling results indicate a significant increase in perchlorate downgradient from Site 2, or an Action Level is promulgated at or below 6 µg/L, additional sampling may be proposed.
3.		RDX was detected at 7,380 ug/kg in boring DP05 at 1.5 feet below ground surface. This boring lies outside of the known areas of the EOD at this site. The horizontal extent of this contamination has not been determined to the west of this boring. The Navy should propose additional soil matrix sampling to characterize the extent of this contamination.	The RDX concentration detected at location DP05 exceeds the EPA Region 9 Residential PRG of 4,420 ug/kg but is significantly less than the industrial PRG of 15,670 µg/kg. The Human Health risk calculated for RDX is insignificant for the Residential, Industrial, and Site-Specific scenarios (Draft RI, Tables 6-2 and 6-4). Additionally, RDX was not detected at the Direct-Push sample locations immediately adjacent to DP05 (DP04 and DP16). Therefore, the elevated RDX concentration has been delineated and additional soil sampling to delineate the extent of RDX in the area of

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			DP05 is not necessary.

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Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 21 July 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review process. References to responses to comments dated 11 January 2006 on the same subject by the same reviewer are also added where applicable.			
GENERAL COMMENTS			
1.		The human health risk assessment appeared to have been conducted in an organized manner. HERD has minor comments pertaining to the selection of chemicals of potential concern (COPECs) due to the elevated reporting limits of some analytes. Additional discussion on the cause of these highly elevated reporting limits should be provided, and tabulated data should be presented to show the samples where reporting limits exceeded twice the maximum detected concentrations.	Section 6.2.2 *Sample Reporting Limit Evaluation,* has been revised to discuss the possible causes of the elevated reporting limits. In addition, Section 6.2.3.3 *Elevated Reporting Limits for Nondetect Values,* has been revised to include a discussion of the cause of the elevated reporting limits for the nondetect observations.
2.		Unless there was prior agreement on the toxicity factors that will be applied in the risk assessment, the risk estimates should utilize both EPA and Cal-EPA toxicity factors. Naphthalene is considered a carcinogen by Cal-EPA, hence, naphthalene should be included in the risk estimates.	Comment noted. Per United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (EPA 2003), the current hierarchy for human toxicity values is: Tier 1 – EPA's IRIS Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values The Navy will continue to utilize the Tier 1 (IRIS) values where they exist. The Navy has included Cal-EPA

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			toxicity values in risk calculations for comparison purposes only. The results are discussed in the Uncertainty section of the Draft Final RI Report. No remedial action is planned to be conducted based on the use of toxicity values other than those from Tier I. See additional response to the 11 January 2006 comment on the same subject.
3.		HERD defers to EPA and OMF personnel familiar with MEC issues for a more thorough review of the MEC risk assessment, but a few specific comments are included in the list of comments in the following section.	Comment noted.

SPECIFIC COMMENTS

1.	Page 4-109, 2nd Paragraph	The report cites state and federal provisional action levels for perchlorate at 18 and 32 ug/L. This report should cite the public health goal (PHG) of 6 ug/L for perchlorate (OEHHA, 2004). Consequently, please add that the PHG for perchlorate was exceeded during the sampling conducted in November 1999. The exceedance was observed in 4 wells, namely, 01-MW201, 01-MW202, 01-MW203, 01-MW204, 01-MW207, and 01-DGMW58	Comment noted. The discussion refers to perchlorate sampling that occurred in 1999. As such, the state and federal provisional action levels that are quoted (18 and 32 ug/L, respectively) are those that were in effect in 1999. The text does not imply that the current PHG is either 18 or 32 ug/L. Subsequent to the utilization of the Federal Action Level, the State Notification Level of 6 ug/L was issued (OEHHA, 2005). Text has been modified to indicate that perchlorate also exceeded the current State Notfication Level of 6 ug/L in three wells, 01-MW201, 01-MW207, and 01-DGMW58.

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2.	Section 4.5.7, Page 4-116	The analytical data for metals from the Stationwide Groundwater Sampling are presented in Table 4-43, instead of Table 4-42 that was cited in the report. The results of the RI Tier I and Tier III-A Groundwater sampling are in Table 4-44 instead of Table 4-43.	Text has been modified to refer to Table 4-43 when discussing metals in stationwide groundwater monitoring rounds, and Table 4-44 when discussing Tier I and Tier III-A metals sampling results.
3.	Appendix G, Table G-2, and Section 6.2.2	The footnotes in Table G-2 indicated that the reporting limits of specific chemicals were not evaluated due to the absence of corresponding PRGs. HERD recommends that the PRGs for structurally similar chemicals be used in the data evaluation. These consist of the following: • Use PRG for dinitrotoluene mixture for 2-amino, 4,6-dinitrotoluene, 4-amino, 2,6-dinitrotoluene • Use PRG for hexane for 2-hexanone • Use PRG (noncarcinogenic) for naphthalene for 2-methylnaphthalene • Use PRG for acenaphthene for acenaphthylene • Use PRG for pyrene for benzo(g,h,i)perylene • Use PRG for anthracene for phenanthrene HERD recommends that chemicals without available PRGs be included in Table G-2 and identified as not having any available PRGs. This will provide a comprehensive presentation of the data and will facilitate the perspective on the uncertainty of the risk assessment.	Comment noted. The Navy generally does not conduct surrogate PRG substitution for structurally similar chemicals unless those chemicals are the only chemicals detected or they are frequently detected chemicals at the site. Neither is the case for Site 1. Structurally similar chemicals may not be similar in their toxicity. Chemicals for which there are no toxicity criteria have been discussed qualitatively Section 6.6.5 (Uncertainties in the Screening Risk Assessment) of the Draft Final RI Report. See additional response to the 11 January 2006 comment on the same subject.

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4.	Section 6.3.3, Page 6-9	Please revise the section based on the preceding comment on the use of structurally similar compounds.	Comment noted. Please see response to comment #3, above. See additional response to the 11 January 2006 comment on the same subject.
5.	Section 6.2.3.3, Elevated Reporting Limits for Nondetect Values	This section cited EPA RAGS (EPA, 1989) for justifying the exclusion of analytes that had reported non-detects because the reporting limits exceeded twice the maximum detected concentration. However, Table G-2 shows a comparison of the range of reporting limits for each analyte to its corresponding residential PRG, but does not show the maximum detected concentrations. Please provide a table showing the maximum detected concentrations and the range of reporting limits. If an analyte was not detected in all samples because its reporting limit is higher than a screening criterion, then the analyte should be included at one-half the reporting limit (EPA, 1989). Excluding the analyte could underestimate the risk. The uncertainty associated with the use of one-half the reporting limit can be discussed in the uncertainty section. HERD recommends that the selection of COPCs be either redone or presented more clearly. Another concern is the qualitative statement that inhalation of VOCs in indoor air is an insignificant pathway. HERD recommends that this statement be supported by evaluating the indoor air pathway.	Tables G-3 and G-4 present the maximum detected concentrations for the 0 to 2 foot interval and the 0 to 10 foot interval, respectively. When a chemical was both detected and not detected in sample media, a proxy concentration of ½ the reporting limit was assigned when calculating exposure point concentrations (such as the 95 percent UCL). If an analyte was not detected in the sample media, then it is not included in the risk assessment. The uncertainty associated with not including these nondetect chemicals in the risk assessment has been discussed in the uncertainty section. Further clarification has been added. The Indoor air pathway has been evaluated using the Johnson and Ettinger model (EPA 2004) and results are presented in the Draft Final RI Report. See additional response to the 11 January 2006 comment on the same subject.
6.	Tables G-10 to	HERD notes that the risk evaluation presented in this	Comment noted. Please see response to General

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	G-13	report does not incorporate the Cal-modified PRGs. Consequently, naphthalene was compared to the noncarcinogenic PRG rather than the Cal-modified PRG based on the carcinogenic effects of naphthalene. HERD recommends that the Cal-modified PRGs or toxicity values be included in the screening risk evaluation.	Comment #2, above.
7.	SQL Evaluation, Page 6-45	HERD disagrees with the assertion that if a chemical is not detected because the reporting limits (RLs) exceed the PRGs, it is possible that these chemicals are not present. The elevated RLs could be due to matrix interferences or due to dilution of the sample because of elevated chemical concentrations. HERD recommends that this statement be deleted because exclusion of chemicals with RLs higher than its PRG would potentially underestimate the risk.	The intent of the discussion of uncertainties associated with the sample quantitation limit is to include both sides of the issue: (a) that the chemical could be present but is not seen because the analytical reporting limit is too high or (b) that the chemical is not present even though the analytical reporting limit is elevated. Two sides of the argument are (1) a chemical has been missed because the sample quantitation limit was too high and therefore potential risk could be underestimated and (2) the chemical is not present and the elevated sample quantitation limit does not affect the risk estimates. These points are made in the existing text. Therefore, Section 6.6.5, Uncertainties in the SRA (SQL Evaluation discussion), does not require revision.
8.	Section 8, Munitions and Explosives of Concern (MEC) Risk Assessment	HERD defers to EPA and OMF for major comments on the MEC risk assessment. Since guidelines pertaining to the MEC risk assessment are still evolving, HERD would like to list some concerns: Section 1.4.2.1 states that the Northern EOD Range has an area of 4.1 acres and the Southern EOD Range has an area of 4.1 acres. Hence, if the Northern and southern Ranges were divided into 1-	The reference to 4.1 acres in the Southern EOD Range and 4.1 acres in the Northern EOD Range was in error. The northern and southern ranges are approximately 17 acres each. Text has been modified to indicate this. The grid system was used to facilitate geophysical activities. It is noted that some of the 12 grids do not correspond to one square acre. Additionally, anomalies were not detected in a number of the grids.

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Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 21 July 2005

Comment No.	Section/ Page No.	Comment	Response
		acre grids, it is unclear why there was a total of nine grids. Figure 1-4 shows more than 9 grids superimposed over the Northern and Southern EOD Ranges. Please clarify.	Therefore only 9 grids were selected for intrusive sampling.
9.	Section 9.1.2.5, Page 9-5	Please correct the table number showing a summary of the human health risk estimates. Instead of Tables 8-1 and 8-2 cited in the text, the correct citation should be Table 9-1 and 9-2.	The tables have been removed from Section 9.2.1.5. Text now refers back to Tables 6-2 and 6-5.

Document Title:

Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Letter dated 1 September 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review process.			
SPECIFIC COMMENTS			
1.	Section 3.1, Page 3-1, Land Use and Natural Resources, Second Paragraph	The paragraph identifies the nearest municipal drinking water source wells ten miles downgradient of IRP Site 1. The Navy is aware of the schedule for the completion of the Irvine Ranch Water District's desalter project. The desalter project will result in municipal supply wells closer than 10 miles downgradient. This fact should be stated and discussed in the report.	Text has been added to Section 3.1 that discusses the upcoming desalter project and the distance between Site 1 and associated extraction wells.
2.	Page 4-43, Phase II RI Tier II Soil Sampling and Analysis	The petroleum corrective action program cleanup levels for petroleum hydrocarbons in surface soils are 100 parts per million (PPM) for gasoline range, 1,000 ppm for diesel range, and a site specific determination for waste oil range. These cleanup levels are appropriate for IRP Site 1.	Comment noted. The petroleum hydrocarbon-contaminated soil is co-located with naphthalene, benzene, and some perchlorate in soil and, as such, will be evaluated in the Feasibility Study.
3.	Table 4-22, Page 4-49, Minimum and Maximum Concentrations of Detected Metals	Please indicate whether the analytical method included and reported molybdenum concentrations, and provide us with all of the data pertaining to the reported values.	The Contract Laboratory Program (CLP) method used to analyze the samples does not typically include molybdenum. The list of 23 metals analyzed during the Phase II RI, which does not include molybdenum, received regulatory concurrence during the development of the Site 1 Phase II RI Work Plan, which was finalized in November 2001.
4.	Page 4-109, Verification of	The State Department of Health Services has replaced the term "action level" with "Drinking Water	Text in the Draft Final RI uses the term "Drinking Water

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Reviewer: John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Letter dated 1 September 2005

Comment No.	Section/ Page No.	Comment	Response
	Perchlorate, Second Paragraph	Notification Level." The notification level for perchlorate is 0.006 milligrams per liter. We use the notification level as the groundwater cleanup goal for perchlorate.	Notification Level" as suggested.
5.	Section 4.6.8, Page 4-125, Metals	To support your finding that Site 1 is not impacting downgradient surface waters, we recommend that you differentiate between metals detected in surface waters within the site, or associated with the pond, and detections at the downgradient sampling point. For surface water flows in the San Diego Creek watershed, we have various criteria that are applicable in addition to the National Recommended Water Quality Criteria or aquatic risk-based screening values. They include: TMDLs (Total Maximum Daily Load) for sediments, nutrients, and toxics; California Toxics Rule criteria; and Basin Plan Objectives.	Comment noted. The downgradient sample was collected within the boundaries of Site 1. Surface water exiting Site 1 only occurs in exceptionally wet seasons such as the Winter of 2004-2005. The surface water sample analysis was conducted per Section 3.3.7.1 of the Final Phase II RI Work Plan. A comparison to the various applicable water quality criteria has been added to Table 4-47 and is summarized in Section 4.6.8.

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Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 11 August 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review and revision process. References to responses to comments dated 23 January 2006 on the same subject by the same reviewer are also added where applicable.			
SPECIFIC COMMENTS			
1.	Section 5.1.3	On Page 5-5, it is stated that a perchlorate bioaccumulation factor (BAF) for soil to plants of 9000 was utilized and drives the food chain risk assessment. However, Attachments H 4-1 and H 4-2 show that the BAF used in the calculations was 282. Please clarify this discrepancy.	The BAF of 282 developed by Ellington et al., 2001 is correct and is the value used in risk calculations. The error in the text on Page 5-5 has been modified to reference the appropriate value.
2.	Appendix H, Section 2.1.1.3	It is stated that future wetland delineation would be conducted according to the U.S. Army Corps of Engineers methodology. As per the Fish and Game Commission Wetlands Policy (1987, see http://www.fgc.ca.gov/html/p4misc.html#DEPARTMENT), DFG has found the U.S. Fish and Wildlife Service (U.S. FWS) wetland definition and classification system to be the "most biologically valid of those definitions and classification systems presently utilized in California." DFG-OSPR recommends that the U.S. FWS definition be employed when delineating wetlands at Site 1. As stated in our June 4, 2003 memorandum, additional biological surveys may be needed to establish the presence or absence of special status species that might be impacted by any proposed remedial actions at Site 1.	The Navy interpreted the intent of the June 4, 2003 memorandum as reaffirming the need for additional biological surveys and the impetus for performing protocol survey for the Riverside fairy shrimp in the ephemeral pond at Site 1. From the results of that study, the Navy acknowledges the presence of a robust Riverside fairy shrimp population. In addition, at the request of the United States Fish and Wildlife Service, sediment sampling was performed in which no anthropogenic hazardous constituents were detected. This information, in combination with historical El Toro Station-wide surveys, is deemed to be sufficient to close this issue. However, if deemed necessary, the ephemeral pond will be evaluated in the context of wetland definition and delineation, and the Navy will coordinate with the appropriate agencies as part of the ARAR identification

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Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 11 August 2005

Comment No.	Section/ Page No.	Comment	Response
			process prior to any proposed response actions.
3.	Appendix H, Section 2.1.6	Please provide a rationale for why inhalation exposure to subsurface volatile organics by burrowing animals is an insignificant pathway.	The complete statement in Section 2.1.6 explains that inhalation exposure factors for wildlife are not available in the literature. Therefore, a quantitative estimate of exposure to VOCs in burrow air for burrowing animals is subject to a high degree of uncertainty. However, qualitatively, the exposure is expected to be insignificant compared to exposure by ingestion pathways. Tier I screening identified 4 VOCs as COPCs based on ingestion pathways. See additional response to the 23 January 2006 comment on the same subject.
4.	Appendix H, Section 2.1.8.3 and Section 2.2.2.4	It is not clear why plant and soil invertebrate screening benchmarks for many organics were not developed, at least for a qualitative evaluation of risk. Plant and soil invertebrate toxicity data, reviewed by the Canadian Council of Ministers of the Environment (CCME, 1999), are available for benzene, toluene, ethylbenzene, and xylene. The literature should be reviewed to identify plant and/or soil invertebrate toxicity values for explosives and perchlorate (e.g., Talmadge et al., 1999; Robidoux et al., 2002; Robidoux et al., 2003; U.S. EPA, 2002). Plant and soil invertebrate benchmarks are available for polycyclic aromatic hydrocarbons (PAHs; e.g., Sverdrup et al., 2001; Sverdrup et al., 2002; Sverdrup et al., 2003). This was previously requested in the	Soil screening values from CCME, 2003 based on protection of agricultural uses of soil have been used to screen BTEX compounds in soil. Guidelines specifically for plants and soil invertebrates have not been published. The literature has been reviewed to identify plant and/or soil invertebrate toxicity values for explosives, perchlorate, and PAHs. Talmage et al., 1999: 2,4,6-TNT 30 mg/kg for plants 2-ADNT 80 mg/kg for plants

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Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 11 August 2005

Comment No.	Section/ Page No.	Comment	Response
		June 4, 2003 DFG-OSPR memorandum.	RDX 100 mg/kg for plants Robidoux et al., 2002 2,4,6 –TNT 58 mg/kg for earthworm RDX 46.7 mg/kg for earthworm HMX 15.6 mg/kg for earthworm Jensen and Sverdrup, (2003) developed a direct contact soil criterion of 25 mg/kg for the sum of 8 PAHs, but not for individual PAHs. As such, the values provided in that reference are considered not appropriate for use with Site 1. See additional response to the 23 January 2006 comment on the same subject.
5.	Appendix H, Attachment H5-1, Benzene	A reproductive endpoint was selected for the mammalian benzene toxicity reference value (TRV; 26 mg/kg/d). Other adverse effects, such as immunological and hematological effects, have been reported at values below the selected reference dose (e.g., leucopenia at 7 mg/kg/d by Wolf et. Al., 1956; ATSDR, 1997), as previously stated in my June 4, 2003 memorandum. Risk managers should be aware that the selected value does not represent a no-effects concentration for all endpoints. However, benzene does not appear to be a significant risk driver at Site 1.	Ecological risk should be based on endpoints that are ecologically relevant such as "reduced growth, impaired reproduction or increased mortality" (*EPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final ,Pg 1-9*). Although physiological or behavioral or other toxicity endpoints may be ecologically important in some cases for some species, these endpoints are not generally used to assess risk to species populations unless no other endpoints are available. See additional response to the 23 January 2006

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Comment No.	Section/ Page No.	Comment	Response
			comment on the same subject.
6.	Appendix H, Attachment H5-1, Ethylbenzene	The selected TRV (136 mg/kg/d), based on the study by Wolf et al. (1956) should be adjusted to 97 mg/kg/d to account for the fact that the study dosed the animals 5 days per week instead of 7 days per week, as previously noted in my June 4, 2003 memorandum. This derivation is consistent with the reference dose developed by the Integrated Risk Information System (IRIS; http://toxnet.nlm.nih.gov).	The TRV for ethylbenzene has been adjusted as suggested.
7.	Appendix H, Attachment H5-1, 2, 4, 6-Trinitrotoluene (TNT).	The selected NOAL (10 mg/kg/d) is based on chronic hepatic effects and anemia observed in mice. DFG-OSPR recommends that the mammalian TRV (0.3 mg/kg/d), selected by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM; Johnson and McAtee, 2000), be utilized. The value represents a 10% response level for decreased body weight and anemia in dogs. The literature review by Johnson and McAtee indicates that dogs and rats are more sensitive to the effects of TNT, compared to mice. Therefore, the proposed value may not be protective of all mammalian wildlife. DFG-OSPR recommends that hazard quotients should be recalculated as risk conclusions may change.	The Navy reviewed the two studies. Neither study examined an ecologically relevant endpoint because they use histological or physiological endpoints instead of reproduction, development or survival endpoints. However, the mouse study better represents the small mammal species likely to be exposed at the site (rodents) compared to the dog study. The NOAL of 10 mg/kg/d based on a rodent study has been retained. See additional response to the 23 January 2006 comment on the same subject.
8.	Appendix H, Attachment H5-1, 2, 4 Dinitrotoluene (DNT)	The selected no-observed adverse effect level (NOAEL; 3.9 mg/kg/d) is based on chronic effects on body weight in rats. The review by ATSDR (1998) indicates that DNT produced anemia and effects on the testes in rats at doses at or below this level. Methemoglobinemia and ataxia in dogs was observed at a lower dose (NOAEL = 0.2 mg/kg/d). This	The study selected (NOAEL 3.9 mg/kg/d) was the lowest chronic dose that produced ecologically relevant adverse effects (mortality) in a species (rat) that is a good surrogate for the small mammals likely to be found at the site. The rat mortality study best represents the exposures at the site.

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		compound or its metabolites oxidize the ferrous ion in hemoglobin and produce methemoglobin, leading to the development of anemia. Therefore, DFG-OSPR recommends that TRV selected by ATSDR for development of the minimal risk level be utilized; a chronic-duration oral NOAEL value of 0.2 mg/kg in dogs. This value may also be used for 2, 6-DANT. DFG-OSPR recommends that hazard quotients should be recalculated as risk conclusions may change.	The beagle study by Ellis et al., 1979, is based on the anemia endpoint in a canine. The anemia endpoint does not necessarily represent a threat to the reproduction and survival of small mammal populations at the site. See additional response to the 23 January 2006 comment on the same subject.
9.	Appendix H, Attachment H5-1, 2-Amino,4,6-Dinitrotoluene (ADNT)	Since TNT was selected as a surrogate for ADNT, the TRV should be revised to 0.3 mg/kg/d. Alternately, the NOAEL selected by USACHPPM (2000) for ADNT of 9 mg/kg/d may be utilized.	The USACHPPM Wildlife Toxicity Assessment for 2-Amino-4,6-Dinitrotoluene and 4-Amino-2,6-Dinitrotoluene was released in final form December 2001 and recommends a NOAEL for Mammal ingestion exposure of 9.0 mg/kg/d. This TRV has been used in the Draft Final RI document.
10.	Appendix H, Attachment H5-1, Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	DFG-OSPR recommends that the mammalian TRV (2.73 mg/kg/d) selected by USACHPPM (Salice et al., 2001) be utilized instead of the listed TRV (7.72 mg/kg/d). The USACHPPM value represents a 10% response level for growth in a chronic study with rats. DFG-OSPR recommends that hazard quotients should be recalculated as risk conclusions may change.	The two studies appear to both be appropriate to represent site exposure scenarios. The Salice et al., 2001 study has been used because it is the more conservative.
11.	Appendix H, Attachment H5-1, Octahydro-1,3,5,7-tetranitro-	DFG-OSPR recommends that the mammalian TRV (1 mg/kg/d) selected by USACHPPM (2001) be utilized instead of the listed TRV (33.1 mg/kg/d). The USACHPPM value is an estimated NOAEL for mortality in rabbits. This comment applies to the	The two studies were reviewed and the Talmage NOAEL for subchronic exposure was adjusted. A revised NOAEL value of 3 mg/kg/day has been used in the Draft Final RI Report. The rabbit is less representative of the species present at the site than

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	1,3,5,7-tetrazocine (HMX)	avian TRV for HMX which utilizes the mammalian TRV. DFG-OSPR recommends that hazard quotients should be recalculated as risk conclusions may change.	the mouse and was not used. See additional response to the 23 January 2006 comment on the same subject.
12.	Appendix H, Attachment H5-1, Inorganics	Some of the selected mammal TRVs are higher than those recommended by the Biological Technical Advisory Group (BTAG). These include arsenic (1.04 vs 0.32 mg/kg/d), cadmium (0.77 vs 0.06 mg/kg/d), cobalt (7.33 vs 1.2 mg/kg/d), and lead (4.7 vs. 1 mg/kg/d). DFG-ORPR recommends alternate hazard quotient calculations be provided for these inorganics that utilize the BTAG-recommended TRVs.	TRVs are selected based on a hierarchy of sources. The primary source is the EPA Eco SSL document as revised in 2005. These values are thoroughly peer reviewed and developed specifically for use in wildlife food chain models. For chemicals lacking TRVs in EPA 2005, the Navy BTAG document (EFAW 1998) is used as the TRV source. Any chemical TRVs not contained in EPA 2005 or EFAW 1998 is obtained from the open toxicology literature. See additional response to the 23 January 2006 comment on the same subject.
13.	Appendix H, Attachment H5-1, Perchlorate	A value of 0.3 mg/kg/d is selected as the mammal TRV for reproductive effects in rats. This is significantly higher than the TRV recommended by U.S. EPA (2002) to evaluate ecological impacts to mammalian receptors. U.S. EPS selected a NOAEL (0.001 mg/kg/d), based on perturbations in thyroid and pituitary hormones, thyroid histopathology, and changes in brain morphometry in rat dams and pups. This endpoint is reflective of perchorate's mechanism of action. DFG-ORP recommends that the U.S. EPA TRV be utilized in revised hazard quotient calculations.	The endpoint is reflective of perchlorate's mechanism of action, but does not represent an ecologically relevant endpoint. A recent evaluation of existing perchlorate toxicity data by ecotoxicologists at USACHPPM selected a NOAEL-based TRV of 0.64 mg/kg/day for mammals for use in ecological risk assessments. The TRV of 0.64 mg/kg/day has been adopted. Details of the USACHPPM evaluation are included in a Technical Memorandum as Attachment 1 to this RTC. See additional response to the 23 January 2006

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Comment No.	Section/ Page No.	Comment	Response
			comment on the same subject.
14.	Appendix H, Attachment H 5-4, 2,4,6-Trinitrotoluene (TNT)	Johnson and McAtee (2000) divided the selected avian NOAEL (7 mg/kg/d) by an uncertainty factor of 100 to account for the interspecific variation and to adjust the subchronic NOAEL to a chronic NOAEL. DFG-OSPR recommends that the avian TRV (0.07 mg/kg/d), selected by the USACHPPM (Johnson and McAtee, 2000), be utilized. This recommendation also applies to chemicals where TNT was used as a surrogate (i.e., ADNT). DFG-OSPR recommends that hazard quotients should be recalculated as risk conclusions may change.	Interspecific uncertainty factors are not normally used in ecological risk assessments. Since they are not used for other chemicals considered in the assessment, they have not been applied in this case. The Navy considers a 90-day study in the quail as a chronic exposure. Therefore, no subchronic to chronic adjustment is necessary. See additional response to the 23 January 2006 comment on the same subject.
15.	Appendix H, Attachment H 5-4, RDX	The listed avian RTV (0.7 mg/kg/d) is derived from a mammal TRV. Although it is protective, it is unclear why the avian TRV recommended by USACHPPM (Salice et al., 2001) was not utilized. They recommend a benchmark dose of 8.14 mg/kg/d based on egg production in quail.	The text has been modified to reflect that quail egg production is a more appropriate endpoint. The dose of 8.14 mg/kg/d has been used.
16.	Appendix H, Attachment H 5-4, Inorganics	Some of the selected avian TRVs are higher than those recommended by the BTAG. These include cadmium (1.47 vs. 0.08 mg/kg/d) and lead (1.63 vs 0.014 mg/kg/d). We recommend alternate hazard quotient calculations for these inorganics.	See response to Comment #12, above.
17.	Appendix H, Attachments H 4-1 and H 4-2	The octanol-water partition coefficient (K_{ow}) values and equations utilized to generate the bioaccumulation factors, where applicable, should be provided in the table so that calculations may be checked. The references for the citations should be provided so that the proposed values can be validated	K_{ow} values with references have been added to new Attachment H 4-3. Section 2.1.5.5 has been updated to indicate that the BAF values that are based on chemical concentrations are based on maximum chemical concentrations in soil

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		with the original references. It would also be helpful to footnote how the different values were selected for the different tiers and steps in the risk assessment.	for Tier I and 95 percent UCL soil concentrations in Tier II. The algorithms for BAFs are all presented in EPA 2005, but have been added to Appendix H, Section 2.1.5.5 in the Draft Final RI Report.
18.	Appendix H, Section 3.4.3.1	DFG-OSPR would like to see a hot-spot evaluation for those chemicals that were detected in less than five percent of the soil samples, prior to their elimination as contaminants of potential ecological concern (COPEC). Significant risks from hot-spots may be considered for remediation, depending on the sensitivity of the habitat and the degree for potential exposure (e.g., sample depth). Spatial mapping of hazard quotient exceedances for all COPECs would greatly assist in evaluating the overall significance of ecological risks at Site 1.	Where low frequency chemicals are not likely to constitute a significant exposure to ecological receptors in the environment, they have been eliminated. Chemicals detected in less than 5 percent of the samples were evaluated to determine if their values were greater than three times the applicable criteria. Because the concentrations were less than three times the applicable ecological screening criteria, none of the chemicals detected in less than 5 percent of the samples indicated a "hot spot". Therefore, spatial mapping of the exceedences is not deemed necessary and has not been performed, and no modification to the text have been made. See additional response to the 23 January 2006 comment on the same subject.

Draft

Perchlorate and Ecological Risk Assessment Installation Restoration Program Site 1 Explosive Ordnance Disposal Range

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

December 2005

Prepared for:
Base Realignment and Closure
Program Management Office West
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Prepared by:
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Prepared under:
Naval Facilities Engineering Command
Contract Number N62742-94-D-0048
Contract Task Order 0072

Draft

Perchlorate and Ecological Risk Assessment Installation Restoration Program Site 1 Explosive Ordnance Disposal Range

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1 Updated Site 1 RI Report Risk Summary Tables

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ACRONYMS AND ABBREVIATIONS

BRAC	Base Realignment and Closure
BCT	BRAC Cleanup Team
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	Department of Defense
EPA	Environmental Protection Agency
HQ	Hazard Quotient
IRP	Installation Restoration Program
LOAEL	Lowest Observed Adverse Effect Level
mg/kg	milligrams per kilogram
mg/kg/d	milligrams per kilogram per day
NIS	sodium/iodide symporter
NOAEL	No-Observed-Adverse-Effect Level
RI	Remedial Investigation
TRV	toxicity reference value
TSH	Thyroid-Stimulating Hormone
UF	uncertainty factor
USFWS	United States Fish and Wildlife Service

1. Background

The purpose of this memo is to provide clarification and additional background information on ecological risk associated with the potential exposure to perchlorate at Installation Restoration Program (IRP) Site 1 at Marine Corps Air Station, El Toro, California. This memo is to be a companion document for responses to comments on ecological risk, which were received from the California Department of Fish and Game and the United States Fish and Wildlife Service (USFWS).

The Draft Remedial Investigation (RI) Report for Site 1 was distributed to the Base Realignment and Closure (BRAC) Cleanup Team (BCT) in June 2005. Comments were received on the document from the California Department of Fish and Game on August 11, 2005, from the USFWS on September 2, 2005, and from the United States (U.S.) Environmental Protection Agency (EPA) on August 24, 2005.

The Draft Site 1 RI Report showed that perchlorate was the primary ecological risk driver at the site. The range of perchlorate-based Hazard Quotients (HQs) for the Ornate Shrew was between 2 and 5. The HQ range for the Deer Mouse was between 2 and 40. The HQ range for Western Meadowlark was between 800 to 6,000, with a HQ range for the Mourning Dove between 2,000 and 10,000The ecological risk assessment in the Draft RI Report acknowledged that there was a significant amount of uncertainty associated with the perchlorate toxicity and that there was ongoing research on perchlorate toxicity. This Technical Memorandum presents the results of the Navy's evaluation of recent peer-reviewed toxicity data. The Navy intends to use the updated toxicity data to refine and reduce the uncertainty in the ecological risk associated with perchlorate.

2. Status of Perchlorate in Ecological Risk Assessment

2.1 POLICY/GUIDANCE ON PERCHLORATE

The EPA published guidance for conducting ecological risk assessments under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1997 (EPA 1997). The 8-step procedure has been adapted by the Navy in its guidance published in 2002 (EPA 2002). The Navy has a Tiered approach that includes EPA's Steps 1 and 2 in the Navy Tier 1 process which is a screening ecological risk assessment. The purpose of the Tier 1 assessment is to screen the majority of chemicals that may be found at a site and identify those chemicals that are toxic enough and present at sufficiently high concentrations to potentially cause adverse effects in ecological receptors (plants, soil invertebrates, fish and wildlife). These chemicals of potential ecological concern are retained for further evaluation in Tier 2. Tier 2 can vary in complexity from the simple recalculation of risk using more realistic exposure assumptions as seen in the Navy Step 3a, to more complex reevaluation to reduce identified unacceptable uncertainties in the risk assessment. This usually focuses on estimating bioavailability of specific chemicals exposed via specific pathways.

To date, there is no specific guidance from EPA, the State of California, the Navy or the Department of Defense (DOD) that addresses the risk to ecological receptors from exposure to perchlorate ions.

2.2 FATE AND TRANSPORT OF PERCHLORATE

2.2.1 Physical/chemical properties

Perchlorate is a very stable anion that is associated with a cation to form an inorganic salt. Perchlorate anion consists of a chlorine (oxidation number of +7) surrounded by four oxygen (oxidation number of -2) atoms to form an oxychlorine anion (-1 charge). Perchlorates are inorganic salts with high melting points as defined in Table 1 and are soluble in water. There are five perchlorate salts that are manufactured in substantial amounts: magnesium, potassium, ammonium, sodium, and lithium perchlorate (ATSDR 2005).

Salts of perchlorates have high solubility in non-aqueous and aqueous environments (EPA 2002; Table 1). Although no specific information on degradation rates (half-lives) was located in the literature, ionic perchlorate reportedly can persist in surface water and groundwater for more than a decade (Callahan and Sprenger 1998). This is because of the high kinetic barrier for perchlorate to react with other constituents in water (Callahan and Sprenger 1998). Perchlorate salts, although relatively stable, are powerful oxidants when concentrated. It is for this reason that ammonium and other perchlorate salts are used in rocket propellants, fireworks, and munitions. Perchlorates are also present in fertilizers that were made with Chilean saltpeter. There is increasing evidence that low levels of perchlorate salts may occur naturally (ATSDR, 2005).

In water, perchlorates will rapidly dissolve and completely dissociate into the perchlorate anion and the corresponding cation. The cations of the solid perchlorate salts listed above are naturally occurring and ubiquitous in the environment. It is the perchlorate anion that is responsible for the potential adverse effects to ecological receptors. In the remainder of this document, perchlorates will be used to refer to the solid salts and perchlorate anion (or simply perchlorate) will be used to refer to the anionic species that is monitored in the environment.

In soils, perchlorate ions do not bind well to soil particles and are easily leached through soil by infiltrating water. The perchlorate ions (and associated cations) tend to accumulate in the saturated zone and move with the groundwater flow. Perchlorate may also be leached into surface water bodies directly via surface water runoff or by discharge of contaminated groundwater to the surface and be carried far from their source. The detection of the perchlorate anion far from its source of production and use may seem to be at odds with the explosive reactivity of the solid perchlorate salts. This is because perchlorates have a large energetic barrier that must be overcome before they begin reacting and, therefore, they are relatively stable at moderate temperatures. Moreover, dilute aqueous solutions of the perchlorate salts, typical of those found in the environment, have almost no oxidizing power (ATSDR, 2005).

Although experimental studies detailing the environmental fate of perchlorates are limited, the current consensus indicates that they are persistent. Laboratory studies indicate that perchlorate undergoes biodegradation by a wide variety of microorganisms under anaerobic conditions. There is also a growing body of evidence that the perchlorate anion may be reduced to chloride by plants.

The perchlorate anion is highly mobile in wet soil and it is expected to ultimately partition to surface water and groundwater. On dry soil, it is immobile. It will not volatilize to the atmosphere, although perchlorates may be present in wind-borne dusts, especially near hazardous waste sites. Few studies were located that discuss bioaccumulation of perchlorates. Based on existing data, bioconcentration of perchlorate has been detected in plants, mammals, amphibians, fish, and insects near sites of known contamination.

Although perchlorate is not actively transported across cell membranes, it has been found at elevated concentrations in some plants, especially in areas of high evapotranspiration such as the desert southwest of the United States. Apparently the perchlorate ions are taken into the plant passively with the uptake of water and are moved into the leaves with the flow of water. As water is lost to evapotranspiration the perchlorate apparently accumulates in the leaves. The available data set is not yet sufficient to predict which plants are capable of accumulating and/or reducing perchlorate (ATSDR 2005).

Key physico-chemical properties of the three most common perchlorate salts, estimated using EPI 2000 Software (developed by the United States Environmental Protection Agency [EPA]), are provided in Table 1. Because the three perchlorate salts are estimated to have low vapor pressures (3.96×10^{-26} to 4.34×10^{-18} mm Hg at 25 °C; [EPA 2000]), partitioning to air will be limited.

Additionally, all are highly soluble in water (0.15×10^5 to 21×10^5 mg/L at 25 °C) and have been identified in both surface and groundwater.

Table 1. Summary of Physical-Chemical Properties of Perchlorate

	Cations Associated with Perchlorate Anion		
Physical Property	$NH_4(ClO_4)$	$Na(ClO_4)$	$K(ClO_4)$
CAS No.	7790-98-9	7601-89-0	7778-74-7
Percent Perchlorate Ion by Weight	84.67%	81.22%	71.8%
Molecular weight	117.49	122.44	138.54
Color	White	White	White
Physical state	Crystalline solid	Crystalline solid	Powder
Melting point [a]	266.8 °C	302.6 °C	302.6 °C
Boiling point [a]	616.0 °C	692.7 °C	692.7 °C
Odor	No data	Odorless	Odorless
Solubility in water at 25 °C (mg/L) [a]	2.0×10^5	21×10^5	0.15×10^5
Partition coefficients [a]:			
Log K_{ow}	-5.84	-7.18	-7.18
Log K_{oc}	1.985	1.687	1.687
Henry's Law constant at 25 °C (atm-m^3/mole) [a]	2.8×10^{-11}	9.15×10^{-19}	2.17×10^{-19}
Vapor pressure at 25 °C (mm Hg) [a]	4.34×10^{-18}	1.47×10^{-25}	3.96×10^{-26}
Conversion factors	1 ppm = 4.80 mg/m^3 1 mg/m^3 = 0.208ppm	1 ppm = 5.0 mg/m^3 1 mg/m^3 = 0.20ppm	1 ppm = 5.66 mg/m^3 1 mg/m^3 = 0.177ppm

[a]Values estimated using EPA EPI Software (EPA 2000)

2.2.2 Toxicity of Perchlorate

The primary target of the perchlorate anion (perchlorate) in vertebrates such as birds and mammals is the thyroid gland. Perchlorate inhibits the transport of iodide (I-) from the blood into the thyroid follicle cells. The inhibition is thought to be accomplished by perchlorate competitively blocking iodide binding to a carrier, or sodium/iodide symporter (NIS), which catalyzes the simultaneous transfer of Na+ and I- across the basolateral membrane of thyroid follicle cells. Perchlorate inhibition of the NIS can limit the availability of iodide needed for the production of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which in turn, may affect the circulating levels of T4 and T3. All toxic effects of perchlorate on the thyroid hormone system derive directly or secondarily from the inhibition of the NIS. The competitive inhibition is completely reversible. If perchlorate exposure is removed, the perchlorate is lost from the thyroid and the blocking effect on the iodine binding site is lost (ATSDR, 2005).

A component of ecological risk assessment is translating effects on the thyroid and circulating thyroid hormones into ecologically relevant endpoints such as survival, growth and reproduction. Measurable effects on thyroid function can be seen at relatively low levels of perchlorate in the blood. However, adverse effects on survival, growth or reproduction may not be measurable until perchlorate levels are much greater.

2.2.3 TRVs for Ingestion Exposures for Wildlife

The ecotoxicologists for the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) have been reviewing the perchlorate toxicology literature to develop mammalian and avian toxicity reference values (TRV) for use in ecological risk assessments at Army sites (USACHPPM 2005). The following toxicity assessment is based on the draft USACHPPM document (USACHPPM, 2005), which has recently been released for public review. Sections 2.3 and 2.4 below are quoted from the draft USACHPPM document.

2.3 TRVs for Ingestion Exposures for the Class Mammalia

"The toxicological database for perchlorate is extensive, and includes chronic as well as reproductive and developmental data. More than three species of two orders are represented, as well as chronic No-Observed-Adverse-Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values. Interpretation of these data in an ecological context is challenging; few adverse effects have been identified, yet the database is comprehensive. There is a general lack of adverse effects. Changes in thyroid structure and function (systemic hormone levels) have been found; however, the relevance of these endpoints to wildlife at the individual or population level of organization is questionable. Mortality is particularly relevant, but occurs only at relatively high exposures.

In the companion studies by York et al. (2001a and 2001b), the authors have stated the LOAEL for rats and rabbits based on structural histological changes to the thyroid were 2.54 and 8.81 mg/kg/d, respectively; species comparable NOAELs were 0.254 and 0.762. York et al. (2004) used slightly different doses than the prior studies resulting in reported LOAEL and NOAEL for rats based on similar histological changes to the thyroid of 2.54 and 0.847 mg/kg/d, respectively. Similar effects on the thyroid gland were reported in studies using deer mice (Thuett et al., 2002b). None of these histological changes in themselves suggest organ failure, merely adaptation (e.g. changes in the size or number of follicular cells, changes in lumen shape, etc.) No evidence of cellular necrosis has been reported, and no other adverse effects (other than changes in T3 and T4 levels) have been linked to these findings.

Available studies on rats indicate that a change in thyroid and pituitary hormone levels (T4, T3, and Thyroid-Stimulating Hormone [TSH]) is a more sensitive endpoint than observable histological changes to the thyroid gland (i.e., the lowest LOAEL reported for the rat is 0.0423 mg/kg/d, where Crofton (1998) reported decreased T4 thyroid hormone levels). The results of Crofton (1998) and King (1995) reveal a significant and rapid response in thyroid hormone levels to low concentrations of perchlorate. However, at higher doses with longer exposure durations or during a critical life stage, adverse whole body responses (e.g., reproduction, fetal development, and growth) have not been observed (York et al. 2001a and 2001b). It should be noted that EPA (2002) considers a dose level of 25.4 mg/kg/d perchlorate ion to be a developmental LOAEL for the rat based on data reported in Argus 2000 (as cited in EPA 2002), but not considered biologically relevant by the Argus study authors and therefore, not reported in the peer reviewed publication (i.e., York et al. 2001a).

The effects of pathologic changes in the thyroid gland to the health and ecology of the whole organism are not well understood. However, adverse effects to this organ may result in abnormalities in development or growth. Due to the lack of definitive correlations between thyroid pathology (indirect endpoint) and more ecologically relevant effects, it is reasonable to consider pathologic changes in the thyroid as nearly equivalent to an adverse effect on development or growth (the direct endpoints; USACHPPM 2000). Although the York et al. and Thuett et al. studies meet the minimum data set requirement of the Standard Practice

(USACHPPM 2000), the data for deer mice was equivocal in nature and not considered sufficient for TRV derivation.

The only marked adverse effect from perchlorate exposure founding the literature is death. Von Burg (1995) reported the results of a 3 month rabbit study where nervous system effects were reported from exposures of 190 mg/kg-d; however, few details were provided and no original data could be found. If the approximation method is used to extrapolate a TRV from the most sensitive LD50 data (rabbit; using an uncertainty factor [UF] of 100), it results in a NOAEL-based TRV of 0.64 mg/kg-d and a LOAEL-based TRV of 6.4 mg/kg-d. This is comparable to a NOAEL and LOAEL-based TRV values using the data from the most sensitive species (rat) in the York et al. studies (0.847 and 2.54 mg/kg/d, respectively) using histological changes in thyroid (i.e., thyroid hyperplasia) as an endpoint. Since these changes were reported as hyperplasia (increases in the number of normal cells), this finding is of uncertain biological significance for ecological receptors and not conducive for TRV derivation. These values are also protective of the only other non-confirmed report of adverse effects (i.e. nervous system effects) in rabbits from exposures of 3 months in duration (Von Burg 1995). Together, these relationships provide a weight of evidence that shows the approximation approach is reasonable when applied to the acute mortality data. Therefore, the TRVs for the Class Mammalia were derived from the LD50 for the rabbit (most sensitive for lethality) using an UF of 100 for the NOAEL-based value and a UF of 20 for the LOAEL-based value.

Table 2 presents the selected TRVs. A medium level of confidence has been given to these TRVs because, though much data are available, there is considerable uncertainty regarding the relevance of thyroid structural and functional changes in wildlife" (USACHPPM, 2005)."

Table 2. Selected Ingestion TRVs for the Class Mammalia

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	0.64	Medium
LOAEL-based	6.4	Medium

2.4 TRVs for Ingestion Exposures for the Class Aves

"Three avian studies were evaluated, with two (McNabb et al. 2004a and 2004b) important in TRV derivation. McNabb et al. (2004a) evaluated the effects of perchlorate on thyroid hormone levels (2- and 8-week study) and growth parameters (8-week study) in 3- to 4-day post-hatch bobwhite quail. In the 2-week study, there was a decrease in thyroidal T4 hormone levels in the 0.0326 mg/kg/d perchlorate ion dose group, while T4 levels were unchanged in the 0.00326 mg/kg/d perchlorate ion dose group. In the 8-week study, all dose groups experienced impacts to thyroid hormone levels. A NOAEL and LOAEL were determined in the 8-week study using thyroid weight and tibia length as endpoints. Thyroid weight was significantly increased at dose levels of greater than or equal to 65 mg/kg/d perchlorate ion and similar to controls at less than or equal to 33 mg/kg/d perchlorate ion. Tibia length was significantly decreased at 261 mg/kg/d, but similar to controls at 130 mg/kg/d. Changes in tibia length have been widely used as an indicator of growth rates in birds, though it is recognized that changes in thyroid weight are on uncertain significance.

In the second study (McNabb et al. 2004b), results from a series of experiments, including those reported in McNabb et al. (2004a), are presented. It was found that reduced thyroidal T4 levels observed after 2 weeks exposure to 0.5 to 5 mg/L ammonium perchlorate were restored to control levels by week 4 and 8 of exposure. Exposure to concentrations of 50 mg/L ammonium perchlorate or greater continued to result in a significant decrease in thyroidal T4 levels. Therefore, the 8-week NOAEL and LOAEL for thyroidal T4 levels are 0.326 (5 mg/L dose group) and 3.26 mg/kg/d (50 mg/L dose group) perchlorate ion., respectively. As presented in McNabb et al. 2004a, the NOAEL and LOAEL for thyroid weight are 33 (500 mg/L dose group) and 65 mg/kg/d (1000 mg/L dose group) perchlorate ion, respectively.

As with mammals, a significant and rapid response in thyroid hormone levels was observed at low doses of perchlorate. Additionally, the McNabb et al. (2004a and 2004b) studies indicate that developing quail chicks appear to have the ability to compensate for early thyroidal hormone effects resulting from exposure to low doses of ammonium perchlorate. Effects on growth parameters (thyroid weight and tibia length) were only observed at higher levels of exposure. Growth inhibition may be relevant to the health and ecology of the species within the class and thus constitutes data from which a TRV could be derived. Therefore, the data from McNabb et al (2004a) were used to derive the avian TRVs where growth rates (indicated by changes in tibia length) were used.

Because the avian toxicity database for perchlorate lack in meeting the minimum data set requirements of the Standard Practice (USACHPPM 2000), TRVs based on an approximation of the NOAEL and LOAEL were developed for Class Aves using UFs. Since these growth changes were evaluated in a sensitive life stage in birds for growth parameters (chicks), these data are considered equivalent in value to chronic data (130 mg/kg-d and 261 mg/kg/d). An UF of 10 was applied to the NOAEL and LOAEL to account for differences between species because a single species and taxonomic order are represented. Table 3 presents the selected TRVs. A medium level of confidence has been given to these TRVs because these studies were of high quality, but lacking in regards to data from other species and lack of other developmental and reproductive data."

Table 3. Selected Ingestion TRVs for the Class Aves

TRV	Dose (mg/kg/d)	Confidence
NOAEL-based	1.3	Medium
LOAEL-based	2.6	Medium

3. Uncertainties in Perchlorate Ecological Risk Assessment

The major uncertainty in assessing the risk to wildlife from exposure to perchlorate in the soil is in selection of an appropriate TRV. The Draft Site 1 RI Report uses adverse effects on the thyroid gland and the thyroid hormones it produces. The connection of these effects to ecologically relevant toxicity endpoints is problematic. Preferred endpoints for ecological risk assessments include survival, growth and reproduction. These endpoints are relevant to the ongoing survival of local populations. The risk assessment to be included in the Draft Final Site 1 RI Report uses TRVs selected by U.S. Army ecotoxicologists for use at Army sites. The TRVs are based on survival (mammals) and growth (birds) and are considered ecologically relevant.

The water solubility also introduces uncertainty in estimating the chronic daily intake (chronic applied dose). Perchlorate is a small anion that is easily absorbed in the stomach and intestines of birds and mammals. However, it is also easily flushed from the system because of its solubility. It is generally not accumulated because it is not actively transported across cell membranes. Since its toxic action is to competitively compete with iodine for binding sites in the thyroid, as exposure drops, perchlorate blood levels drop and iodine binding sites on the thyroid become available. Therefore, the adverse effects of perchlorate are reversible and depend heavily on current exposure.

The uptake of perchlorate by plants also contributes to the uncertainty of food chain exposure for herbivores. A wide range of concentrations of perchlorate have been measured in plants. The highest levels of perchlorate ion in plants appear to be associated with regions of high evapotranspiration. The high level of variability in perchlorates in various plants and plant parts from different regions of the country contributes to uncertainty in estimating exposure and thus estimating risk to plant eaters.

Some of the higher detections of perchlorate at Site 1 are more than 2 feet below the soil surface. The California risk assessment guidance (DTSC 1998) requires that all chemicals found in the soil to a depth of six feet be assessed. This definition of the soil exposure zone is proposed to include exposure to burrowing mammals. However, over 95 percent of the exposure of most birds and mammals come through the ingestion of food. Only 3 or 4 percent of food chain exposure comes from the incidental ingestion of soil that may come from depths below two feet. The plants and soil invertebrates that make up the bulk of the wildlife diet are, for the most part, in contact with the top 2 feet of soil. The assumption that birds and mammals get significant exposure from chemicals below 2 feet in depth overestimates risk and contributes to uncertainty in the risk assessment. Table 4 summarizes these sources of uncertainty in the perchlorate risk assessment.

Table 4: Sources of Uncertainty in Estimating risks to Wildlife from Perchlorate exposure

Source of Uncertainty	Effect
Perchlorate Toxicity	The major adverse effect of perchlorate on wildlife is through altering the production of hormones by the thyroid gland. The relationship of thyroid hormones to ecologically relevant toxicity endpoints in wildlife is unclear.
Perchlorate water solubility	Perchlorate salts released to surface soils are subject to leaching through the soil with the infiltration of rainwater. It may not persist in the surface soils for extended periods, especially in rainy areas or seasons. This is a source of uncertainty in estimating exposure and thus risk.
Perchlorate uptake	Perchlorate ion does not appear to be actively transported in or out of cells. It is easily absorbed through the stomach and intestine of mammals and birds. It is also easily flushed from the system because of its solubility.
Perchlorate accessibility to wildlife	The California risk assessment guidance requires that all chemicals found in the soil to a depth of six feet be assessed. The plants and soil invertebrates that make up the bulk of the wildlife diet are, for the most part, in contact with the top 2 feet of soil. The assumption that birds and mammals get significant exposure from chemicals below 2 feet in depth overestimates risk and contributes to uncertainty in the risk assessment.

4. Update of Site 1 Ecological Risk Assessment Using USACHPPM TRVs

The tables contained in Attachment 1 summarize the results of the updated ecological risk assessment, which will be incorporated into the upcoming Draft Final RI Report. The only change from the Draft RI Report is a decrease in the calculated HQ for perchlorate. The highest HQ for perchlorate is 3 for the deer mouse, using the USACHPPM perchlorate TRVs.

5. References

Agency for Toxic Substances and Disease Registry (ATSDR), 2005. *Draft Toxicological Profile for Perchlorates*, US Department of Health and Human Services, September.

California Department of Toxic Substances Control (DTSC), Human and Ecological Risk Division (HERD). 1998. HERD Ecological Risk Assessment Note Number 1. Sacramento, CA. http://www.dtsc.ca.gov/ScienceTechnology/ftp/econote1.pdf.

Callahan, C., and M. Sprenger, 1998. Perchlorate Ecological Risk Studies-A Report on Literature Reviews and Studies Conducted by the Ecological Impact/ transport and Transformation Subcommittee of the Interagency Perchlorate Steering Committee. US Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis. Risk Analysis Directorate, Risk Assessment Division. Brooks Air Force Base, Texas IERA-RS-BR-TR-2001-0004.

Crofton, K., 1998. *Reanalysis of Thyroid Hormone Data from the Subchronic Perchlorate Study Submitted by Springborn Laboratories SLI study no. 3455.1) [memorandum with attachment to Annie Jarabeck].* Research Triangle park, NC: US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory; July 21 (revised October 12 and November 18).

King,J. Jr., 1995. *Effects of Ammonium Perchlorate on Thyroid Hormone Levels of the Sprague-Dawley Rat [thesis],* Air Force Institute of Technology, AFIT/GEE/ENV/95D-09.

McNabb, F., C. Larsen, and P. Pooler , 2004a. *Ammonium Perchlorate Effects on Thyroid Function and Growth in Bobwhite Quail Chicks.* Environ. Toxicol. and Chem. 23(4):997-1003.

McNabb, F., D. Jang and C. Larsen, 2004b. *Does Thyroid Function in Developing Birds Adapt to Sustained Ammonium Perchlorate Exposure?*, Toxicol. Sci. 82: 106-113.

Thuett, K, E. Roots, L. Mitchell, B. Gentles, T. Anderson, R. Kendall, and E. Smith, 2002. *Effects of In Utero and Lactational Ammonium Perchlorate Exposure on Thyroid Gland Histology and Thyroid and Sex Hormones in Developing Deer Mice (Peromyscus maniculatus) Through Postnatal Day 21.* J. Toxicol. Environ. Health Part A., 65(24):2119-2130.

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), 2000. *Standard Practice for Wildlife Toxicity Reference Values*, Technical Guide254, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, October

_____ 2005. *Wildlife ToxicityAssessment for Perchlorate, External Review Draft*, USACHPPM Doc. No. 87-MA02T6-05D, Environmental Health Risk Assessment Program and Health Effects Research Program, Aberdeen Proving Ground, Maryland, November.

U.S. Environmental Protection Agency (EPA), 2002. *Perchlorate Environmental contamination: Toxicological Review and Risk Characterization. External Review Draft,* NCEA-1-0503. US Environmental Protection Agency, Office of Research and Development, January.

_____, 2000. EPI Suite Software. Available at: htpp://www.epa.gov/opt/exposure/docs/episuited1.htm

_____, 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final.* EPA 540-R-97-006, Environmental Protection Agency, Office of Solid Waste and Emergency Response, June.

US Department of the Navy (DON), 2002. Ecological Risk Assessment Process. Available at http://web.ead.anl.gov/ecorisk/process/pdf/index.cfm

Von Borg, R., 1995. *Toxicology Update: Perchlorates.* J. Applied Toxicol.15: 237-241.

York, R., W. Brown, M. Girard, and J. Dollarhide, 2001a.. *Two-generation Reproduction Study of Ammonium Perchlorate in Drinking Water in Rats Evaluates Thyroid Toxicity.* International Journal of Toxicology, 20:183-197.

York, R., W. Brown, M. Girard, and J. Dollarhide, 2001b. Oral (drinking water) Developmental Toxicity Study of Ammonium Perchlorate in New Zealand White Rabbits. International Journal of Toxicology, 20:199-205.

York, R., J. Barnett, Jr., W. Brown, R. Garman, D. Mattie, and D. Dodd, 2004. *A Rat Neurodevelopmental Evaluation of Offspring, Including Evaluation of Adult and Neonatal Thyroid, from Five Mothers Treated with Ammonium Perchlorate in Drinking* Water, International Journal of Toxicology, 23: 191-214.

Attachment 1
Updated Site 1 RI Report Risk Summary Tables

Revised Site 1 RI Table 7-6. Tier 2, Step 3a, Hazard Quotient Values Greater than 1 for Soil COPCs after Tier 2, Step 3a BERA Calculations

COPC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Western Meadowlark	Loggerhead shrike
Semivolatile Organics						
Di-n-butylphthalate	-	-	-	10	40	-
Explosives						
Perchlorate	-	3 (6)	-	2 (2,000)	2 (800)	-
Metals						
Beryllium	-	-	-	5	2	-
Cadmium	6	5	-	-	3	-
Copper	30	10	-	5	20	-
Lead	-	-	-	-	2	-
Mercury	-	-	-	1	2	-
Nickel	10	8	-	-	1	-
Selenium	9	5	-	-	1	-
Zinc	4	10	-	3	7	-
Dioxins						
Total 2,3,7,8-TCDD (Mammal)[1]	5	2	-	NA	-	NA
Total 2,3,7,8-TCDD (Bird)[1]	NA	NA	NA	-	NA	-

Revised Site 1 RI Table 7-8. Summary of Risk Driver HQ Values for Ornate Shrew Based on Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	Mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	2	9.15	**6**	1.17	<1	3.98	**3**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	4	862	**30**	12.18	<1	45.4	1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**7**	12.5	**10**	4.25	**5**	6.76	**8**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**3**	67.76	<1	213	<1
Perchlorate	0.0416	**<1 (2)**	0.087	<1	0.038	<1	0.66 *	**3 (5)**
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
N-nitrosodiphenylamine	Not a COPC				3.37	<1	66.7	**2**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC				0.378	<1	41	<1

Notes:

* Maximum

Values in parentheses are those from Draft RI Report (June 2005)

Revised Site 1 RI Table 7-9. Summary of Risk Driver HQ Values for Deer Mouse Based on Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	<1	1.1	<1	0.4	<1	0.555	<1
Cadmium	2.2	**1**	9.15	**5**	1.17	<1	3.98	**2**
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**2**	862	**20**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	NA	<1
Mercury	0.16	<1	0.51	<1	0.22	<1	0.86	<1
Nickel	5.81	**4**	12.5	**8**	4.25	**3**	6.76	**4**
Selenium	1.03	**2**	2.12	**5**	0.72	**2**	1.4	**3**
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	**2**	1560	**10**	67.76	<1	213	**1**
Perchlorate	0.0416	**2**	0.087	**3 (6)**	0.038	**1 (6)**	0.66 *	**20 (40)**
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	<1	22.1	<1	9.12	<1	22.1	<1
N-nitrosodiphenylamine	Not a COPC				3.37	<1	66.7	**3**
Phenol	2.32	<1	1.2	<1	2.14	<1	NA	<1
2,4-Dinitrotoluene	Not a COPC				0.378	<1	41	<1

Notes:

* Maximum

Values in parentheses are those from Draft RI Report (June 2005)

Revised Site 1 RI Table 7-10. Summary of Risk Driver HQ Values for Western Meadowlark Based on Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	1	1.1	**2**	0.4	<1	0.555	1
Cadmium	2.2	<1	9.15	**3**	1.17	<1	3.98	1
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	**3**	862	**20**	12.18	<1	45.4	1
Lead	21.98	<1	93.3	**2**	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	**2**	0.22	<1	0.86	**3**
Nickel	5.81	<1	12.5	1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	1	1,560	**7**	67.76	<1	213	<1
Perchlorate	0.0416	**<1 (2000)**	0.087	**2 (800)**	0.038	**<1 (800)**	0.66 *	**7 (6,000)**
Toluene	0.29	<1	1.83	1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**10**	22.1	**40**	9.12	**20**	22.1	**40**
N-nitrosodiphenylamine	Not a COPC				3.37	<1	66.7	**3**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC				0.378	**2**	41	**40**

Notes:

* Maximum

Values in parentheses are those from Draft RI Report (June 2005)

Revised Site 1 RI Table 7-11. Summary of Risk Driver HQ Values for Mourning Dove Based on Varied Assumed Exposure Point Concentrations

	0 to 6 feet Surface Soil Assumption				0 to 2 feet Surface Soil Assumption			
	Mean		95% UCL		Mean		95% UCL	
Chemical Name	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ	mg/kg	HQ
Barium	58.47	<1	77.3	<1	54.78	<1	60.1	<1
Beryllium	0.575	**2**	1.1	**5**	0.4	**2**	0.555	**2**
Cadmium	2.2	<1	9.15	<1	1.17	<1	3.98	<1
Chromium	6.54	<1	6.49	<1	5.19	<1	5.78	<1
Copper	132.69	<1	862	**5**	12.18	<1	45.4	<1
Lead	21.98	<1	93.3	<1	7.06	<1	16.5	<1
Manganese	91.24	<1	105	<1	85.48	<1	96.2	<1
Mercury	0.16	<1	0.51	**1**	0.22	<1	0.86	**2**
Nickel	5.81	<1	12.5	<1	4.25	<1	6.76	<1
Selenium	1.03	<1	2.12	<1	0.72	<1	1.4	<1
Vanadium	11.36	<1	14.7	<1	11.19	<1	16	<1
Zinc	280.71	<1	1560	<1	67.76	<1	213	<1
Perchlorate	0.0416	**1 (2000)**	0.087	**2 (2,000)**	0.038	**1 (2000)**	0.66 *	**20 (10,000)**
Toluene	0.29	<1	1.83	<1	0.49	<1	1.83	<1
Di-n-butylphthalate	6.05	**4**	22.1	**10**	9.12	**4**	22.1	**10**
N-nitrosodiphenylamine	Not a COPC				3.37	<1	66.7	**4**
Phenol	2.32	<1	1.2	<1	2.14	<1	0.868	<1
2,4-Dinitrotoluene	Not a COPC				0.378	**5**	41	**90**

Notes:

* Maximum

Values in parentheses are those from Draft Final RI Report (June 2005)

Document Title:

Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Judy Ann Gibson, Environmental Contaminants Biologist, Field Spill Coordinator, U.S. Fish & Wildlife Service, email dated 2 September 2005

Comment No.	Section/ Page No.	Comment	Response
Note: These responses may differ slightly from those distributed in December 2005 due to various section and page number changes in the document that are a result of the review process.			
GENERAL COMMENTS			
1.		The focus of our review of the subject document was the Screening Ecological Risk Assessment (SERA and Baseline Ecological Risk Assessment (BERA) presented in Section 7 and Appendix H. Overall, it appears that our major comments to the Work Plan, Amendment 1 to the Work Plan, and the Draft Screening Ecological Risk Assessment have been addressed. The Service believes that the additional analytical data provided by Amendment 1 to the Work Plan for the EOD pond is essential to future risk management decisions and potential restoration efforts for the pond. We appreciate the Navy's decision to provide that data.	Comment noted.
SPECIFIC COMMENTS			
1.	Table 7-1	Table 7-1 gives the units for metals analysis for water as milligram/liter. After checking Appendix C analytical results, Service believes this is a typographical error shown in Table 7-1. Appendix C, Table C-9 gives the units for metal analysis for water as micrograms/liter. Please advise inasmuch as this discrepancy could significantly effect the results of the risk assessment.	The correct units for inorganics in surface water are milligrams per liter. Table C-9 incorrectly identifies the units as micrograms per liter. The Draft Final RI has been modified to identify the units as milligrams per liter in Table C-9, which has been renamed Table E-9 as Appendix C has been renamed Appendix E.
2.	Table 7-1	Table 7-1 shows the maximum surface soil concentration for mercury as 7.1 mg/kg. Results of Sample Number HA09 shows the maximum soil	The maximum concentration for mercury at Site 1 is 10.6 mg/kg (sample LD130). However, that sample was a duplicate, with the second sample (sample

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Reviewer: Judy Ann Gibson, Environmental Contaminants Biologist, Field Spill Coordinator, U.S. Fish & Wildlife Service, email dated 2 September 2005

Comment No.	Section/ Page No.	Comment	Response
		concentration reported for mercury as 10.6 mg/kg. This may not effect the results of the risk conclusions.	LD129) having a concentration of 3.6 mg/kg. As per Section 6.2.3.1, and consistent with Navy policy, when two concentrations are greater than the reporting limit, they are averaged. In this case, the resulting average concentration was 7.1 mg/kg, which is the concentration that was used for the risk assessment.
3.		Please comment as to why the Selected Final Chronic Values (FVCs) (sic) that were agreed to by the agencies were not used as the ecological screening values for the surface water analysis. The maximum surface water concentration for cadmium exceeded the FVC (sic) for Sample LE524, 01-Pond; however, this may not effect the risk outcome.	The FCVs developed for calculation of sediment screening values were developed specifically to calculate sediment screening values to protect fairy shrimp. They were developed using chronic toxicity to daphnids as the endpoint. Daphnids are generally more sensitive to dissolved chemicals than aquatic life in general. The surface water screening values are for the protection of aquatic life in general and not specifically daphnids. The daphnid FCVs were developed specifically for use in calculating sediment screening values to protect fairy shrimp and are not appropriate for general surface water screening use.
4.	Section 7.2.1, Sediment	In 7.2.1 Sediment - It is stated that seven COPCs in the pond soil had maximum reporting limits that were higher than their respective sediment screening values (Attachment G 6-2 of Appendix G). Were the reporting limits compared to sediment screening values Attachment G 6-2 of Appendix G, Human Health Risk Assessment Tables. It appears that they were compared to screening values in Attachment H 6-2 of Appendix H (Site 1 Ephemeral Pond Sediment Sample Results)?	Comment noted. The proper citation should be Attachment H 6-2. The citation has been corrected in the Draft Final RI Report.

Document Title:

Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Judy Ann Gibson, Environmental Contaminants Biologist, Field Spill Coordinator, U.S. Fish & Wildlife Service, email dated 2 September 2005

Comment No.	Section/ Page No.	Comment	Response
5.	Section 7.2.1.1	It is stated that all chemicals with a maximum reporting limit that exceeded a screening value were retained as COPCs for further evaluation. Attachment H 6-2 shows that reporting limits for Bis(2-Ethylhexyl)Phthlate, 1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4,6-Trinitrotoluene, Hexahydro-1,3,5-Trinitro-1,3,5-Triazine, Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine and antimony exceeded sediment screening values. It is stated that only one chemical (mercury) exceeded its screening value and is considered a COPC in the SRA. In addition to mercury, please explain why the seven compounds that exceeded the reporting limits for the sediment screening values were not retained as a COPCs. If they were not retained as COPCs, how was risk evaluated for the compounds with reporting limits that exceeded the sediment screening criteria?	Mercury is the only chemical detected in sediments that exceeded its screening value and is carried forward to Tier II. In Section 7.2.1.3 and in the full ecological risk assessment (Appendix H), there is an explanation that, because the reporting limits exceeded the screening values, the potential risk may be underestimated. The risk is evaluated qualitatively for these non-detects.
6.	7.1.1.1, Risk Characterization – Sediment	It is stated that results of the Tier 1, Step 2 sediment screening indicate that only mercury poses potential risks to benthic organisms in the Site 1 pond. In section 7.1.1.2 Tier 1, Step 2 Exit Criteria, it is stated that the 7 compounds (Bis(2-Ethylhexyl)Phthlate, 1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4,6-Trinitrotoluene, Hexahydro-1,3,5-Trinitro-1,3,5-Triazine, Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine and antimony) that had reporting limits that exceeded their respective criteria may lead to an underestimation of risks due to potential exposures to these chemicals. It is stated in Appendix H 1.1.4.2 (Sediment) that the results of the Tier1, Step 2 sediment screening indicated that only mercury poses potential risks to benthic organisms in the Site pond.	Mercury is the only chemical detected at a concentration in sediment exceeding the screening value. This is identified as a potential risk because the concentration is known to exceed the screening value. The non-detected chemicals are not known to exceed the screening values. Details of unknown chemical concentrations are discussed in the Uncertainty section of the risk assessment. In the Draft Final RI Report, Section 7.2.1.1 (Identification of Chemicals of Potential Concern, Sediment) has been edited to include the nondetects that had at least one exceedance of the screening value and thus contribute to uncertainty in the risk assessment.

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Reviewer: Judy Ann Gibson, Environmental Contaminants Biologist, Field Spill Coordinator, U.S. Fish & Wildlife Service, email dated 2 September 2005

Comment No.	Section/ Page No.	Comment	Response
		This seems to be a discrepancy with the statement contained in Section 7.1.1.2 of the document. The Service agrees with the statement in Section 7.1.1.2 that there is uncertainty and may be underestimation of risks due to the potential exposures to the chemical compounds with reporting limits above the sediment screening criteria. Please further clarify the refinement of the sediment risk conclusion.	

Document Title:

Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
GENERAL COMMENTS			
1		The EPA has reviewed the subject response to comments (RTCs) and considered the additional discussion and information provided by the Navy during and following the 20 December 2005 conference call. We appreciated the opportunity to discuss the major issues presented in our comments on the Draft RI Report and are available to further discuss these issues in order to expedite delivery of a mutually acceptable Draft Final RI Report. Attached you will find additional discussion in support of EPA's position on two issues related to the human-health risk assessment presented in the Draft RI Report. We have presented this followup under the general topics discussed on the December conference call. With regard to a third issue from that call – "use structurally similar chemicals as surrogates are not planned" as noted on the conference call agenda – EPA toxicologist Gerald Hiatt has discussed this issue with DTSC toxicologist Riz A. Sarmiento and the issue has been resolved to the regulatory agencies' satisfaction.	Comment noted. Please see responses to comments 1, 2, and 3 below.
SPECIFIC COMMENTS			
1.	Cal EPA Toxicity Values Will be Evaluated and Discussed in the Uncertainty	OSWER Directive 9285.7-53, Human Health Toxicity Values in Superfund Risk Assessments. In a number of the RTCs, the Navy states that they intend to use Tier 1 (IRIS) values where they exist in preference to any other (Tier 2 or 3) values and cites the Directive	The risk estimates using the Cal/EPA toxicity values are presented along with the risk estimates using the IRIS-based toxicity factors. A discussion is also presented in Section 6.6.5.3, Uncertainties in Toxicity Assessment.

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Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
	Section	as the basis for their decision. This position represents a misunderstanding of the intent of the Directive. An important goal for OSWER in preparing this directive was to specify additional sources of information that can be utilized when the toxicity data in IRIS have been superseded by newer science. Thus, the intent was not only to specify that IRIS should be the first source consulted, but also to note IRIS may not be the only source, especially if better toxicity information is available elsewhere: The Directive notes "...risk assessors normally need not search further [than IRIS]...", but also notes "...in some cases more recent [than IRIS] credible and relevant data may come to the Agency's attention." It further directs EPA to "...use the best science available on which to base risk assessments." Therefore, the intent of the Directive is twofold: (1) to reaffirm that IRIS is the first source to which risk assessors should turn in finding toxicity values and (2) to provide guidance on other sources to be used when either there is no toxicity value in IRIS or when newer, better science is available elsewhere in peer-reviewed, publicly available sources. In this regard, it is noteworthy that Cal/EPA toxicity values are specifically identified in the Directive as appropriate Tier 3 toxicity values. Regarding Cal/EPA's toxicity values, there is a long-standing agreement between Region 9 and Cal/EPA to use the more conservative (i.e., more "health-	

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Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
		protective") toxicity value in Superfund risk assessment in cases where both agencies have developed toxicity values and there is a significant difference (usually interpreted to mean more than 4-fold) between those values. In recognition of this policy, this agreement is noted in Section 2.4 of the Background Technical Document for the current Region 9 PRG Table and the table itself contains "Cal-Modified" PRG values for the relevant chemicals. It is also noted that the issue of primacy of state values was settled by the U.S. EPA Administrator as a result of a Dispute Resolution between Region 9 and DOD regarding Castle AFB. The Administrator determined that States had the right to compel use of more stringent values and environmental standards for facilities within their boundaries. Furthermore, it is the Region's opinion that the use of the Cal/EPA toxicity values is in DOD's long-term interest in many cases. Since newer Cal/EPA toxicity values often represent more recent, better science, it is likely that U.S. EPA will similarly revise its toxicity values for the same chemicals in the future. When this happens, the revised U.S. EPA toxicity values will be incorporated into the 5 year review process and, if sufficiently more conservative, may prompt a corresponding revision of cleanup levels.	
2.	Toxicity Equivalent Factors for Dioxins	U.S. EPA reiterates its position that a TEQ approach should be used for developing cumulative risk estimates for dioxin congeners and that it is not acceptable to only consider risks posed by only the	Per EPA 2000, the converted equipotent concentrations were summed to obtain a toxicity equivalent quotient (TEQ) EPC for each sample. For these calculations, nondetected dioxin and furan

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Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
	Congeners	2,3,7,8-TCDD congener. U.S. EPA Comment 38 (provided below) is a full discussion of this issue. **38. Section 6.5 & Section 6.6, General (Dioxins Issues)** -- For risk assessment purposes, dioxins and furans are not single analytes but rather a suite of closely related congeners, many of which share a common mechanism of toxicity and carcinogenicity, albeit with varying potencies. The current draft risk assessment inherently makes the assumption that only one of the dioxin/furan congeners found at the site -- 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) -- contributes to cancer risk; this assumption is present in the risk assessment by virtue of the fact that only the 2,3,7,8-TCDD concentrations are compared to risk-based screening levels. This assumption is unreasonable and runs counter to the risk assessment guidance and standard of practice for both EPA and Cal/EPA. It is also counter to the policy of the World Health Organization (WHO) and the consensus of the global scientific community. Regarding assessment of risks from the full spectrum of dioxin-like compounds, the standard of practice for Superfund risk assessment is to calculate a 2,3,7,8-TCDD-equivalent concentration using the WHO Toxicity Equivalence (TEQ) Factors, as endorsed by EPA, and to use this "TEQ concentration" when assessing risks or making comparisons	results were estimated as one-half the reporting limits unless the constituent was not detected anywhere else onsite. The results were included in the total risk. Reference: EPA. 2000b. Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, Part I: Estimating Exposure to Dioxin-like Compounds, vol. 2 (Sources of Dioxin-like Compounds in the United States), and Part II: Health Assessment for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds, Chapter 9. Toxicity Equivalence Factors (TEF) for Dioxin and Related Compounds. Office of Research and Development, Washington, D.C. NCEA-I-0836. May.

Document Title:

Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
		to the dioxin PRG. This approach should be incorporated into the screening and site-specific risk assessments for Site 1. Fortunately, the approach used in the current draft document does not materially affect the conclusions of the risk screening process. Dioxin/furan congeners other than 2,3,7,8-TCDD made a significant contribution to the overall dioxin TEQ concentration in a number of surface soil samples (eg., in some samples 2,3,7,8-TCDD accounted for less than 10% of the total dioxin exposure point concentration as determined by the TEQ concentration). However, even taking the additional congeners into consideration via the TEQ concentration, there was only a single soil sample (ie., 01-T33, Table G-9) which exhibited a TEQ concentration (23.7 ng/kg) greater than the residential soil PRG of 3.9 ng/kg used for risk screening at the site; since this was a subsurface sample, it is not expected to indicate a potentially significant excess cancer risk. It is recommended that these issues be addressed for dioxins in revising the RI Report. In this regard, it is EPA's understanding that the TEQ approach has been used by Southwest Division for a number of other sites and we suggest that Patricia Underwood, Navy toxicologist, be contacted for details.	

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Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch, United States Environmental Protection Agency, Region 9; Letter dated 9 January 2006

Comment No.	Issue	Comment	Response
3.	"use of structurally similar chemicals as surrogates is not planned"	EPA toxicologist Gerald Hiatt has discussed this issue with DTSC toxicologist RIZ A. Sarmiento and the issue has been resolved to the regulatory agencies' satisfaction.	Comment noted. While there is no Region 9 PRG for 2-methylnaphthalene, further review of the Environmental Protection Agency website indicated that there is an oral reference dose (RfDo) provided in IRIS. This RfDo for 2-methylnaphthalene has been incorporated into the Draft Final RI Site 1 risk assessment. Therefore it was not necessary to use naphthalene as a surrogate for 2-Methylnaphthalene.

Document Title:

Navy's Response to Comments on Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 11 January 2006

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENTS			
1.		HERD reviewed the supplementary information presenting the evaluation of the constituents listed in the preceding section. Based on the surrogates recommended by HERD, the Navy's evaluation demonstrated the following: • Out of the six detections of (2-methylnaphthalene), only one had a detected concentration (270 mg/kg) above the EPA residential PRG (56 mg/kg) based on the noncarcinogenic effects of the suggested surrogate compound, i.e., naphthalene. There was a total of 6 detects out of 147 samples that were analyzed. HERD recommends that 2-methylnaphthalene be included in the evaluation. Please note that the Cal-EPA residential soil PRG of 1,700 ug/kg needs not be presented in the Table because HERD's comment specifically recommended the PRG based on the noncarcinogenicity of naphthalene. • 2-hexanone was detected in 9 out of 174 samples, 2-amino, 4-6-dinitrotoluene and 4-amino, 2,6-dinitrotoluene were each detected once out of 148 samples. However, the reported concentrations were estimated values and were lower than the corresponding PRGs of the recommended surrogate compounds. • Acenaphthylene, benzo(g,h,i)perylene, and	Comment noted. Please see response to comment #2 regarding evaluation of 2-methylnaphthalene.

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Navy's Response to Comments on Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 11 January 2006

Comment No.	Section/ Page No.	Comment	Response
		phenanthrene were not detected in the 147 samples that were analyzed, and the sample quantitation limits were below the corresponding PRGs of the recommended compounds. The Navy's response is as follows: "The Navy does not conduct surrogate PRG substitution for structurally similar chemicals unless those chemicals are the only chemicals detected or they are frequently detected chemicals at the site (i.e., greater than 5%). Since neither is the case for Site 1, the Navy will incorporate the use of surrogate PRGs into the risk assessment for Site 1. This is consistent with the draft response to comments for the Site 1 Draft RI." Since HERD's evaluation is not based on compliance with Navy's guidance or perspective, HERD appreciates the supplemental information that was provided.	
2.		The supplemental information demonstrates that no further evaluation is required for the chemicals that were compared to the PRGs of the recommended surrogate compounds. HERD disagrees, and recommends that 2-methylnaphthalene be included in the evaluation. It is HERD's understanding that the supplemental information and the indoor air pathway evaluation using the Cal/EPA-modified Johnson and Ettinger model will be presented in the revised Phase II RI Report. In addition, the other specific comments from HERD should be addressed adequately in the revised Phase II RI Report.	While there is no Region 9 PRG for 2-methylnaphthalene, further review of the Environmental Protection Agency website indicated that there is an oral reference dose (RfDo) provided in IRIS. This RfDo for 2-methylnaphthalene has been incorporated into the Draft Final RI Site 1 risk assessment. Therefore it was not necessary to use naphthalene as a surrogate for 2-Methylnaphthalene. The evaluation of the indoor air pathway using the Cal/EPA-Modified Johnson and Ettinger model (Cal-EPA 2004) has been incorporated into the

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Navy's Response to Comments on Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 11 January 2006

Comment No.	Section/ Page No.	Comment	Response
			document in Section 6.5.4. Responses to the 21 July 2005 DTSC-HERD General Comments 1 and 2, and Specific Comments 1, 2, 3, 4, 5, 6, 8, and 9 have been incorporated into the document. Reference: California Environmental Protection Agency (Cal-EPA). 2004. Vapor Intrusion Guidance Document – Final Interim California Environmental Protection Agency, Department of Toxic Substances Control. December (as revised February 2005).
3.		The risk estimates using the Cal/EPA toxicity values should be presented along with the risk estimates using the toxicity factors from EPA's Integrated Risk Information Service (IRIS), and should not be presented in the uncertainty section of the RI Report, as indicated in the Navy's response. HERD will not recommend approval of the revised RI Report unless the risk estimates are presented accordingly.	The risk estimates using the Cal/EPA toxicity values are presented along with the risk estimates using the IRIS-based toxicity factors. A discussion is also presented in Section 6.6.5.3, Uncertainties in Toxicity Assessment.

Document Title:

Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 23 January 2006

Comment No.	Comment No. in Responses to Comments	Comment	Response
GENERAL COMMENTS			
1.		The responses to Specific Comments (as numbered in the August 11 2005 memorandum) 1,2,6,9,10,15, and 17 are acceptable, pending review of the revised Phase II RI document. For the remaining responses to comments, DFG-OSPR has specific comments, detailed below.	Comment noted.
SPECIFIC COMMENTS			
1.	Comment 3, Appendix H, Section 2.1.6	Quantitative methods for estimating inhalation exposure to volatile organics are available [e.g., Hope, 1995; U.S. Environmental Protection Agency (EPA), 2005]. DFG-OSPR requests that additional detail be provided as to why inhalation exposure to subsurface volatile organics by burrowing animals is considered an insignificant pathway.	A sample calculation using the burrow air model from Hope (1995) is attached. The sample uses toluene (max detect =41 mg/kg in surface soil) with the ornate shrew exposure assumptions. The calculation demonstrates that the expected applied dose of toluene through inhalation of burrow air is insignificant compared to the ingested dose from soil invertebrates ingestion.
2.	Comment 4, Appendix H, Section 2.1.8.3, and Section 2.2.2.4	a. The Canadian Council of Ministers of the Environment (CCME, 1999) soil quality guidelines for benzene, toluene, ethylbenzene, and xylene do consider soil contact of plants and invertebrates in a park-like setting. The soil quality guidelines are as follows: benzene, 0.5 mg/kg; ethylbenzene, 1.2 mg/kg; toluene, 0.8 mg/kg; xylene, 1 mg/kg. b. For 2,4,6-trinitrotoluene (TNT), a plant TRV of	a. The Navy has used the CCME 1999 soil quality guidelines for "parkland" as suggested, rather than for "agriculture". These have been added to the Tier I Direct Contact screening tables H 6-3 and H 6-4.

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Responses to Comments on the Draft Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 23 January 2006

Comment No.	Comment No. in Responses to Comments	Comment	Response
		30 mg/kg soil was selected, based on Talmadge et al. (1999). Talmadge et al. (1999) reviewed a study where bean, wheat, and grass were grown in pots with TNT concentration of 10, 30, or 60 mg/kg soil (dry weight). At 60 mg/kg there was marked chlorosis and a 50% reduction in plant height, at 30 mg/kg there was a 25% reduction in plant height, and no phytotoxic effects were observed at 10 mg/kg. A recent study by Rocheleau et al. (2006), reports toxicological benchmarks for TNT based on effects in alfalfa, millet and ryegrass. In freshly amended treatments, the lowest concentration that produced a 20% decrease in shoot biomass or seedling emergence was 33 mg/kg. Therefore, the 30 mg/kg level may be used as TRV exceedences based on the data presented in these studies. For example, Rocheleau et al. (2006) found that dinitrotoluenes were more phytotoxic than TNT and that weathering of TNT enhanced phytotoxicity in some cases.	b. Because DFG-OSPR agrees with the Navy's selected TRV for 2,4,6-trinitrotoluene, the Navy has used the Talmadge et al value of 30 mg/kg for the direct contact soil screening value as proposed in response to comment # 4 December 2005 Please see Tables H 6-3 and H 6-4.
		c. For 2-aminodinitrotoluene (2-ADNT), a plant TRV of 80 mg/kg soil was selected, based on Talmadge et al. (1999). Talmadge et al. (1999) reviewed a study where yellow nutsedge was grown in soil with 80 mg/kg 2-ADNT for 42 days. There were no significant effects on plant weight. Although the data are limited, DFG-OSPR finds this no-observed	c. Because DFG-OSPR agrees with the Navy's selected TRV for 2-aminodinitrotoluene (2-ADNT), the Navy has used the Talmadge et al value of 80 mg/kg for the direct contact soil screening value as proposed in response to comment # 4 December 2005. Please see Tables H 6-3 and H 6-4.

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		adverse effect level (NOAEL) acceptable.	
		d. For RDX, a plant TRV of 100 mg/kg soil was selected based on Talmadge et al. (1999). Talmadge et al. (1999) reviewed a study where cucumber was exposed to 0, 50, 100, or 200 mg/kg RDX/kg soil. Biomass was significantly reduced at 100 and 200 mg/kg. Similar findings have been reported by Winfield et al. (2004). Therefore, the 100 mg/kg level represents a low observed adverse effect level (LOAEL) and DFG-OSPR will interpret exceedance of this level as a potential risk to plants.	d. The Navy's selected TRV for RDX exposure by plants is the Talmadge et al. value of 100 mg/kg for the direct contact soil screening. Because the invertebrate screening value is less than the plant screening value (See comment 4 e), the more conservative value of 46.7 mg/kg was used in the soil screening tables H 6-3 and H 6-4.
		e. For soil invertebrates, TRVs were selected for TNT (58 mg/kg soil), RDX (46.7 mg/kg) and HMX (15.6 mg/kg), based on Robidoux et al. (2002). These values represent LOAELs for earthworm reproduction and growth and DFG-OSPR will interpret exceedances of these levels as a potential risk to soil invertebrates. Newer studies (e.g., Simini et al., 2003); Phillips et al., 2004; Kuperman et al., 2005) indicate that the toxicity of these compounds is higher in low organic matter soils or aged soil treatments. DFG-OSPR will interpret the significance of TRV exceedances based on the data presented in these newer studies.	The more conservative plant TRV of 30 mg/kg for TNT was selected by the Navy for the screening tables H 6-3 and H 6-4. This is lower than the TRVs presented in Kuperman et al., 2005. e. The Navy has used the Robidoux et al., 2002 LOAEL values for RDX and HMX for screening soil for adverse effects as proposed in response to comment # 4 December 2005 because the suggested studies (Simini et al, 2003 and Philips et al, 2004) assess acute toxicity endpoints which do not represent chronic exposure scenarios.
		f. Perchlorate TRVs for plants and soil invertebrates were not addressed in the	

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		responses to comments. The U.S. EPA (2002) proposed values of 1 to 4 mg/kg perchlorate/kg wet weight soil. These values will be utilized by DFG-OSPR when evaluating the significance of ecological risks associated with perchlorate at Site 1.	f. The Navy has used this range for plant and invertebrate screening. The range is used on a dry weight basis assuming that soil moisture in the test is approximately 40 percent (ASTM, 2004).
		g. Plant and soil invertebrate benchmarks were not provided for polycyclic aromatic hydrocarbons (PAHs). As previously requested in the June 4, 2003 DFG-OSPR memorandum, Sverdrup et al. (2002) and Jensen and Sverdrup (2003) have soil invertebrate toxicity benchmarks for PAHs (i.e., 20 mg/kg for naphthalene and 37 mg/kg for fluoranthene) that should be discussed. Sverdrup et al. (2003) and Jensen and Sverdrup (2003) also have toxicity data for plants (i.e., 58 mg/kg for fluoranthene). Jensen and Sverdrup do provide sediment quality criteria for individual PAHs, as well as a criterion for "sum PAHs." Therefore, risks from individual PAHs should be evaluated at Site 1. DFG-OSPR will provide DTSC with hazard quotients for individual PAHs if potential risks are not discussed in the RI Report.	g. Risks for individual PAHs are evaluated in the Draft Final Phase II RI. The soil invertebrate screening values of 20 mg/kg for naphthalene and 37 mg/kg for fluoranthene have been added to the Direct Contact soil screening tables H 6-3 and H 6-4.

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3.	Comment 5, Appendix H, Attachment H 5-1, Benzene	While growth, reproduction, and mortality are important endpoints to evaluate, the response to this comment does not consider that other adverse effects (i.e., immunological impacts) may indirectly affect these endpoints. For example, decreased resistance to disease can lead to increased mortality in the field. Consideration of indirect endpoints is part of the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) standard process for selecting TRVs (USACHPPM, 2000). DFG-OSPR does not agree that adverse immunological and hematological effects associated with benzene exposure are not ecologically relevant. DFG-OSPR will advise DTSC on the ecological significance of hazard quotients calculated for benzene.	The Wolf et al, 1956 NOAEL of 1mg/kg-d (ATSDR references 17 and 25) (provided in the original Comment 5) is based on an intermediate exposure with dosing in water by gavage. These are the lowest doses observed for any endpoint for oral exposure. The Navy reiterates the previous response: "Ecological risk should be based on endpoints that are ecologically relevant such as "reduced growth, impaired reproduction or increased mortality" (*EPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final, Pg 1-9*). Although physiological or behavioral or other toxicity endpoints may be ecologically important in some cases for some species, these endpoints are not generally used to assess risk to species populations unless no other endpoints are available." Consistent with this guidance, the Navy does not consider these endpoints to be ecologically significant and has not incorporated the use of TRVs based on adverse immunological and hematological effects associated with benzene.
4.	Comment 7, Appendix H, Attachment H 5-1, 2, 4, 6-Trinitrotoluene	DFG-OSPR does not agree with the Navy's interpretation of the TNT toxicity data for mammals. First, the studies did not rely solely on histological or physiological endpoints. Johnson and McAtee (2000) developed the TRV based on decreased weight gain	The Navy accepts the mammal NOAEL based on a growth endpoint recommended by USACHPPM and the high level of confidence they associate with that value. The TRV of ED_{10} = 0.3 mg/kg/d has been used in the food chain model.

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	(TNT).	(an indicator of growth) and anemia in dogs, which was deemed to adversely affect future fitness. As stated in the Response to Comment 5, growth is considered to be an ecologically relevant endpoint by U.S. EPA. Secondly, since dogs and rats appear to be comparable in sensitivity, and more sensitive than mice, the TRV developed by Johnson and McAtee (2000) is protective of the variety of ecological receptors at Site 1. The draft Phase II RI (Table 2-2) lists the coyote, bobcat, California ground squirrel, Botta's pocket gopher, desert cottontail, and San Diego black-tailed jackrabbit as the mammals observed at Site 1. The argument that the mouse better represents the mammal species at Site 1 is not supported by these observations. DFG-OSPR continues to recommend that the mammalian TRV (0.3 mg/kg/d), selected by the USACHPPM (Johnson and McAtee, 2000) be utilized. If the Navy is not willing to revise the hazard quotient calculations, DFG-OSPR will provide alternate hazard quotients to DTSC in order to evaluate the significance of ecological risks from TNT.	
5.	Comment 8, Appendix H, Attachment H 5-1, 2, 4 Dinitrotoluene (DNT)	Anemia, induced by this class of compounds, has been considered an ecologically relevant endpoint by USACHPPM (see comment above). DFG-OSPR does not agree with the Navy's interpretation that anemia does not necessarily represent a threat to the reproduction, survival (and growth) of mammals at the site. The selected NOAEL (3.9 mg/kg/d) is based on chronic effects on body weight in rats. The review by the Agency for Toxic Substances Disease Registry	Anemia, by itself was not recognized as an ecologically relevant endpoint. It became relevant when associated with a growth endpoint. A review of the ATSDR (1998) chronic oral exposure data shows that the 0.2 mg/kg-d TRV was for hematological effects. (Ellis et al., 1979). TRVs associated with mammalian growth and reproduction endpoints ranged from 8 mg/kg-d (NCI, 1978) to 95 mg/kg-d (Ellis et al, 1979). The preponderance of evidence from the above-referenced

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		(ATSDR, 1998) indicates that DNT produced anemia and effects on the testes (i.e., reproduction) in rats at doses at or below this level. DFG-OSPR continues to recommend that the TRV selected by ATSDR for development of the minimal risk level be utilized for DNT; a chronic-duration oral NOAEL value of 0.2 mg/kg in dogs. If the Navy is not willing to revise hazard quotient calculations, DFG-OSPR will provide alternate hazard quotients to DTSC in order to evaluate the significance of ecological risks from DNT.	studies, conducted on several mammalian species, shows that the TRV of no effect (3.9 mg/kg-d) selected by the Navy represents an ecologically relevant endpoint. Therefore, the Navy has not incorporated the TRV of 0.2 mg/kg-d based on anemia associated with 1,2,4 DNT.
6.	Comment 11, Appendix H, Attachment H 5-1, Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	DFG-OSPR recommended that the mammalian TRV (1 mg/kg/d) selected by USACHPPM (2001) be utilized. The Navy is not dividing the TRV from the draft Phase II RI (33.1 mg/kg/d) by ten to extrapolate to a chronic study (3/mg/kg/d). This adjusted value is relatively close to what DFG-OSPR recommended. Since rabbits have been observed at Site 1, DFG-ORPR does not concur that the rabbit is less representative of the species present at the site. Additionally, the rabbit model was the basis of the perchlorate TRV selected by the Navy (see below). DFG-OSPR will evaluate the magnitude of hazard quotient exceedances, and provide recommendations to DTSC regarding the significance of ecological risks associated with HMX.	The USACHPPM report recommends 2 different sets of TRVs for mammals. The first USACHPPM recommendation of 1mg/kg-d for the class Mammalia is made with a low level of confidence because only one order of mammals was sufficiently characterized. The second USACHPPM recommendation of a NOAEL equal to 9 mg/kg-d for mammalian omnivores is presented with a medium level of confidence based on well documented work with rodents. The TRV recommended by the Navy for this risk assessment is based on a study of mice which appear to be more sensitive to HMX than rats. Based on this, the NOAEL TRV of 3 mg/kg-d derived from Talmadge et al. 1999 has been used because it represents a reasonable ecologically relevant TRV.
7.	Comment 12, Appendix H, Attachment H 5-	If the Navy is unwilling to provide alternate hazard quotient calculations for arsenic, cadmium, cobalt, and lead, utilizing the BTAG-recommended mammalian TRVs (U.S. Navy, 1998), DFG-OSPR will provide	The representative species selected for the Site 1 ecological risk assessment are similar in feeding behavior to the species selected for the EPA Eco SSL document (EPA 2003): small ground-feeding birds and

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	1, Inorganics	these calculations to DTSC to present a range of ecological risk estimates.	mammals. The Navy has used the interim final EPA Eco SSL documents for those chemicals covered as they are thoroughly peer reviewed and are developed from ecologically relevant endpoints. The secondary source of TRVs used in this risk assessment is the Navy-BTAG document (EFAW 1997) for chemicals not included in the EPA Eco SSL document. TRVs for chemicals not included in either the primary or secondary source were derived from the peer reviewed toxicology literature, which are considered tertiary sources. The selection hierarchy has evolved over the years as the various Eco SSL documents have been published as Interim Final. As a result, the Navy has not provided alternate hazard quotient calculations based on secondary or tertiary sources where primary sources are available.
8.	Comment 13, Appendix H, Attachment H 5-1, Perchlorate	A value of 0.64 mg/kg/d is selected as the mammal TRV, based on an internal draft report (USACHPPM, 2005). The NOAEL based TRV was extrapolated, using a 1,000 fold uncertainty factor, from a lethal dose to 50% of the rabbits tested (LD_{50} = 635 mg/kg). This is significantly higher than the TRV recommended by U.S. EPA (2002) to evaluate ecological impacts to mammalian receptors (0.001 mg/kg/d), based on perburbations in thyroid and pituitary hormones, thyroid histopathology, and changes in brain morphometry in rat dams and pups. It is also higher than the TRV used in the draft Phase II RI report (0.3 mg/kg/d) based on a reproductive endpoint in the rat). For birds, the draft Phase II RI	The mammalian ecological TRV proposed in EPAs "Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization, External Review Draft, (Jan. 2002)" uses 0.01 mg/kg-d as the LOAEL from which the RfD is derived. It is based on medical endpoints relevant to human health. An uncertainty factor of 10 was applied to extrapolate a NOAEL for a mammalian ecological TRV although the population implications are unknown. The TRV recommended by USACHPPM was based on a reevaluation of the same data used by EPA and the Navy, as well as other data, using endpoints relevant to ecological risk assessment. The Navy will follow the

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		report utilized a TRV of 0.0016 mg/kg for perchlorate, based on a thyroid function endpoint. This value was acceptable to DFG-OSPR. It now appears that the USACHPPM (2005) avian perchlorate TRV (1.3 mg/kg/d) is being adopted. This TRV is based on altered growth in chicks, and utilized uncertainty factors to account to interspecies variability. The USACHPPM internal draft report concluded the ecological relevance of changes in thyroid structure and function is uncertain. Due to the draft nature of the USACHPPM document and uncertainty regarding the biological significance of altered thyroid function, DFG-OSPR recommends that the USEPA (2002) mammalian TRV (0.001 mg/kg/d), the avian TRV in the draft Phase II RI report (0.0016 mg/kg/d), and the draft USACHPPM TRVs be utilized in hazard calculations to represent the range of potential adverse effects to mammals and birds. The ATSDR (2005) has recently released a draft toxicological profile for perchlorates. When reviews of the USACHPPM (2005) and ATSDR (2005) documents are completed, these final documents can be utilized to interpret the significance of the range of hazard quotient values.	USACHPPM draft recommendation until a final TRV is available. For reference, as requested by DFG, the Navy has calculated HQ values using the USEPA (2002) mammalian TRV of 0.001 mg/kg-d and avian TRV of 0.0016 mg/kg-d. The wide range of HQs are included in a table attached to these RTCs. The range is also discussed in Section 3.5 of Appendix H (Tier 2 Uncertainties Analysis), as well as Section 7.3.2 of the RI text (Tier 2 Uncertainties Analysis).
9.	Comment 14, Appendix H, Attachment H 5-4, 2, 4, 6-Trinitrotoluene (TNT)	No reference is provided to support the statement that interspecific uncertainty factors are not normally used in ecological risk assessments. They have been used by USACHPPM (2000) to address data gaps and have a history of use in toxicity extrapolations involving terrestrial wildlife (U.S. EPA, 1996; Chapman et al., 1998). The avian perchlorate TRV	The Navy utilizes the USACHPPM and EPA definitions of a chronic study (one that spans greater than ten percent of an animal's lifespan). EPA 2005 lists the maximum life span of the Northern bobwhite quail as 6.5 years, however, the normal life span is much less. Few live longer than 5 years and 80% live less than 1 year. The EPA Wildlife Exposure Factors Handbook

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		currently proposed for use by the Navy utilizes an interspecies uncertainty factor (USACHPPM, 2005). Secondly, while the Navy may consider a 90-day study in the Northern Bobwhite Quail as chronic in duration, this is not consistent with current approaches. A number of sources consider a chronic study as one that spans greater than ten percent of an animals lifespan (USACHPPM, 2000; U.S. EPA, 2005b; U.S. Navy, 1997). The Bobwhite Quail has a lifespan of 6.5 years (U.S. EPA, 2005). Therefore, a 90-day study covers less than ten percent of the lifespan and would be considered a subchronic study. DFG-OSPR continues to recommend that the avian TRV (0.07 mg/kg/d), selected by USACHPPM (Johnson and McAtee, 2000), be utilized. If the Navy is not willing to revise hazard quotient calculations, DFG-OSPR will provide alternate hazard quotients to DTSC in order to evaluate the significance of ecological risks from TNT.	(1993) reports that quail living to November of their first year are expected to live another 10 to 11 months. Based on natural quail longevity, a 90 day study is a chronic study and should not be considered subchronic. There is only 1 bird toxicity study available (Gogal et al, as cited in USACHPPM, 2000) and the authors calculated an ingestion NOAEL of 7 mg/kg-day for 2.4.6-TNT. Since there is only a single study available, the Navy accepts an uncertainty factor of 10 in extrapolating to other species. The Navy will utilize a NOAEL-based TRV of 0.7 mg/kg-day.
10.	Comment 16, Appendix H, Attachment H 5-4, Inorganics	If the Navy is unwilling to provide alternate hazard quotient calculations for cadmium and lead, utilizing the BTAG-recommended avian TRVs (U.S. Navy, 1998), DFG-OSPR will provide these calculations to DTSC to represent a range of ecological risk estimates.	The representative species selected for the Site 1 ecological risk assessment are similar in feeding behavior to the species selected for the EPA Eco SSL document (EPA 2003): small ground-feeding birds and mammals. The Navy has used the interim final EPA Eco SSL documents for those chemicals covered as they are thoroughly peer reviewed and are developed from ecologically relevant endpoints. The secondary source of TRVs is the Navy-BTAG document (EFAW 1997) for chemicals not included in the EPA Eco SSL document. TRVs for chemicals not included in either the primary or secondary source are derived from the

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			peer reviewed toxicology literature, which are considered tertiary sources. As a result, the Navy has not provided alternate hazard quotient calculations based on secondary or tertiary sources where primary sources are available.
11.	Comment 18, Appendix H, Section 3.4.3.1	DFG-OSPR requests that additional text be added to the draft Phase II RI to describe the "hot-spot" analysis for infrequently detected contaminants that was described in the response to this comment. DFG-OSPR continues to believe that spatial mapping of hazard quotient exceedances for risk-driving contaminants would greatly assist in evaluating the overall significance of ecological risks at Site 1.	The information presented in the response to comments regarding the "hot-spot" analysis has been added to Section 3.4.3.1 (Frequency of Detection) of Appendix H. Additionally, Figure 2-4 in Appendix H of the Draft RI Report presents all surface soil sampling locations that exceed ecological screening criteria.
CONCLUSION			
		The draft final Phase II RI for Site 1 should address the comments provided herein. Several of the TRVs recommended by DFG-OSPR in an August 11, 2005 memorandum to DTSC were not adopted by the Navy. Additionally, new TRVs were proposed in the Navy's responses to comments that are not acceptable to DFG-OSPR. To facilitate finalizing the Phase II RI, DFG-OSPR recommends that alternate hazard quotients be provided to discuss the range of potential risks. If the Navy is unwilling to provide alternate hazard quotients, DFG-OSPR will provide these hazard quotients to DTSC and interpret the significance of potential ecological risks at Site 1	Acknowledged. Because the range for the perchlorate TRVs is so great, as requested, the Navy has provided the range of potential risks for perchlorate, which is attached to these RTCs and discussed in Section 7.3.2 of the Draft Final RI text (Tier 2 Uncertainties Analysis), and Section 3.5 of Appendix H (Tier 2 Uncertainties Analysis). However, for the above stated reasons, the Navy has not provided the requested risk ranges for other various chemicals.

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		accordingly.	

Perchlorate NOAEL-Based Hazard Quotient Comparison

Species	NOAEL-Based TRV	LOAEL-Based TRV	NOAEL-Based Hazard Quotient	LOAEL-Based Hazard Quotient
Deer Mouse	0.64 (USACHPPM 2005)	6.4 (USACHPPM 2005)	3	0.3
	0.00019 (USEPA 2002)	0.019 (USEPA 2002)	2,000	200
Ornate Shrew	0.64 (USACHPPM 2005)	6.4 (USACHPPM 2005)	0.4	0.04
	0.00128 (USEPA 2002)	0.0128 (USEPA 2002)	200	20
Western Meadowlark	1.3 (USACHPPM 2005)	13 (USACHPPM 2005)	1	0.1
	0.00162 (USEPA 2002)	0.0162 (USEPA 2002)	800	80
Mourning Dove	1.3 (USACHPPM 2005)	13 (USACHPPM 2005)	2	0.2
	0.00162 (USEPA 2002)	0.0162 (USEPA 2002)	2,000	200

References

American Society for Testing and Materials (ASTM). 2004. Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with Lumbricid Earthworm *Eisenia fetida* and the Enchytraeid Potworm *Enchytraeus albidus*. E1676-04, West Conshohocken, PA.

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Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological Profile for 2,4- and 2,6-Binitrotoluene. U.S. Department of Health and Human Services, Atlanta, Georgia CCME. 1999. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Canadian Council of Ministers of the Environment. Winnipeg.

Engineering Field Activity West (EFAW). 1998. Development of Toxicity Reference Values as Part of a Regional Approach for Conducting Ecological Risk Assessments at Naval Facilities in California. Draft Technical Memorandum. San Bruno, Calif.: Department of the Navy, Engineering Field Activity West, Naval Facilities Engineering Command. Contract N62474-94-D-7609, CTO 027. July.

Environmental Protection Agency (EPA). 1993. Wildlife Exposure Factors Handbook, Vol. I. EPA/600/R-93/187a. Office of Research and Development. December.

_____. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment. Interim Final. EPA/540/R-97/006. Office of Solid Waste and Emergency Response. June.

_____. 2002. Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization. U.S. Environmental Protection Agency, Office of Research and Development. Washington, D.C.

_____, 2003. Guidance for Developing Ecological Soil Screening Levels. Draft. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460.

_____,2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Hope, B.K. 1995. A review of models for estimating terrestrial ecological receptor exposure to chemical contaminants. Chemosphere 30(12):2267-2287.

Robidoux, P.Y., J. Hawari, G. Bardai, L. Paquet, G. Ampleman, S. Thiboutot, G.I. Sunahara. 2002. TNT, RDX and HMX decrease earthworm (Eisenia andrei) life cycle responses in a spiked natural forest soil. Arch. Environ. Contam. Toxicol. 43:470-388.

Talmage, S. S., D. M. Opresko, C. J. Maxwell, C. J. E. Welch, F. M. Cretella, P. H. Reno, and F. B. Daniel, 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. Rev. Envtl. Contam. Toxicol., 161:1-156.

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U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). 2005. Wildlife Toxicity Assessment for Perchlorate. Draft Report. November.

Burrow Air Inhalation model (Hope, 1995, pg 2278-2279)
Toluene

Soil Concentration	41 (mg/kg);	Ornate shrew weight =	0.00585 kg

Dv =(IR*ECvap)/W)*Theta*Y*Bt **Applied dose =** 4.99E-06 mg/kg-day

Where:

Dv= Applied dose via inhalation of burrow air		
EC_{vap}= Exposure concentration in burrow air	1.64E-04	
IR= inhalation rate, M^3 per day	0.00035652	M^3/day
Bt=fraction of day spent in burrow, unitless	0.5	
W = weight	0.00585	kg
Theta= SUF (burrow), unitless	1	
Y=seasonality factor, unitless	1	

ECvap= {[H/(R*T)}/(p_s*f_{oc}*K_{oc})*Ec_{sss}*p_a **Conc. in burrow air =** 1.64E-04 mg/M^3

H= Henry's law constantPa-m^3/mol	0.00594	
R= Universal gas constant, 8.314 Pa-m^3/mol/K	8.314	
T= temperature, K (0° C = 273.15 K)	288.15	K
p_a= air density, kg/m^3 @15 C	0.8787	kg/M^3
f_{oc}= soil fractional organic carbon content, unitless (USEPA, 1996)	0.002	
K_{oc}= soil-water partition coefficient normalized for OC, L/kg	182.00	L/kg
P_s = Dry soil bulk density, Kg/L (mg/cm^3) (USEPA, 1996)	1.5	mg/cm^3

Toluene
0.00594

USEPA, 1996. Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, Washington DC, May 1996.

Toluene Exposure for Ornate Shrew (Tier 1 model) at Site 1

Weight =	0.00585	kilograms live weight		
Food intake =	1.119	grams per day (dw)	BCF_e = 8.48	(USEPA, 2005)
Inhalation rate =	0.00036	M^3 per day		

Soil Conc. (mg/kg dw)	Burrow Air Applied dose* (mg/kg-d)	Exposure per day			Air Pathway percent of total dose
		Soil Ingestion Dose (mg/kg-d)	Invert Ingestion Dose (mg/kg-d)	Total Ingested Dose (mg/kg-d)	
41	0.00000499	0.395	112	112.40	0.0000044%

* Assume that all of applied dose is absorbed.

USEPA. 2005. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460. Revised February 2005.

Appendix I-2
Responses to Comments Received on Draft Final RI Report

Document Title:

Draft Final Phase II Remedial Investigation Report, Installation Restoration (IR) Program Site 1, Former Explosive Ordnance Disposal Training Range, Former Marine Corps Air Station El Toro, California

Reviewer: Mr. Rich Muza, Remedial Project Manager, United States Environmental Protection Agency Region 9, Federal Facility and Site Cleanup Branch, Letter dated 31 August 2006

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENTS			
1.		Due to the repetitive nature of some comments -- in particular, those on the various risk assessments, many of which were provided in our comments on the draft report -- and to expedite finalization of this document and advancement of the site work, we would recommend that a meeting or conference call be arranged to further discuss these comments prior to delivery of the Final RI Report.	The Navy agrees that a technical meeting to discuss agency comments would facility finalization of the RI. A BCT meeting was held on 25 October 2006 to discuss the issues, and a follow-up meeting is scheduled for 7 November 2006.
2		Finally, the Navy notes in the RI Report that it intends to transfer the site to an entity which will use it for a similar purpose (ie., arms training, explosive demolition, etc.). It also notes that the effort to transfer the land to another agency for use as a training area has been in progress for several years now without success. Given the lack of success in transferring this property and the uncertainty that the site will ever be used again for a similar purpose, EPA cautions the Navy with regard to establishing cleanup levels which would preclude the use of the land for another purpose; this concern is present in many of the attached comments. It is recommended that this issue also be discussed in a meeting of all parties.	The Federal Aviation Administration (FAA) has recently provided a letter to the Navy which states that the FAA has determined that it is in the best interest of the US Government that this parcel of property be included in and made a part of the overall "Habitat Area" – a parcel of property at El Toro being managed by the FAA on behalf of the US Government. Upon receipt of this parcel, FAA will enter into applicable agreements with the FBI and USFWS for "continued like use". Included with this letter is GSA Form 1334, "Request for Transfer of Excess Real and Related Personal Property", as well as the Legal Description of the site and the Record of Survey for the site. In support of the property transfer, the Navy is preparing an Environmental Summary Document (ESD) which includes a Memorandum of Understanding between the Navy and the FAA. The Navy plans to provide the BCT with periodic updates about the progress of the property transfer. The Navy will develop and propose cleanup goals

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			consistent with future land use.
SPECIFIC COMMENTS			
1.	Section 1.4, General	There are issues with the labeling of the tables. The citations appear to be incorrect throughout the background discussions. It is recommended that this issue be addressed in the final document.	The text will receive a through review prior to distribution of the Final version.
2	Section 3.3.3, Page 3-36	"There are very limited areas of these habitats onsite, which limit their significance." From an ecological standpoint, the fact that these types of habitats are becoming rare in this area makes them very important and worthy of protection and expansion in any way possible. It is recommended that this statement be deleted from the text.	The statement will be deleted.
3	Section 4.1, Page 4-2	A citation of Figure 1-3 is provided for the boundary of the geophysical survey grid while this information is actually presented on Figure 1-4. It is recommended that this error be corrected in the final document.	The citation will be revised to refer to Figure 1-4.
4	Section 4.3.2.9, Page 4-66	"For the subsurface soil interval of 0 to 10 feet bgs, the maximum detection of 1,580 mg/kg exceeds both the California-modified PRG value of 150 mg/kg and the EPA Region 9 PRG value of 400 mg/kg. However, the 95 percent UCL value of 93.4 mg/kg is below both values." This discussion appears to be addressing a lead detection that exceeded residential PRGs. However, no mention of lead is provided anywhere within this paragraph. It is recommended that this issue be clarified.	The text will be revised as follows: "...the maximum detection **for lead** of 1,580 mg/kg..."
5	Section 4.5.2, Page 4-99 and Table 4-38	The discussion states that there was a detection of bis(2-ethylhexyl)phthalate at 49 ug/l in 01-MW102; however, Table 4-38 reports this detection at 01-DGMW57. It is	Table 4-38 will be revised to indicate that the detection of BEPH was in well 01-MW102.

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Comment No.	Section/ Page No.	Comment	Response
		recommended that this discrepancy be resolved.	
6	Section 4.5.5, Page 4-114 & Table 4-41	The first bullet here contains statements that are not consistent with the water-quality data provided on Table 4-41. A review of this information suggests that data from both the January-February 2005 and March 2005 sampling rounds are being cited. However, some statements (eg., the highest perchlorate concentration of 185 ug/l) do not include the March 2005 data. It is recommended that this discrepancy be resolved.	The text will be revised as follows: "Perchlorate concentrations greater than its California public health goal (6 µg/L) were detected in all five Hydropunch™ samples collected from boreholes in the southern portion of IRP Site 1 (01-HPA6, 01-HPA7, 01-HPA8, 01-HPA9, and 01-HPA10). Of the samples collected from those locations, the highest perchlorate value was in Hydropunch™ borehole 01-HPA8 at a concentration of 219 µg/L. The alluvium Hydropunch™ sample collected from borehole 01-HPA7 had a concentration of 185 µg/L. A groundwater sample collected from the monitoring well installed in the vicinity of 01-HPA7 (01-MW223) had a perchlorate concentration of 74.6 µg/L."
7	Section 5.1.4, General	EPA provided a comment on the Draft RI Report regarding the presence and migration of perchlorate in ground water at Site 1 years after activities which would have released this contaminant into the environment were terminated by the Marines (see Comment #33 from our August 24, 2005 letter). In our comment EPA recommended that potential hydrogeological scenarios that support these issues be further discussed in the text. EPA is in agreement with the Navy's response to this comment as provided in Appendix I to this report. While some of the information presented in the response is incorporated into the discussions within the Draft Final RI Report, it is recommended that additional discussion be added to this section to adequately cover the issues addressed in the response to our previous comment.	The following information will be added to Section 5.1.4.1: "Perchlorate persists in the bedrock at Site 1 is primarily due to either the immature nature of this sandstone (incomplete cementation) or to differential weathering, or both. It is hypothesized that perchlorate has become "lodged" in this differential porosity and is only able to escape slowly through mechanisms which are not yet fully understood. This property is demonstrated in three features: •Eighteen separate hydrogeologic zones (primarily within the bedrock) identified from the long-term aquifer stress tests performed at Site 2, which has hydrogeologic zones similar to those at Site 1, •The detailed continuous coring that was conducted at Site 1 under Tier III-C of the RI supports the current conceptual site model. The random appearance of gypsum (HCL reactive) cement, with non-reactive dry, moist and wet zones

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			throughout these cores clearly demonstrates that there are immature, not fully cemented deposits; thereby implicating the variable nature of its hydrology, and •The aquifer stress tests conducted recently at Site 1 (June 2005) yielded a response to shallow aquifer stress at deep well 01-MW222 but not at shallow well 01-MW204 (see Figure 2-4 in the Draft RI Report). Considered together, perchlorate probably progressed by dissolution from the surface soil at Site 1 through the weathering profile within the bedrock to the less weathered bedrock where it became lodged in a complex matrix of hydraulically separate zones that are periodically, but only partially, "flushed" by significant recharge events, such as occurred in early 2005."
8	Section 5.1.4.2, General	The information provided in this discussion was expanded from the draft to the draft final. This has provided a more detailed assessment of perchlorate migration at Site 1. However, some of the discussion is confusing as presented. For example, the final statement of this section (page 5-11) refers to "the geological equivalent of a 'stain'". It is recommended that an edit of this discussion be performed to assure that the text is fully understandable in the final report.	The text will be reviewed and revised as necessary in order to eliminate confusion.
9	Section 5.1.5, Page 5-11	"The upper reaches of the alluvial channel in the vicinity of 01-HA10..." The citation of "01-HA10" appears to be incorrect; is the hydropunch sampling location being addressed here "01-HPA10"? It is recommended that this discrepancy be resolved.	The text will be revised to refer to Hydropunch™ sampling location 01-HP10.
10	Section 6.5.4, General	Assessment of the vapor intrusion potential for VOCs in soil and ground water at the site was performed via the Johnson and Ettinger (J&E) model starting from VOC concentration	At Site 1, risks to indoor residents/workers are driven by the presence of benzene, naphthalene and xylene in soil. One apparent reason for the greater uncertainty of the J&E results

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		data in either the soil matrix or ground water (see results presented in Tables G-13 and G-16). Of the two approaches, EPA's preference is for decision-making to focus on potential indoor impacts predicted by modeling from ground water, because of the greater uncertainties of modeling from soil matrix data. In the event of future development at Site 1, either residential or commercial, it is recommended that the Navy consider the following: 1) perform soil vapor monitoring at the site and rerun the J&E model using soil vapor data as the input and 2) installing a passive vapor barrier, with option to be retrofitted to an active system, under occupied structures.	from soil is the variability of chemical concentrations seen in soil. Because each of these chemicals was detected in too few samples to accurately calculate a 95 % UCL, the maximum detected concentration was used to estimate VOC concentrations in indoor air. These concentrations likely reflect worse-case scenarios, and risks tend to be greatly overestimated. For example, benzene (a risk driver on Table G-13) was detected in only 3 of 175 samples, with the maximum concentration at 610 ug/kg. The other detections were 430 ug/kg and 36 ug/kg. Reporting limits for non-detects were generally between 5 and 10 ug/kg. This information suggests that an average concentration in soil is far less (i.e., 1 -2 orders of magnitude) than the level represented by the maximum detected concentration. Similarly, average concentrations for naphthalene and xylene in soil are likely an order of magnitude or more lower than the maximum detected concentrations used in all risk calculations, including the evaluation of indoor air. Therefore risks to future residents or workers exposed to VOCs in indoor air is likely acceptable. While groundwater results also used the maximum detected concentration of TCE (the risk driver noted in Table G-16), risk estimates are already within the EPA acceptable risk range of 10^{-6} to 10^{-4}. Limitations of the data set required that maximum reported concentrations for many VOCs be used in risk calculations. The level of exposure to site chemicals by future residents or workers would expectedly be an average concentration since the extensive soil sampling did not consistently detect/report the elevated VOC concentrations that were used in the risk evaluation. The risk assessment has been developed based on

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			the most likely reuse scenario, which is similar to past use (EOD training range). If in the future, the site were slated to be used for anything other than "like use", the future property owner would need to comply with all applicable laws and regulations pertaining to that specific reuse scenario.
11	Section 6.6.2, Page 6-40 and Table 6-4	As noted in our previous comments on the Draft RI Report, the site-specific risk evaluation for the "Construction/Utility Workers" makes the assumption that a construction/utility worker's exposure duration is 3 years for the RME scenario and 1 year for the CT scenario. By using these exposure duration values, the risk assessment inherently assumes that MCAS El Toro is the only contaminated property that a construction/utility worker receptor will ever work on; this assumption is unrealistic. Given the general paucity of previously undeveloped land in Southern California and the recent emphasis by municipalities and government agencies to redevelop 'brownsfield'-type properties, it would be more reasonable to assume that Southern California construction/utility workers routinely encounter contaminated properties. Therefore, in order to generate a soil PRG which achieves a given target risk level over a construction/utility worker's career, it would be more appropriate to assume that 50% (RME) to 25% (CT) of that career involves work at contaminated properties. Over a 25 year working career, the corresponding exposure durations would be 12.5 years (RME) and 6.25 years (CT). No change on this issue has been made in the Draft Final RI Report. In the Appendix I response to review comments on the Draft RI Report, the Navy acknowledged "that a construction worker could encounter contamination at locations other than Site 1" but disagreed "that this information should be reflected in exposure assessment assumptions for Site 1 because this risk assessment focuses on incremental risks posed by the	A site-specific PRG is calculated using exposure factors that are specific for an exposure pattern at a specific site. Therefore, the site-specific PRGs derived for the construction/utility worker at El Toro Site 1 reflect the potential exposures based on assumed activities from future "like use". Site-specific PRGs do not include quantitative evaluation of potential exposures at other sites. The Navy concluded that the exposure durations used in the site-specific risk evaluation were appropriate because the construction/utility worker, unlike the commercial/industrial worker, had a very low likelihood of spending 50% of their career working at Site 1. For comparison purposes, the risk for the Construction/Utility Worker has also been calculated using the exposure duration of 12.5 years (RME) and 6.25 years (CT). The calculated risk is $4x10^{-6}$ and $6x10^{-7}$, respectively.

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		site and does not attempt to estimate lifetime risks for construction workers (or other receptors)..." (see response to EPA Comment #44 in Appendix I). It is technically correct that Superfund risk assessment guidelines do not attempt to estimate risks from an entire lifetime of exposure. However, examination of the default assumptions for residential and commercial/industrial RME scenarios clearly shows an intent to address potential risks arising from exposure durations reflecting a majority or a significant fraction of a lifetime or working career (eg., residential exposure duration = 30 years, commercial/industrial = 25 years). In this context, using an assumed exposure duration of 3 years for a construction/utility worker in Southern California seems incompatible with the intent of Superfund's risk assessment guidance. It is recommended that our comment on this issue from review of the Draft RI Report (Comment #44 in our August 24, 2005 letter) be taken into consideration by the Navy and be addressed in the Final RI Report.	
12	Section 7, General	The CADF&G (see Dr. Regina Donohoe's August 1, 2006 letter) have addressed the specific toxicological issues raised in their review of the Draft RI Report. Many of their comments on the draft have not been addressed by the Navy in the draft final. EPA recommends that the Navy (as recorded in our letter of August 24, 2005) revise the document to address these comments	Comment noted. The Navy has responded to all comments from CADF&G regarding toxicological issues. However, the Navy does not agree that all recommendations are appropriate for inclusion in the Phase II RI Report. Ms. Donohoe has provided separate comments on the Draft Final RI report, and DON has provided responses to those comments. Please see those responses for further details.
13	Section 7, General	The general tone of the ecological assessment is that there is no risk to biota on site; however, there are instances where the document states that there may be risk to individuals, yet there is no risk to populations (eg., Executive Summary, Page xi). This is a vague and potentially misleading statement that is not based on investigation of the populations on-site. . If there is potential risk to the individual (supported both by Dr. Donohoe's and the Navy's calculations), then there is risk to populations. If the Navy is	The ERA does not imply that there is no risk to ecological receptors at the site. There were low levels of risk to certain ecological receptors identified from certain chemicals, but the Navy concluded that the level of risk is not sufficient to warrant further evaluation or a response action. The Navy's conclusion indicating that risk to individuals does not necessarily result in risk to populations is supported by Sample and others (1999), who have demonstrated that individual effects do not necessarily equate to population

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		convinced that risk to individuals does not present a risk to populations, then the Navy should propose population studies to support this premise. It is recommended that this issue be addressed in the final document.	level effects. In addition, Loar et al. (2001) concluded that population-level effects inferred from contaminant effects on individuals were often less than the population-level effects predicted by model simulations. EPA's comment that "If there is potential risk to the individual ... then there is risk to populations." is an area of debate. Populations possess characteristics that individuals do not such as natality rate, mortality rate, age structure, sex ratio, and history. An individual is born, produces a certain number of offspring, and dies at a specific age. The survival of a population through time depends on the age structure, age-specific sex ratio, and a balance in the natality and mortality rates. These are related to individual characteristics but individual impairment or death does not necessarily mean that the population is imperiled. References Sample, B, K. Rose, and G. Suter, III, 1999. *Estimation of population-level effects on wildlife based on individual-level exposures: Influence of life history strategies.* IN: P. Albers, G. Heinz, and H. Ohlendorf (eds.). Proceedings of Symposium on Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities, and Ecosystems, SETAC Press. Loar, J., L. Mann, K. Rose, and B. Sample, 2001. *Estimation of potential population effects of contaminants on wildlife, Final Report.* Project No. 60037, US Department of Energy, Office of Basic and Applied Science and Office of Biological and Environmental Research.
14	Section 7, General	While there are numerous maps displaying contaminant exceedences for human health, there is a lack of maps in	Figures 2-4 and 3-1 in Appendix H will be presented in Section 7 of the RI report as suggested.

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		the main text showing exceedences of ecological criteria. It is recommended that the maps found in Appendix H be reproduced and placed in the appropriate sections in the main text in the Final RI Report.	
15	Appendix G, PRG Values	There appear to be a number of incorrect EPA Region 9 PRG values in the various tables in Appendix G. The Region 9 PRG value for benzene in residential soil appears to be incorrect. The value listed in Tables G-11 and G-12 is 1.00E+03 ug/kg (1,000 ug/kg); the correct value should be 6.4E-01 mg/kg (0.64 mg/kg). The tap water PRG also appears to be incorrect. The value listed in Table G-52 is 3.36E-01 ug/l; the correct value should be 3.5E-01 ug/l. The Region 9 PRG value for bis(2-ethyl,hexyl)phthalate in residential soil also appears to be incorrect. The value listed in Tables G-11 and G-12 is 3.77E+04 ug/kg (3.77E+01 mg/kg); the correct value should be 3.5E+01 mg/kg. It is recommended that these issues be resolved.	The PRG for benzene in soil referenced the correct cell in another table but inadvertently added 1000 instead of multiplying by 1000 to change the units from mg/kg to µg/kg. The calculation will be corrected prior to distribution of the Final RI report. The tap water PRG for benzene has been corrected on Table G-15 to be 3.5E-01 The carcinogenic PRG for bis(2-ethylhexyl)phthaleate (3.47E04 mg/kg) is correct in Table G-11 , but will be corrected on Table G-12.
16	Appendix H, Section 2.1.3, Page 2-13	The surface soil values should have been screened against the Navy BTAG TRVs. As the State has pointed out in their comments, this approach would have produced a more conservative screening and, therefore, would be more protective of the biota on site. It is normal procedure to screen against the most conservative values and then, if necessary, adjust the exposure to more site-specific values in the baseline ecological risk assessment. It is recommended that the Navy follow standard protocols and use the BTAG TRVs as requested by the State to assess risk.	The Navy BTAG TRVs are ingested dose levels (mg/kg-day) and not soil screening values. The Navy uses the BTAG TRVs to calculate soil screening values and to compare to estimated chronic daily doses for representative wildlife species. The Navy uses the BTAG-low TRV in its risk estimates for all chemicals in the BTAG list (developed in 1997) except those for which there are more recent values developed by EPA in the 2005 Eco SSL documents. These newer values are based on a more extensive database, including more recent toxicological studies. In addition they have undergone extensive peer review. Since they were developed for use in estimating ECO SSL values, the Navy's opinion is that they are appropriate for use in screening level risk assessments.
17	Appendix H,	"The primary source of TRVs was the 'TRV-low level'..."	The Navy uses the BTAG-low TRV in its risk estimates for all

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Reviewer: Mr. Rich Muza, Remedial Project Manager, United States Environmental Protection Agency Region 9, Federal Facility and Site Cleanup Branch, Letter dated 31 August 2006

Comment No.	Section/ Page No.	Comment	Response
	Section 2.1.7, Page 2-27	The Navy does not use these BTAG values in this document. It is recommended that this issue be addressed in the final document.	chemicals in the BTAG list (developed in 1997) except those for which there are more recent values developed by EPA in the 2005 Eco SSL documents. These newer values are based on a more extensive database, including more recent toxicological studies. In addition they have undergone extensive peer review. Since they were developed for use in estimating Eco SSL values, the Navy's opinion is that they are appropriate for use in screening level risk assessments. This explanation will be incorporated into the final RI to clarify the use of BTAG-low and Eco SSL TRVs by the Navy.
18	Appendix H, Section 2.2.2.1, Page 2-34	"It is assumed that if risks are judged insignificant for the average individual receptor, they will be considered insignificant at the population level. However, if risks are present at the individual receptor level, risks may or may not be important at the population level." This contradicts earlier statements that risk to the individual does not imply risk to the population. It is recommended that this conflict be resolved in the final document.	The two statements are not contradictory. Potential risk to an individual of a species does not automatically imply risk to the species population. Populations possess characteristics related to survival that are lacking in individuals, such as mortality rate and natality rate. The population survives when they are in balance.
19	Appendix H, Section 2.2.4.1, Page 2-42 & Section 4.1, Page 4-1	It is stated in Section 2.2.4.1 that two Ephemeral Pond samples were taken and that in combination, aluminum, barium, copper, lead, and mercury all exceeded aquatic life criteria. However, the last sentence in this section states that only aluminum, barium and copper exceeded aquatic life criteria. In addition, in Section 4.1 it is also stated that four metals (aluminum, barium, copper and mercury) exceeded the screening values. It is recommended that the discrepancies between these various sections be resolved.	The text will be revised to indicate that between the two samples, aluminum, barium, copper, lead, and mercury exceeded aquatic life criteria.
20	Appendix H, Section 3.4.3.1, Page 3-6	Chemicals that are identified as a potential risk to biota yet have a low frequency of detection should not be deleted from the risk assessment until the Navy has verified that they do not constitute "hot spots". It is recommended that further information be provided here or a reference to	Section 3.4.3.1 of Appendix H discusses frequency of detection and the rationale for screening of COPCs. Chemicals that are detected infrequently in the surface soil are not generally available to contribute significantly to

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Reviewer: Mr. Rich Muza, Remedial Project Manager, United States Environmental Protection Agency Region 9, Federal Facility and Site Cleanup Branch, Letter dated 31 August 2006

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		specific sections within the Final RI Report be made to support deletion of these chemicals. If data do not support deletion, it is recommended that the Navy address this issue as appropriate.	sitewide receptor exposure. The frequency of detection for each chemical is presented in Attachment H-3. Of the COPCs that were retained for further evaluation in Tier 2, Step 3a, the following were detected in less than 5 percent of surface soil samples: acetone, ethylbenzene, total xylenes, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, hexachlorobenzene, naphthalene, n-nitrosodiphenylamine, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, RDX, HMX, antimony, silver, and thallium. The calculated Tier 2 HQ values for these 16 chemicals have been included in Seciton 7.3.4.5 and Table 7-13 of the Final RI report.

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Reviewer: Sue Hakim, Remedial Project Manager, Base Closure and Reuse Unit,, California Department of Toxic Substances Control, Letter dated 14 August 2006

Comment No.	Section/ Page No.	Comment	Response
SPECIFIC COMMENTS			
1.	Summary and Conclusions, Page 9-2, Item Number 3	The last sentence states: Concentrations of naphthalene exceeded the Cal-Modified EPA Region 9 residential and industrial PRGs of 1.7 and 4.2 mg/kg respectively, at seven sampling locations." Please remove the words "Region 9" from this sentence and correct the industrial PRGs value (4.47 mg/kg). Also please reconcile Figure 4-2 with the same information for naphthalene and throughout the whole document.	The phrase, "Region 9" will be removed from all instances when discussing Cal-Modified PRGs as suggested. Figure 4-2 will be revised to show that the Cal-Modified Industrial PRG for Naphthalene is 4.2 mg/kg, which is consistent with the rest of the document.

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Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 10 August 2006

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENTS			
1.		HERD does not recommend using soil data to evaluate the vapor intrusion pathway because of greater uncertainties associated with predicting the indoor air concentrations in soil. Therefore, HERD recommends that results of the indoor air evaluation based on groundwater data, rather than soil data, be used as one of the factors in the risk management decision.	In the Draft Final RI Report, vapor intrusion risk estimates are provided based on both soil and groundwater data, and uncertainties with the indoor air evaluation are discussed. The Navy agrees that indoor air evaluations from soil have more uncertainty than those from groundwater due to the likely soil heterogeneity and contaminant levels for many chemicals in soil as compared to groundwater. The Navy proposes to use the results of the indoor air evaluation based on groundwater as a factor in risk management.
SPECIFIC COMMENTS			
1.	Figure 4-2	It appears that the Figure identifies the naphthalene concentrations that exceeded the CalEPA-modified PRGs instead of the EPA Region 9 PRGs. HERD recommends that the accuracy of the Figure be reviewed and corrected, if necessary.	Figure 4-2 will be revised to show that the Cal-Modified Industrial PRG for Naphthalene is 4.2 mg/kg, which is consistent with the rest of the document.
DISCUSSION AND CONCLUSIONS			
		This Draft Final report addressed and incorporated the comments provided by HERD on the Draft RI Report for Site 1. As requested by HERD, the risk estimates based on using CalEPA-modified toxicity	Comment noted. The Navy does not believe the levels of naphthalene left remaining in subsurface soil constitute sufficient

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Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 10 August 2006

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		factors were presented along with the risk estimates based on using the USEPA toxicity factors. If the CalEPA-modified toxicity factors are applied, the cumulative risk estimates due to potential soil exposures of a resident are consistently at 1E-04 due to naphthalene, which is considered a carcinogen by CalEPA. Naphthalene was detected only once in the surface soil, but was detected at a frequency of 4% in the subsurface soil. Considering that naphthalene was detected in a limited area in Trench 34, HERD recommends that the Navy considers the removal of the soils where naphthalene concentrations exceeded the CalEPA-modified PRGs. The USEPA has not classified naphthalene as a carcinogen. Hence, the cumulative risk due to surface soil exposures of a resident, based on using EPA toxicology factors, is 8E-06. Overall, the risk estimates due to potential soil exposures of a resident range from 8E-06 to 1E-05 due to arsenic and RDX. The risk estimate due to vapor intrusion of TCE from groundwater is 7E-07 when the CalEPA-modified toxicity factors are applied. However, the risk due to potential indoor air exposures to TCE from the groundwater is estimated to be 3E-05 when the USEPA toxicity factors are applied. The difference in the results of the indoor air evaluation is attributed to TCE being considered more carcinogenic by USEPA. In general, the most current information should be used in risk assessments. However, the U.S. EPA slope factor is provisional since comments have been	risk to warrant a removal action for the following reasons: 1) The risk to a theoretical future resident as currently estimated for the reasonable maximum exposure scenario is within the EPA acceptable risk range of 10^{-6} to 10^{-4}. 2) The infrequency with which naphthalene was detected (4% in subsurface soil, 6 samples out of 148) suggests that the exposure point concentrations would likely be much less than the maximum detected concentration used to estimate risk. A detection frequency of 5% is used in RAGs Part A (EPA 1989) as an example of low frequency of detection to eliminate a chemical from the COC list. 3) While risks for the potential future resident were calculated using subsurface soil results, the soil to which future residents are potentially exposed would likely consist of a mixture of existing surface soil (where naphthalene was not detected) and subsurface soil such that the overall levels of naphthalene would be expectedly less. TCE was detected in 3 out of 19 groundwater samples, which is 16%. However, those 3 samples were from the initial sampling event. Subsequently, the three wells were resampled and results indicated that TCE was not detected in those wells above reporting limits, nor was TCE detected in newly-installed wells in the

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		made by interested parties including the Air Force. Since the California O.E.H.H.A. has not revised its cancer slope factors, it is appropriate to retain the earlier cancer slope factors. This opinion is likely to change when U.S. EPA reaches a final decision about these provisional cancer slope factors. The Navy states that TCE was only detected in one round of sampling but TCE was detected at a frequency of 16%. Although 3E-05 (based on EPA toxicity factor) is within the risk management range of 1E-06 to 1E-04, HERD recommends that the Navy provide a more robust justification that no further evaluation or monitoring is required.	general vicinity. Although the screening level risk assessment for indoor air due to vapor emission from groundwater resulted in cumulative incremental cancer risks of $3x10^{-5}$, that risk is primarily associated with TCE (99%), and for the above reasons, the Navy does not believe that further evaluation is necessary. Future use of the site will be consistent with previous uses (EOD training range). The Navy has developed several scenarios in order to provide a range of risk. The residential scenario represents an upper-bound risk estimate, and the three site-specific scenarios (Construction/Utility Worker, Casual Trespasser, and EOD Training Range Supervisor) provide more realistic, lower bound risk estimates. It is this range of risk that should be used by the risk managers when making response action decisions.

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SPECIFIC COMMENTS			
1.	Appendix H, Section 2.1.5.5, Chemical Specific Factors, and Attachment H-4	DFG-OSPR has reviewed the octanol-water partition coefficients (K_{ow}) that were added in Attachment H-4. Organic-carbon distribution coefficients (K_{ow}) were not provided for calculation of invertebrate bioaccumulation factors (BAFs) and some K_{ow} values for explosives were modeled when empirical data are available (Talmadge et al., 1999). Nevertheless, estimated plant and soil invertebrate BAFs for explosives in Attachment H-4 were compared to a recent compilation of empirically derived BAFs (Tsao and Sample, 2005; Best et al, 2006). The selected values appear to provide a reasonable estimate of bioaccumulation in plants and some soil invertebrates. Estimated BAFs for 1,3,5-trinitrohexahydro-l ,3,5-triazine (RDX) and octahydro-l ,3,5,7-tetranitro-l ,3,5,7-tetrazocine (HMX) in soil invertebrates are about an order of magnitude lower than empirical BAFs reported in the literature. DFG-OSPR is not recommending changes to the Draft Final RI/FS, but would like to point out this uncertainty in the estimated bioaccumulation rates, as noted in Appendix H, Section 2.2.3.	As noted in the comment, the uncertainty in the estimation of bioaccumulation rates is presented in Appendix H, Section 2.2.3.
2.	Appendix H, Section 2.1.7, Toxicity Evaluation	Perchlorate toxicity benchmarks for plants and soil invertebrates were not addressed in the Draft Final RI but the RTCs (Appendix I) indicated that the values recommended by U.S. EPA (2002; 1 to 4 mg perchlorate/kg wet weight soil) would be utilized. A recent study on the toxicity of perchlorate to earthworms concluded that 1.3 mg perchlorate/kg soil	As noted in the comment, the 95 percent UCL is below the level of concern.

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		was the effective concentration for reducing cocoon production in 50% of the test animals (EC_{50}) exposed for 21 days (Landrum et al., 2006), supporting the U.S. EPA (2002) toxicity benchmarks. Surface soil analytical data (Attachment H-3) show that the maximum detected perchlorate concentration (1.6 mg/kg) is within the range of concern but the 95% upper confidence limit (UCL; 0.087 mg/kg) is below the level of concern.	
3.	Appendix H, Attachment H-5, Benzene	The Navy continues to assert that adverse immunological and hematological effects associated with benzene exposure are not ecologically relevant. DFG-OSPR continues to disagree. However, alternate benzene HQs for mammals, calculated using DFG-OSPR's recommended TRV (7 mg/kg/d), do not change the overall risk conclusion for this chemical (see Table 1, Below). DFG-OSPR concurs that, using the current site characterization data, ecological risks associated with benzene ingestion are not significant, but should be considered in the cumulative risk associated with this class of compounds (see Comment 11).	Consistent with numerous EPA guidances cited below, the Navy used the highest ranking and the most relevant endpoints (mortality, reproduction, and growth) in developing TRVs for conducting the ecological risk assessment for Site 1. EcoSSL Guidance (2005), Attachment 4-4 Section 4.7, states the following: *"The following endpoints are selected in order of preference for derivation of TRVs.* • *Studies measuring reproductive endpoints are considered the most appropriate and are preferred. Reproductive endpoints are assigned a score of 10. ...* • *Studies measuring mortality or survival (chronic) as an endpoint are also considered appropriate but are less preferable to reproductive endpoints. These study endpoints are assigned a score of 9...*

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			• *Studies measuring growth are also considered appropriate for establishing TRVS these endpoints are assigned a score of 8....* • *Studies measuring organ function, behavior, or neurological function are considered less useful in establishing TRVs...* • *Studies measuring biochemical effects or changes that are either hormonal, chemical or enzymatic in nature are considered the least useful."* As noted in the comment, the use of the DFG-OSPR-proposed alternative TRV for benzene does not change the results of the risk assessment. The following is from the EPA Eco SSL Guidance (2000): Although biochemical, behavioral, physiological and pathological endpoints are coded in the toxicity data base (Attachment 4-3), "*For purposes of identification and derivation of a TRV for calculation of an Eco-SSL, the endpoints have been predefined. The wildlife TRV is calculated based on chronic exposure data from reproduction and growth endpoints with chronic mortality also considered (Attachment 4-5). In the data evaluation scoring system, chronic exposure data that measure reproductive endpoints are given the highest preference followed by chronic mortality and then growth. Other changes in 'fitness' such as organ*

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			function, behavior, neurological function and biomarkers are provided consideration but are scored as a lower priority." (EcoSSL Guidance Appendix 4-4, Section 4.6), 2000 Additionally, page 1-9 *of Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final* (EPA 1997), states, "Ecological risk should be based on endpoints that are ecologically relevant such as "reduced growth, impaired reproduction or increased mortality". Although physiological or behavioral or other toxicity endpoints may be ecologically important in some cases for some species, these endpoints are not generally used to assess risk to species populations unless no other endpoints are available."
4.	Appendix H, Attachment H-5, 2,4-Dinitrotoluene (DNT)	A) The Navy DNT no observed-adverse-effect level (NOAEL; 3.9 mg/kg/d) is based on chronic effects on body weight in rats. DFG-OSPR recommended a chronic NOAEL of 0.2 mg/kg (ATSDR, 1998), based on hematological, hepatic and neurological effects in dogs. In 2006, the U.S. Army Center for Health Promotion and Preventive Medicine released a wildlife toxicity assessment for 2,4 and 2,6-DNT (USACHPPM, 2006). USACHPPM selected the same dog study for TRV development, based on neuromuscular effects, and modeling was done to develop benchmark doses. The LED_{10} (95% lower confidence limit on the effective dose in 10% of the animals, ED_{10}) was 0.67 mg/kg/d and the ED_{10} was 1.4 mg/kg/d. Therefore, DFG-OSPR continues to	A) The DFG-OSPR-proposed TRV is based on hematological, hepatic, and neurological effects in dogs. USACHPPM TRV is based on the same study. As in response to Specific Comment 3 above, and previously stated in response to DFG-OSPR Specific Comment 5 on the Draft RI Report, and in response to Specific Comment 3 above, ecological risk should be based on endpoints that are more ecologically relevant such as "reduced growth, impaired reproduction or increased mortality" (EPA, 1997). B) Frequency of Detection (FOD) 2,4-Dinitrotoluene was detected in 4% of samples collected from 0 to 6 feet bgs (6 samples in 144). As a

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		assert that the selected TRV (3.9 mg/kg/d) is not protective for mammals. B) When Tier 1 HQs were calculated for the alternative TRVs, results indicated potential risk for the ornate shrew and deer mouse (see Table 2, Below). Due to a low frequency of detection (4%), DNT did not proceed to the Tier 2 evaluation (see Comment 11).	part of the weight of evidence evaluation, this analyte is eliminated in Tier 2. A detection frequency of 5% is used in RAGs Part A (EPA 1989) as an example of low frequency of detection to eliminate a chemical from the COC list. The elimination of infrequently detected chemicals in Tier 2 was not conducted only on the basis of the EPA RAGs guidance. The potential exposure of receptors to infrequent chemicals was also an important consideration. If chemicals are present only at limited locations at the site, their effect on individuals of the species present will be limited. This is especially true of mobile wildlife that may be exposed to a chemical only occasionally. Risk results from both exposure and toxicity, thus, if exposure is insignificant, then risk is insignificant. For receptors of limited mobility, a limited number of individuals may be impacted by the limited distribution of COPCs on the site. Adverse effects to a few immobile individuals such as plants or soil invertebrates, is not expected to have a significant effect on the survival and growth of populations of these organisms on the site. For this reason, plants and soil invertebrates are not normally selected by risk managers as drivers for a CERCLA response action unless there are threatened or endangered plants or invertebrates at the location that should be protected as individuals. HQ values were calculated for those chemicals detected less frequently than 5 percent. Attached are

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			four Tables (Tables 11 through 14) showing the calculation of Tier 2 risk for chemicals previously eliminated based on a low frequency of detection. This is a conservative estimate because per EPA ProUCL guidance, the exposure point concentration used for the HQ calculation for the infrequently detected (10 or less) chemicals is the maximum detection. These tables demonstrate, quantitatively, de minimus risk to ecological receptors except for 3 chemicals. Therefore, the DoN approach is reasonable given the sparse distribution of COPCs and their effect on the species populations. The HQ for 3 chemicals exceeds 1: Antimony (driven by the maximum of 103 mg/kg at T-23 among 5 detections from 143 samples), Xylene (driven by the maximum of 98 mg/kg at T-24 among 3 detections from 168 samples), and 2,4-DNT (driven by the maximum of 7 mg/kg at T-23 among 6 detections from 147 samples), HQs are calculated using LOAEL-based TRVs and Tier 2 exposure assumptions. The Tier 1 HQs summarized by DFG-OSPR in Table 2 (below) are conservative values used only for screening chemicals for further consideration. 2,4-DNT was retained for further consideration in Tier 2 where it was previously dropped because its low frequency of detection in the environment means a low exposure potential which equates to a low potential for risk. The use of 5 percent FOD is a useful screening tool to assess the potential for significant exposure. The calculated Tier 2 HQ values for 2,4-DNT have been included in Section 7.3.4.5 and Table 7-13 of the

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			Final RI report.
5.	Appendix H, Attachment H 5-1, 2,4-DNT	NOAEL (0.01 mg/kg/d) and low observed-adverse-effect level (LOAEL; 1.3 mg/kg/d) based TRVs for DNT were recently developed for birds (USACHPPM, 2006). These new TRVs indicate that mammalian derived TRVs may not be protective of avian receptors. HQs were calculated using the USACHPPM (2006) TRVs and the exposure estimates in Attachment H-7. Results indicated potential risk to the Mourning Dove and Meadowlark (see Table 3, below). Due to a low frequency of detection, DNT did not proceed to the Tier 2 evaluation (see Comment 11).	2,4-Dinitrotoluene was detected in 4% of samples collected from 0 to 6 feet bgs (6 samples in 144), therefore, exposure of ecological receptors is assumed to be insignificant. This chemical was carried through to Tier 2, but because exposure is insignificant, it was previously eliminated for further analysis as a COC on the basis of frequency of detection and the potential for exposure as outlined in response 4B, above Additionally, the DFG-OSPR TRV of 0.01 mg/kg/d is a NOAEL value from USACHPPM 2006. The same study developed a LOAEL value of 1.3 mg/kg/d, which is also shown in Table 3. The calculated Tier 2 HQs for 2,4-DNT have been included in Section 7.3.4.5 and Table 7-13 of the Final RI report.
6.	Appendix H, Attachment H-5, HMX	DFG-OSPR recommended that the mammalian TRV (1 mg/kg/d), selected by USACHPPM (2001), be utilized for HMX. The Navy selected a mouse study that reported a mortality endpoint (3 mg/kg/d). The Navy TRV is relatively close to what DFG-OSPR recommended, and the Tier 1 risk conclusions are not significantly different (see Table 4, below). Due to a low frequency of detection (1%), HMX did not proceed to the Tier 2 evaluation (see Comment 11)	HMX was detected in 1% of samples collected from 0 to 6 feet bgs (1 sample in 144), therefore, exposure of ecological receptors is assumed to be insignificant. This chemical was carried through to Tier 2, but because exposure is insignificant, it was previously eliminated as a COC on the basis of frequency of detection and the potential for exposure as outlined in response 4B in Tier 2. Because the TRVs are similar in value, substitution of one for the other would not affect the results of the risk assessment. The calculated Tier 2 HQs for HMX have been included in Section 7.3.4.5 and Table 7-13 of the Final RI report.

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7.	Appendix H, Attachment H-5, Inorganics	The Navy was unwilling to provide alternate HQs for arsenic, cadmium, cobalt, and lead that utilized the BTAG-recommended mammalian, low TRVs (U.S. Navy, 1998). DFG-OSPR has provided these Tiers 1 and 2 HQs to represent a range of ecological risk estimates (see Table 5, below). Risk conclusions are comparable between the two sets of TRVs with cadmium and lead presenting potential risks.	Arsenic, Cadmium, Cobalt, and Lead TRVs in BTAG were developed in 1998 (EFAW 1998). TRVs utilized in this risk assessment (Table 7, below) were developed in the EPA Eco SSL document as revised in 2005 using a thorough peer review process. The more recent, peer reviewed TRVs are utilized. The Navy BTAG-low TRVs were selected for use in the risk assessment for all other COCs (for which there was a BTAG-low TRV).
8.	Appendix H, Section 2.2.3.2, and Attachment H 5-1, Perchlorate	DFG-OSPR appreciates that a range of risk estimates were presented for perchlorate to reflect the uncertainties associated with the ecological significance of perchlorate effects on birds and mammals. These estimates indicate that the 95% UCL perchlorate concentration in soil (87 µg/kg) results in exceeding daily doses predicted to have adverse effects on thyroid function and NOAELs for survival, growth and reproduction. Daily doses do not exceed the LOAEL for these latter effects, indicating there is uncertainty as to whether survival, growth and reproduction may be affected by perchlorate. In looking at the distribution of perchlorate concentrations in soil, it seems likely that the risks estimates are driven by the hotspot at LE182, 01-T34 (1600 µg/kg). Risk managers should consider this hot-spot as a potential source of perchlorate exposure (see Comment 11).	Comment noted. The perchlorate TRV used by the Navy is based on growth endpoints, which are considered more ecologically relevant than physiological endpoints by EPA. See response to comment 3 above. The 1.6 mg/kg detection of perchlorate at 01-T34 is the highest detection on the site and is collocated with elevated concentrations of naphthalene.
9.	Appendix H, Attachment H-5, 2,4,6-	DFG-OSPR continues to recommend that the avian TRV (0.07 mg/kg/d), selected by the USACHPPM (Johnson and McAtee, 2000), be utilized for TNT.	See response to comment no. 3. TNT was detected in 1% of samples collected from 0 to 6 feet bgs (2 samples in 144); therefore, exposure of ecological

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	Trinitrotoluene (TNT)	When Tier 1 hazard quotients were calculated for the alternative TRV, results indicated potential risk to the three bird receptors (see Table 6, below). Due to a low frequency of detection (1%), TNT did not proceed to the Tier 2 evaluation (see Comment 11).	receptors is assumed to be insignificant. This chemical was carried through to Tier 2, but because exposure is insignificant, it was previously eliminated as a COC on the basis of frequency of detection and the potential for exposure as outlined in response 4B above. The calculated Tier 2 HQs for 2,4,6-TNT have been included in Section 7.3.4.5 and Table 7-13 of the Final RI report.
10.	Appendix H, Attachment H-5, Inorganics	The Navy was unwilling to provide alternate HQs for cadmium and lead that utilized the BTAG-recommended, avian, low TRVs (U.S. Navy, 1998). DFG-OSPR has provided these Tier 1 and Tier 2 HQs to represent a range of ecological risk estimates (see Table 7, below). The results indicate potential risk to birds from cadmium and lead.	Cadmium and Lead TRVs in BTAG were developed in 1998 (EFAW 1998). TRVs utilized in this risk assessment (as summarized in Table 7) were developed in the EPA Eco SSL document as revised in 2005 using a thorough, peer review process. The more recent peer-reviewed TRVs are utilized. The Navy BTAG-low TRVs were selected for use in the risk assessment for all other COCs (for which there was a BTAG-low TRV).
11.	Appendix H, Sections 2.2.4.3 and 3.6.3.1	DFG-OSPR requested that additional text be added to the Draft Final Phase II RI to explain the "hot-spot" analysis for infrequently detected contaminants. Sections and figures have been added to spatially describe the distribution of contaminants of potential ecological concern (COPECs). However, the ERA concludes that these hot-spots do not present a significant risk to the ecological receptors at the site. We have concerns regarding the interpretation of risks associated with these hot spots. a. Petroleum-Related Compounds. In Section 2.2.4.3, it is acknowledged that Tier 1	a. It is true that a few soil samples in the location of the former detonation trenches have exceedances of screening values for petroleum related compounds. However, the Tier 2 risk assessment showed that the limited exposure provided by the small area of petroleum constituents around the former detonation trenched does not present a risk of adverse effects to wildlife (birds and mammals). Efroymson and others (2004) compiled a large number of sources from the literature in an

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		exceedances are driven by a few sample locations near the former disposal trenches. Maximum soil concentrations for petroleum-related compounds generally occur at the sampling location 01-T34 at a depth of 2 feet (see Table 8, below). At this location, concentrations of benzene, ethylbenzene, toluene, xylenes (BTEX), naphthalene, and 2-methylnapthlene exceed soil-screening levels for the protection of plants and soil invertebrates. Total petroleum hydrocarbon (TPH; petroleum hydrocarbons-diesel) concentrations in soil are equivalent to levels that have been reported to have adverse effects on plants and soil invertebrates (e.g., Efryomson et al, 2004). We believe that these TPH concentrations and detection frequencies (18%) should be considered by risk managers because indicator compounds, such as BTEX, do not always accurately predict the ecotoxicity of petroleum mixtures (Suter, 1997). Tier 1 HQs for birds and mammals also indicate potential risks associated with this hot-spot, especially when cumulative risks for these classes of compounds are considered. DFG-OSPR is concerned that the petroleum contamination may impact less mobile receptors, such as plants and soil invertebrates, as shown by the HQ exceedances below. Additionally, it may be a source for groundwater contamination or future exposure of wildlife if site conditions	attempt to develop soil screening benchmarks for total petroleum hydrocarbons and found that it was not possible at this time. "The variabilities in petroleum materials, chemical analytical methodology, age of hydrocarbon-soil contact , nutrient amendment, and measured effect level did not permit much meaningful aggregation of the data" (Efroymson et al., 2004). They caution that the toxicity values for petroleum mixtures presented in the paper are intended to inform the future development of screening benchmarks and that remediation goals are often determined based on a risk assessment for vertebrates. Tier 1 HQ values exceed 1 and indicate that a chemical should be further evaluated in Tier 2. Upon further evaluation it was determined that they are not likely a risk, especially at the population level. b. Although the direct contact screening values for certain metals, petroleum constituents and explosives suggest that some plants or soil invertebrates may suffer adverse effects from exposure to site surface soils, the area with elevated concentrations is relatively small and the entire population should be taken into account, not a few individuals who may encounter a small area of contaminated soil. Further, laboratory methods for extraction of metals from the soil are quite severe. "Total metals" is not usually an accurate representation of the metals that are

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		change. b. Metals. Metal Tier 1 HQ exceedances are at sampling locations 01-T-28 and 01-T33 at a depth of 3 feet, adjacent to the areas of petroleum contamination (see Table 9, below). The Tier 1 HQs for plants, soil invertebrates, birds and mammals are considerable in magnitude and warrant concern, especially considering uncertainties with the TRVs, as discussed in Comments 7 and 10. For the Tier 2 HQs for birds and mammals, several metals presented a significant risk to birds and mammals (e.g., cadmium, copper, lead, and zinc) based on the NOAEL TRVs (Appendix H, Section 3.4). Using LOAEL based TRVs, copper HQs still exceeded 1. Refined risk estimates (i.e., Tier 2) are not provided for plants and soil invertebrates, but 95% UCL soil concentrations exceed screening criteria for copper and zinc. DFG-OSPR is concerned that these metal-contaminated hot-spots present risk to less mobile receptors, and may be a source of future exposure of wildlife if site conditions change. c. Explosives. Tier 1 HQs indicated potential risk associated with perchlorate and explosive compounds, especially considering the uncertainties with the TRVs identified in Comments 2, 4, 5, 6, 8 and 9 (see Table 10, below). In the Tier 2 ERA, many organic	bioavailable to plants and soil invertebrates. Under natural soil conditions a certain percentage of the total metals may be tied up in non-soluble forms that are unavailable to plants and invertebrates. Thus, direct contact HQ values based on soil analytical results are invariably overestimations of the potential for adverse effects. In addition, the vegetation present in the small "hot spot" area consists of shallow-rooted grasses and forbs and most contamination is located at a depth of two feet or deeper, beyond the reach of the grasses and forbs (Perry, 1984). This is especially true of arid zone species that typically have a widely spread surface root mass to intercept the small infrequent rains that do not penetrate more than a few inches into the ground. Deeper anchor roots generally serve to secure larger plants against the wind and have few absorptive root hairs. c. Frequency of detection is a valid consideration in assessing the exposure potential to any environmental constituent. Risk is based on a combination of toxicity and exposure and a low exposure to even a very toxic chemical may not result in adverse effects (see discussion in RTC 4B, above). Risk managers will take into consideration DFG-OSPR concerns about the potential

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		COPECs, including explosive compounds, were eliminated due to being detected in less than five percent of the samples (see Table 10, below). DFG-OSPR does not agree with eliminating these compounds based on frequency of detection. While explosive compounds have not been found to be elevated site-wide, they are present as hot-spots, particularly at sample locations BH01 and T34. DFG-OSPR is concerned that these explosive-contaminated hot-spots present risk to less mobile receptors, and may be a source of future exposure of wildlife if site conditions change. Additionally, perchlorate contamination in soil may continue to contribute to the observed groundwater contamination.	effects to plants and invertebrates of exposure to the soils in the trench area, but they must also consider future land use. The property is slated to continue to be used as an EOD training range by the new property owner. Cleanup of ranges in use may be premature since the continued operations may negate the results of the cleanup resulting in a waste of limited resources. As provided during the 10/25/06 BCT meeting, the FAA has requested continued use for the FBI as and EOD training range. If in the future, the site were slated to be used for anything other than "like use", the Navy would re-evaluate the risks and, if appropriate, the feasibility of conducting a respone action. The future property owner would comply with all applicable laws and regulations pertaining to protection of ecological receptors.
CONCLUSION			
		DFG-OSPR continues to disagree on the selection of several TRVs, and has provided alternate HQs in this memorandum. We request that these comments be included in Appendix I to record DFG-OSPR's concerns regarding the selected TRVs and overall risk conclusions. The ERA concludes that no further evaluation is necessary to protect the ecological receptors at Site 1. We do not believe the Draft Final RI has adequately evaluated risks associated with the hot-spot areas. Due to the significant levels of soil contamination in the hot-spot areas (see Comment	Comment noted. The comments and RTCs have been included as an attachment to the Final RI Report. The Tier 2 HQs have been calculated for low frequency of detection chemicals. The HQs have been included in Section 7.3.4.5 and Table 7-13 of the Final RI report. Risk managers will take into consideration DFG-OSPR concerns about the potential effects to plants and invertebrates of exposure to the soils in the trench area, but they must also consider future land use. The property will continue to be used as an EOD training

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		11), DFG-OSPR recommends additional evaluation of the disposal trench areas. In lieu of making further changes to the Draft Final RI, these concerns may be addressed in the feasibility study for Site 1. Remediation of these areas would reduce current potential risk and future risks should conditions change at the site. We believe risk managers should consider the feasibility of this option.	range by the new property owner. Cleanup of operational ranges may be premature since the continued operations may negate the results of the cleanup resulting in a waste of limited resources. If in the future the site were slated to be used for anything other than "like use", the Navy would re-evaluate the risks, and if appropriate, the feasibility of conducting a response action.

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Tables

Table 1. Benzene HQ Comparison

Benzene TRV	Ornate Shrew Tier 1 HQ	Deer Mouse Tier 1 HQ	Weasel Tier 1 HQ
DFG-OSPR: 7 mg/kg/d	0.21	0.53	0.001
Navy: 26 mg/kg/d*	0.05	0.10	0.0004

*Navy HQ values are from Attachment H-7

Navy response to Table 1: After utilizing DFG-OSPR TRVs, HQ is less than 1 for all receptors.

Table 2. 2,4-Dinitrotoluene HQ Comparison

2,4-DNT TRV	Ornate Shrew Tier 1 HQ	Deer Mouse Tier 1 HQ	Weasel Tier 1 HQ
DFG-OSPR: 0.2 mg/kg/d	11.15	246.0	0.47
USACHPPM: 0.67 mg/kg/d	3.32	73.4	0.14
Navy: 3.9 mg/kg/d*	0.40	10.0	0.02

*Navy HQ values are from Attachment H-7

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Navy response to Table 2: 2,4-Dinitrotoluene was detected in 4% of samples collected from 0 to 6 feet bgs (6 samples in 144). This analyte was evaluated in Tier 2 but was previously eliminated due to insignificant exposure (low detection frequency, and limited distribution; therefore, insignificant risk to the population of the receptor). Additionally, DFG-OSPR TRV is based on hematological, hepatic, and neurological effects in dogs. USACHPPM TRV is based on the same study. As has been previously stated in response to DFG-OSPR comments, ecological risk should be based on endpoints that are ecologically relevant such as "reduced growth, impaired reproduction or increased mortality" (EPA, 1997).

Table 3. 2,4-Dinitrotoluene HQ Comparison

2,4-DNT TRV	Mourning Dove Tier 1 HQ	Meadowlark Tier 1 HQ	Shrike Tier 1 HQ
DFG-OSPR: 0.01 mg/kg/d	4130	170	0.042
USACHPPM: 1.3 mg/kg/d	31.7	1.3	0.0003
Navy: 0.39 mg/kg/d*	100	4.0	0.001

*Navy HQ values are from Attachment H-7

Navy response to Table 3: 2,4-Dinitrotoluene was detected in 4% of samples collected from 0 to 6 feet bgs (6 samples in 144), therefore, exposure of ecological receptors is assumed to be insignificant. This analyte was evaluated in Tier 2 but was previously eliminated due to insignificant exposure (low detection frequency, and limited distribution; therefore, insignificant risk to the population of the receptor). 2,4-DNT Tier 2 HQs are shown in Tables 11 through 14. Additionally, the DFG-OSPR TRV is a NOAEL value from USACHPPM 2006. The same study developed a LOAEL value of 1.3 mg/kg/d, which is shown in Table 3.

Table 4. HMX HQ Comparison

HMX TRV	Ornate Shrew Tier 1 HQ	Deer Mouse Tier 1 HQ	Weasel Tier 1 HQ
DFG-OSPR: 1 mg/kg/d	0.02	49	0.09

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Table 4. HMX HQ Comparison

HMX TRV	Ornate Shrew Tier 1 HQ	Deer Mouse Tier 1 HQ	Weasel Tier 1 HQ
Navy: 3 mg/kg/d*	0.007	10	0.02

*Navy HQ values are from Attachment H-7

Navy response to Table 4: HMX was detected in 1% of samples collected from 0 to 6 feet bgs (1 sample in 144), therefore, exposure of ecological receptors is assumed to be insignificant. This analyte was evaluated in Tier 2 but was previously eliminated due to insignificant exposure (low detection frequency, and limited distribution; therefore, insignificant risk to the population of the receptor). HMX Tier 2 HQs are shown in Tables 11 through 14.

Table 5. Arsenic, Cadmium, Cobalt, and Lead HQ Comparison

TRV* (mg/kg/d)	Ornate Shrew HQs Tier 1 / Tier 2	Deer Mouse HQs Tier 1 / Tier 2	Weasel HQs Tier 1 / Tier 2
As			
BTAG: 0.32	1.8	0.51	0.51
Navy: 1.04	0.6	0.20	0.2
Cd			
BTAG: 0.06	2483 / 81	47 / 10	35 / 0.04
Navy: 0.77	200 / 6	4 / 5	3 / 0.003
Co			
BTAG: 1.2	0.26	0.04	0.07
Navy: 7.33	0.04	0.007	0.01
Pb			
BTAG: 1.0	114 / 3	13 / 3	21 / 0.02
Navy: 4.7	20 / 0.7	3 / 0.7	5 / 0.005

*Navy HQ values are from Attachment H-7

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Navy response to Table 5: Arsenic, Cadmium, Cobalt, and Lead TRVs in BTAG were developed in 1998 (EFAW 1998). TRVs utilized in this risk assessment (as summarized in Table 5) were developed in the EPA Eco SSL document as revised in 2005 using a thorough peer review process. The more recent TRVs are utilized.

Table 6. TNT HQ Comparison

TNT TRV (mg/kg/d)	Mourning Dove Tier 1 HQ	Meadowlark Tier 1 HQ	Shrike Tier 1 HQ
USACHPPM: 0.07	80	8	1
Navy: 0.7*	8	0.8	0.1

*Navy HQ values are from Attachment H-7

Navy response to Table 6: TNT was detected in 1% of samples collected from 0 to 6 feet bgs (2 samples in 144). This analyte was evaluated in Tier 2 but was previously eliminated due to insignificant exposure (low detection frequency, and limited distribution; therefore, insignificant risk to the population of the receptor). TNT Tier 2 HQs are shown in Tables 11 through 14.

Table 7. Cadmium and Lead HQ Comparison

TRV* (mg/kg/d)	Mourning Dove HQs Tier 1 / Tier 2	Meadowlark HQs Tier 1 / Tier 2	Shrike HQs Tier 1 / Tier 2
Cd			
BTAG: 0.08	63 / 4	1312 / 56	19 / 0.52
Navy: 1.47	3 / 0.2	71 / 3	1 / 0.03
Pb			
BTAG: 0.014	2700 / 88	8714 / 274	1078 / 29
Navy: 1.63	21 / 0.8	71 / 2	9 / 0.2

*Navy HQ values are from Attachment H-7

Navy response to Table 7: Cadmium and Lead TRVs in BTAG were developed in 1998 (EFAW 1998). TRVs utilized in this risk assessment (as summarized in Table 7) were developed in the EPA Eco SSL document as revised in 2005 using a thorough, peer review process. The more recent TRVs are utilized.

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Table 8. Maximum Soil Concentration / HQ Comparison

COPEC	% Detect.	Max. Soil Conc. (mg/kg)	Sample Location	Plant/Invertebrate HQ	Bird/Mammal Tier 1 HQ
Benzene	2	0.610	01-SS-T29a-S02-D3.0	1	<1
Ethylbenzene	2	14	01-SS-T34-S01-D2.0	12	3
Toluene	14	41	01-SS-T34-S01-D2.0	51	5
Xylenes	2	9.8	01-SS-T34-S01-D2.0	98	1000
Naphthalene	2	128	01-SS-T34-S01-D2.0	6	10
2-Methylnaphthalene	2	270	01-SS-T34-S01-D2.0	14*	10
PHC - Diesel	18	37.000	01-SS-T34-S01-D2.0	Not Evaluated	Not Evaluated

*Naphthalene used as a surrogate

Navy response to Table 8: The HQs presented in this table are from Tier 1. Benzene, Ethylbenzene, Xylenes, Naphthalene, and 2-Methylnaphthalene were all detected in less than 5% of samples collected from 0 to 6 feet bgs). This analyte was evaluated in Tier 2 but was previously eliminated due to insignificant exposure (low detection frequency, and limited distribution; therefore, insignificant risk to the population of the receptor). Xylene Tier 2 HQs are shown in Tables 11 through 14. There are currently no ecological screening criteria for evaluation of petroleum hydrocarbons.

Table 9. Maximum Soil Concentration / HQ Comparison

COPEC	Max. Soil Conc. (mg/kg)	Sample Location	Plant/Invertebrate HQ	Bird/Mammal Tier 1 HQ
Cadmium	156	01-SS-T34-S01-D2.0	5	200
Chromium	171	01-SS-T28-S01-D3.0	428	8
Copper	16,700	01-SS-T33-S01-D3.0	335	1000
Lead	1,580	01-SS-T33-S01-D3.0	14	70

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Table 9. Maximum Soil Concentration / HQ Comparison

COPEC	Max. Soil Conc. (mg/kg)	Sample Location	Plant/Invertebrate HQ	Bird/Mammal Tier 1 HQ
Zinc	29,100	01-SS-T28-S01-D3.0	582	100

Navy response to Table 9: The HQs presented in this table are from Tier 1. Further refinement in Tier 2 (including the use of 95 percent UCL and other refined exposure factors) resulted in significantly lower HQs. Using LOAEL-based TRVs resulted in all metals but copper having HQs less than 1. The UCL for copper is skewed upward by a single high detection. The concentrations and resulting Tier 2 LOAEL HQs do not indicate significant risk to receptors. TNT and RDX Tier 2 HQs are shown in Tables 11 through 14. Additionally, risk to individual vs. risk to population should be considered (Sample et al., 2000). This area is quite small and the entire population should be taken into account, not a few individuals who may encounter the small area of contaminated soil.

Table 10. Maximum Soil Concentration / HQ Comparison

COPEC	% Detect.	Max. Soil Conc. (mg/kg)	Sample Location	Plant/Invertebrate HQ	Bird/Mammal Tier 1 HQ
Perchlorate	7	1.6	01-SS-T34-S02-D6.0	0.4 – 1.6	100
TNT	1	7.86	01-SS-BH01-S01-D5.0	0.3	10
RDX	3	14	01-SS-BH01-S01-D5.0	0.3	10
HMX	1	1.4	01-SS-BH01-S01-D5.0	0.09	2

Navy response to Table 10: The HQs presented in this table are from Tier 1. Further refinement in Tier 2 (including the use of 95 percent UCL and other refined exposure factors) resulted in significantly lower HQs. Using LOAEL-based TRVs resulted in all analytes here having HQs less than 1. Navy reiterates that any analyte detected in less than 5 percent of all samples is not likely to result in significant exposure to ecological receptors and thus is not considered a significant risk to them.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological Profile for 2,4- and 2,6-Dinitrotoluene. U.S. Department of Health and Human Services, Atlanta, Georgia

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Best, E.P.H., Geter, K.N., Tatem, H.E., and Lane, B.K. 2006. Effects, transfer, and fate of RDX from aged soil in plants and worms. Chemosphere 62: 616-625.

Efroymson, R.A., B.E. Sample and M.J. Peterson. 2004. Ecotoxicity data for total petroleum hydrocarbons in soil: Plants and soil-dwelling invertebrates.

Johnson, M.S. and M. J. McAtee. 2000. Wildlife Toxicity Assessment for 2,4,6-Trinitrotoluene. U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Project Number 39-EJ-1138-00. Aberdeen Proving Ground, Maryland. October. **http://chppm-www.apgea.army.mil/erawg/toMA(TNT)-Final(OctOO).pdf**

Landrum, M., J.E. Canas, G. Coimbatore, G.P. Cobb, W.A. Jackson, B. Zhang, T.A.Anderson. Effects of perchlorate on earthworm (Eisenia fetida) survival and reproductive success. Science of the Total Environment 363: 237-244.

Perry, T.D. 1984. Tree Roots: Facts and Fallacies. Arnoldia 49(4).

Sample, B. E., K. A. Rose, G. W. Suter, II, 2000. Estimation of Population-Level Effects on Wildlife Based on Individual-Level Exposures: Influence of Life History Strategies, In:Albers, P. H., G. H. Heinz and H. M. Ohlendorf, 2000, Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities, and Ecosystems. SETAC Special Publication Series, SETAC Press, Pensacola, Florida, USA, 351 p.

Suter, G.W. 1997. A Framework for Assessing Ecological Risks of Petroleum-Derived Materials in Soil. ORNLITM-13408. Oak Ridge National Laboratory. Oak Ridge, Tennessee.

Talmage, S.S., D.M. Opresko, C.J. Maxwell, C. Welsh, F.M. Cretella, P.H. Reno and F.B. Daniel. 1999. Nitroaromatic munition compounds: Environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161 : 1-1 56.

Tsao, A. and Sample. B. 2005. Literature-derived bioaccumulation models for energetic compounds in plants and soil invertebrates. Technical memorandum to Mark Johnson, U.S. Army Center for Health Promotion and Preventive Medicine. June 27, 2005. **https://www.denix.osd.milldenix/Public/Library/Cleanup/CleanupOfc/Documents/Risk/PlantSoilInvert2005.pdf**

U.S. Army, Center for Health Promotion and Preventive Medicine (USACHPPM). 2001 Wildlife Toxicity Assessment for HMX, Project Number 39-EJ-1138-01 E, Aberdeen Proving Ground, Maryland, October 2001.

Document Title:

Draft Final Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Range, Former Marine Corps Air Station El Toro, California

Reviewer: Regina Donohoe, Ph.D., Staff Toxicologist, California Department of Fish and Game, Office of Spill Prevention and Response, Letter dated 1 August 2006

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). 2006. Wildlife Toxicity Assessment for 2,4 and 2,6-Dinitrotoluene, Project Number 39- EJ-1138-01, Aberdeen Proving Ground, Maryland.

U.S. Environmental Protection Agency, (EPA). 1989. Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December.

———. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment. Interim Final. EPA/540/R-97/006. Office of Solid Waste and Emergency Response. June.

———. 2000. Ecological Soil Screening Level Guidance, Draft. US Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

———. 2002. Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization. U.S. Environmental Protection Agency, Office of Research and Development. Washington D.C.

———. 2003 Ecological Soil Screening Level Guidance, Attachment 4-3, Revised. OSWER Directive 9285.7-55, Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC, March

———. 2003 Ecological Soil Screening Level Guidance, Attachment 4-5, Revised. OSWER Directive 9285.7-55, Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC, November.

———. 2005 Ecological Soil Screening Level Guidance,Revised. OSWER Directive 9285.7-55, Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC, February.

U.S. Navy, Engineering Field Activity West (EFAW). 1998. Development of Toxicity Reference Values as Part of a Regional Approach for Conducting Ecological Risk Assessments at Naval Facilities in California. Draft Technical Memorandum. San Bruno, CA.

Table 11: Ornate Shrew Diet Pathways - Tier 2, Step 3a*

Exposure Parameters for: *Sorex ornatus*

Daily Food Ingested (mg/day, dry wt.):	1119
Fraction Soil Ingested:	0.009
Fraction Plant Ingested:	0.05
Fraction Prey Ingested:	0.941
Fraction Invertebrate Prey Ingested:	1
Receptor Weight (kg):	0.00585
Foraging Area (hectares):	0.22
Site Use Factor:	1

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	L-TRV (mg/kg-day)	HQ
Ethylbenzene	1.40E+01	2.41E-02	2.34E+01	1.35E-02	2.34E+01	1.24E+03	2E-02
Xylenes, Total	9.80E+01	1.69E-01	1.72E+02	8.83E+00	1.81E+02	2.32E+01	8E+00
Acetone	8.70E+00	1.50E-02	6.04E+00	2.11E+00	8.16E+00	6.39E+02	1E-02
Bis (2-ethylhexyl) phthalate	4.20E-01	7.23E-04	1.22E+01	3.49E-04	1.22E+01	2.56E+02	5E-02
Naphthalene	1.28E+02	2.20E-01	1.01E+02	1.49E+01	1.17E+02	6.30E+02	2E-01
N-Nitrosodiphenylamine	6.67E+01	1.15E-01	3.27E+01	6.29E+00	3.91E+01	2.56E+02	2E-01
RDX	1.40E+01	2.41E-02	3.02E-01	5.76E-02	3.84E-01	3.49E+01	1E-02
2-Methylnaphthalene	2.70E+02	4.65E-01	1.76E+02	1.72E+00	1.78E+02	6.30E+02	3E-01
2,4-Dinitrotoluene	7.00E+00	1.21E-02	1.21E+00	2.46E+00	3.68E+00	4.99E+01	7E-02
2,4,6-Trinitrotoluene	7.86E+00	1.35E-02	2.55E-01	3.18E-01	5.86E-01	1.10E+02	5E-03
HMX	1.40E+00	2.41E-03	5.04E-03	1.91E+00	1.92E+00	4.30E+01	4E-02
Antimony	1.03E+02	1.77E-01	1.85E+01	2.91E-02	1.87E+01	5.90E-01	3E+01
Silver	5.80E+00	9.98E-03	2.13E+00	7.77E-04	2.15E+00	1.14E+02	2E-02

*** Use LOAEL-based Toxicity Reference Values**

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	L-TRV (mg/kg-day)	HQ
Thallium	1.52E+01	2.62E-02	1.23E+00	3.63E-02	1.29E+00	5.55E+00	2E-01
Hexachlorobenzene	2.20E-01	3.79E-04	5.98E-01	2.31E-04	5.99E-01	2.56E+01	2E-02
1,3-Dinitrobenzene	6.30E-01	1.08E-03	8.39E-02	3.20E-02	1.17E-01	2.56E-01	5E-01

* Use LOAEL-based Toxicity Reference Values

Table12: Deer Mouse Diet Pathways - Tier 2, Step 3a*

Exposure Parameters for: ***Peromyscus maniculatus***

Daily Food Ingested (mg/day, dry wt.):	3322
Fraction Soil Ingested:	0.012
Fraction Plant Ingested:	0.494
Fraction Prey Ingested:	0.494
Fraction Invertebrate Prey Ingested:	1
Receptor Weight (kg):	0.0196
Foraging Area (hectares):	0.1
Site Use Factor:	1

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	L-TRV (mg/kg-day)	HQ
Ethylbenzene	1.40E+01	2.85E-02	1.09E+01	1.18E-01	1.10E+01	1.15E+03	1E-02
Xylenes, Total	9.80E+01	1.99E-01	7.99E+01	7.73E+01	1.57E+02	2.15E+01	7E+00
Acetone	8.70E+00	1.77E-02	2.81E+00	1.84E+01	2.13E+01	5.94E+02	4E-02
Bis (2-ethylhexyl) phthalate	4.20E-01	8.54E-04	5.66E+00	3.05E-03	5.67E+00	2.38E+02	2E-02
Naphthalene	1.28E+02	2.60E-01	4.72E+01	1.31E+02	1.78E+02	5.86E+02	3E-01
N-Nitrosodiphenylamine	6.67E+01	1.36E-01	1.52E+01	5.51E+01	7.04E+01	2.38E+02	3E-01
RDX	1.40E+01	2.85E-02	1.41E-01	5.04E-01	6.73E-01	3.25E+01	2E-02
2-Methylnaphthalene	2.70E+02	5.49E-01	8.18E+01	1.51E+01	9.75E+01	5.86E+02	2E-01
2,4-Dinitrotoluene	7.00E+00	1.42E-02	5.63E-01	2.15E+01	2.21E+01	4.64E+01	5E-01
2,4,6-Trinitrotoluene	7.86E+00	1.60E-02	1.18E-01	2.78E+00	2.92E+00	1.03E+02	3E-02
HMX	1.40E+00	2.85E-03	2.34E-03	1.68E+01	1.68E+01	4.00E+01	4E-01
Antimony	1.03E+02	2.09E-01	8.62E+00	3.19E-01	9.15E+00	5.90E-01	2E+01
Silver	5.80E+00	1.18E-02	9.93E-01	6.80E-03	1.01E+00	1.06E+02	1E-02

*** Use LOAEL-based Toxicity Reference Values**

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	L-TRV (mg/kg-day)	HQ
Thallium	1.52E+01	3.09E-02	5.73E-01	3.18E-01	9.22E-01	5.16E+00	2E-01
Hexachlorobenzene	2.20E-01	4.47E-04	2.78E-01	2.03E-03	2.81E-01	2.38E+01	1E-02
1,3-Dinitrobenzene	6.30E-01	1.28E-03	3.90E-02	2.80E-01	3.20E-01	2.38E-01	1E+00

* Use LOAEL-based Toxicity Reference Values

Table 13: Mourning Dove Diet Pathways - Tier 2, Step 3a-LOAEL*

Exposure Parameters for: ***Zenaida macroura***

Daily Food Ingested (mg/day, dry wt.):	16479
Fraction Soil Ingested:	0.061
Fraction Plant Ingested:	0.939
Fraction Prey Ingested:	0
Fraction Invertebrate Prey Ingested:	1
Receptor Weight (kg):	0.119
Foraging Area (hectares):	5.30E-01
Site Use Factor:	0.574

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	LOAEL-TRV (mg/kg-day)	HQ
Ethylbenzene	1.40E+01	6.78E-02	0.00E+00	1.05E-01	1.73E-01	9.70E+01	2E-03
Xylenes, Total	9.80E+01	4.75E-01	0.00E+00	6.89E+01	6.93E+01	2.06E+00	3E+01
Acetone	8.70E+00	4.22E-02	0.00E+00	1.64E+01	1.65E+01	1.00E+02	2E-01
Bis (2-ethylhexyl) phthalate	4.20E-01	2.03E-03	0.00E+00	2.72E-03	4.75E-03	1.10E+01	4E-04
Naphthalene	1.28E+02	6.20E-01	0.00E+00	1.16E+02	1.17E+02	2.25E+02	5E-01
N-Nitrosodiphenylamine	6.67E+01	3.23E-01	0.00E+00	4.91E+01	4.94E+01	2.00E+02	2E-01
RDX	1.40E+01	6.78E-02	0.00E+00	4.49E-01	5.17E-01	8.14E+01	6E-03
2-Methylnaphthalene	2.70E+02	1.31E+00	0.00E+00	1.34E+01	1.47E+01	2.25E+02	7E-02
2,4-Dinitrotoluene	7.00E+00	3.39E-02	0.00E+00	1.92E+01	1.92E+01	1.30E+00	1E+01
2,4,6-Trinitrotoluene	7.86E+00	3.81E-02	0.00E+00	2.48E+00	2.52E+00	7.00E+00	4E-01
HMX	1.40E+00	6.78E-03	0.00E+00	1.49E+01	1.49E+01	3.00E+01	5E-01
Antimony	1.03E+02	4.99E-01	0.00E+00	2.84E-01	7.83E-01	5.90E-02	1E+01
Silver	5.80E+00	2.81E-02	0.00E+00	6.06E-03	3.42E-02	8.90E+00	4E-03

*** Use LOAEL-based Toxicity Reference Values**

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	LOAEL-TRV (mg/kg-day)	HQ
Thallium	1.52E+01	7.36E-02	0.00E+00	2.83E-01	3.57E-01	2.56E+00	1E-01
Hexachlorobenzene	2.20E-01	1.07E-03	0.00E+00	1.80E-03	2.87E-03	4.32E+00	7E-04
1,3-Dinitrobenzene	6.30E-01	3.05E-03	0.00E+00	2.50E-01	2.53E-01	8.40E-01	3E-01

* Use LOAEL-based Toxicity Reference Values

Table 14: Meadow Lark Diet Pathways - Tier 2, Step 3a-LOAEL*

Exposure Parameters for: ***Sturnella neglecta***

Daily Food Ingested (mg/day, dry wt.):	14038
Fraction Soil Ingested:	0.064
Fraction Plant Ingested:	0.343
Fraction Prey Ingested:	0.593
Fraction Invertebrate Prey Ingested:	1
Receptor Weight (kg):	0.0941
Foraging Area (hectares):	0.42
Site Use Factor:	0.72

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	LOAEL-TRV (mg/kg-day)	HQ
Ethylbenzene	1.40E+01	9.67E-02	8.32E+00	5.24E-02	8.47E+00	9.70E+01	9E-02
Xylenes, Total	9.80E+01	6.77E-01	6.11E+01	3.42E+01	9.60E+01	2.06E+00	5E+01
Acetone	8.70E+00	6.01E-02	2.15E+00	8.15E+00	1.04E+01	1.00E+02	1E-01
Bis (2-ethylhexyl) phthalate	4.20E-01	2.90E-03	4.33E+00	1.35E-03	4.33E+00	1.10E+01	4E-01
Naphthalene	1.28E+02	8.85E-01	3.61E+01	5.78E+01	9.48E+01	2.25E+02	4E-01
N-Nitrosodiphenylamine	6.67E+01	4.61E-01	1.16E+01	2.44E+01	3.64E+01	2.00E+02	2E-01
RDX	1.40E+01	9.67E-02	1.08E-01	2.23E-01	4.27E-01	8.14E+01	5E-03
2-Methylnaphthalene	2.70E+02	1.87E+00	6.26E+01	6.67E+00	7.11E+01	2.25E+02	3E-01
2,4-Dinitrotoluene	7.00E+00	4.84E-02	4.30E-01	9.51E+00	9.99E+00	1.30E+00	8E+00
2,4,6-Trinitrotoluene	7.86E+00	5.43E-02	9.06E-02	1.23E+00	1.38E+00	7.00E+00	2E-01
HMX	1.40E+00	9.67E-03	1.79E-03	7.41E+00	7.43E+00	3.00E+01	2E-01
Antimony	1.03E+02	7.12E-01	6.60E+00	1.41E-01	7.45E+00	5.90E-02	1E+02
Silver	5.80E+00	4.01E-02	7.59E-01	3.01E-03	8.03E-01	8.90E+00	9E-02

*** Use LOAEL-based Toxicity Reference Values**

Chemical	RME Soil Concentration (mg/kg)	Soil Ingested Dose (mg/kg-day)	Invertebrate Ingested Dose (mg/kg-day)	Seed Ingested Dose (mg/kg-day)	Total Ingested Dose (mg/kg-day	LOAEL-TRV (mg/kg-day)	HQ
Thallium	1.52E+01	1.05E-01	4.38E-01	1.41E-01	6.84E-01	2.56E+00	3E-01
Hexachlorobenzene	2.20E-01	1.52E-03	2.13E-01	8.96E-04	2.15E-01	4.32E+00	5E-02
1,3-Dinitrobenzene	6.30E-01	4.35E-03	2.99E-02	1.24E-01	1.58E-01	8.40E-01	2E-01

* Use LOAEL-based Toxicity Reference Values

Document Title:

Draft Final Phase II Remedial Investigation Report, Installation Restoration Program Site 1, Former Explosive Ordnance Disposal Training Range, Former Marine Corps Air Station El Toro, California

Reviewer: John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Letter dated 29 September 2006

Comment No.	Section/ Page No.	Comment	Response
SPECIFIC COMMENTS			
1.	Executive Summary, Summary Results, Northern and Southern Explosive Ordnance Disposal Training Ranges, fourth hyphen/bullet, page viii	It should be noted that petroleum hydrocarbon contamination of the diesel, gasoline, and waste oil range are identified in concentrations that normally require corrective action. Additionally, within the report, groundwater and surface water sample results are reported as having measurable concentrations of petroleum hydrocarbons. Site 1 needs to be added to the petroleum corrective action program for assessment and possible remedy of the petroleum hydrocarbons released at the site.	Hydrocarbon concentrations in soil at Site 1 are limited to a small area in the central part of the site (Trench 34 and Borehole B-1) and are adequately delineated. Groundwater TPH concentrations range from 50 to 100 µg/L for TPH as Motor Oil, 50 to 100 µg/L for TPH as Diesel, and 20 to 40 µg/L for TPH as Gasoline. Surface water TPH concentrations in the stream sample in the southern portion of the site were 40 µg/L for TPH as Motor Oil and 10 µg/L for TPH as Diesel. TPH as Gasoline was not detected in the stream sample above reporting limits. Benzene was detected in Site 1 groundwater at a maximum concentration of 0.4 µg/L (MCL = 1 ug/L). Toluene was detected at a maximum concentration of 0.8 µg/L (MCL is 150 µg/L). Ethylbenzene was detected at a maximum concentration of 3.6 ug/L (MCL is 300 µg/L). Total Xylenes was detected at a maximum concentration of 4.9 µg/L (MCL is 1,750 µg/L). BTEX concentrations were nondetect in all surface water samples. Groundwater data collected to date indicates low levels of petroleum hydrocarbon and BTEX concentrations. These concentrations are at levels that would not trigger active response actions. Current groundwater data (as presented in the Draft Final RI report, Section 4.6.6 and Table 4-47) also suggests that the release to the soil is not continuing to degrade groundwater quality. As a result, the Navy will monitor the petroleum hydrocarbon and BTEX concentration as a

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Comment No.	Section/ Page No.	Comment	Response
			component of on going CERCLA activities. Should this monitoring indicate continued impairment of groundwater quality, then an evaluation of response alternatives will be performed as part of the CERCLA process.
2.	Section 4.5.8, General Chemistry, RI Tier 1 and Tier III-A Groundwater Sampling and Analysis, Page 4-116	Nitrate concentrations of groundwater at the site are identified as between 1.7 milligrams (mg)/liter (L) to 20 mg/L. The Regional Board's Water Quality Control Plan (Basin Plan) water quality objective nitrate for the Irvine Groundwater Management Zone (IGMZ) is 5.9 mg/L. Site 1 is located outside and upgradient of the groundwater basin, and is a tributary to the basin. If a significant area of Site 1 is a source of nitrate and causes an impact to the groundwater basin at or above the water quality objective, the nitrate is considered a contaminant of concern at Site 1. Site 1 should be evaluated as a source of nitrate contamination to the IGMZ.	Nitrate concentrations at Site 1 groundwater (95% UCL=10.21 mg/kg) are consistent with the ambient levels in nearby areas within Irvine Groundwater Management Zone (IGMZ) (Wildermuth Environmental 2000). In addition, a review of Nitrate data collected at well 02UGMW25 located upgradient of Site 2 show a comparable range of Nitrate concentrations as those found at Site 1 and other ambient wells (Groundwater Monitoring Data Summary Report 1999 Monitoring Round 9, 10, & 11 [CDM 2000]). This data indicates that the nitrate concentrations at Site 1 are consistent with ambient levels and the site does not represent a source of nitrate to the IGMZ. In addition, nitrate is routinely monitored as part of two commonly-used remediation technologies for perchlorate, namely Ion Exchange and biodegradation. This is due to the fact that perchlorate treatment efficiency is affected by nitrate concentrations in groundwater. Reference: Wildermuth Environmental. 2000. *Final Technical Memorandum, TIN/TDS Study – Phase 2A of the Santa Ana Watershed.* Prepared for the TIN/TDS Task Force.

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Comment No.	Section/ Page No.	Comment	Response
3.	Section 9, Summary and Conclusions, Section 9.1.1.5, Surface Water Contamination, Number 5, Page 9-4	Identifies seven metals that were detected in surface water, at concentrations exceeding the national recommended Water Quality Criteria or risk-based screening values for aquatic life. Exceedances of surface water quality criteria and screening values were found in the samples taken from surface water runoff downgradient of the identified disposal areas. However, in Sections 9.1.3 Ecological Risk Assessment and 9.2.4 Ecological Risk, the downstream aquatic receptors are not considered. Therefore, we do not concur with your conclusion that the evaluation is complete with regard to protection of aquatic ecological receptors at Site 1. We believe this site is a threat to downstream aquatic receptors, and an evaluation of the magnitude, source, and nature of that threat is appropriate in a remedial investigation.	In the Baseline Ecological Risk Assessment (Tier 2, Step 3a), filtered surface water samples were utilized to characterize risk using dissolved metal concentrations. The results indicated that aluminum and barium exceeded screening values (and had hazard quotients greater than 1) for the Ephemeral Pond surface water samples. For the sample collected at the downgradient portion of the site, copper exceeded its screening value (and had a hazard quotient of 1.29). The text in Section 9.1.1.5 has been revised to clearly indicate that copper exceeded its screening criteria in the surface water sample collected from the downgradient portion of the site. In conclusion, one constituent exceeded its threshold value, and surface water flows from Site 1 are infrequent (based on the past 5 years). This support the Navy's conclusion that risk is insignificant for downgradient aquatic receptors. The Navy does recognize that Total Maximum Daily Loads (TMDLS) for San Diego Creek and its tributaries of are being developed and will be adopted in the near future. The current conditions (an inactive training range) have been demonstrated to not have a significant threat on downgradient aquatic receptors. Upon transfer, the transferee will be responsible for meeting all applicable Federal, state, and local requirements for their continued use of the site.

From: Muza.Richard@epamail.epa.gov [mailto:Muza.Richard@epamail.epa.gov]

Sent: Tuesday, November 14, 2006 13:09
To: Newton, Darren CIV OASN (I&E) BRAC PMO West
Cc: Devries.Sonce@epamail.epa.gov; Hiatt.Gerald@epamail.epa.gov; Arnold, Content P CIV NAVFAC SW; Tamayo, Arturo R CIV NAVFAC SW; QThan@dtsc.ca.gov; jbroderick@waterboards.ca.gov
Subject: IRP Site 1 RTCs & Eco Issues Resolution

Darren

EPA has reviewed the RTCs for the Site 1 Draft Final Phase II RI Report. While we are not in agreement with all of the RTCs, we are looking at proceeding on the path forward as discussed during last Tuesday's conference call. With regards to the question as to whether a remedial action on soils with elevated naphthalene levels might address ecological risk concerns, we have the following observations to offer:

1. The naphthalene detections which exceed EPA Region 9 residential and industrial PRGs (as depicted in Figure 4-2 in the Draft Final Phase II RI Report) are located in the same general area as the elevated metal detections shown in Figures 4-4- and 4-6. The elevated metals are not collocated, aside for one sample location, but excavating for naphthalene could remove some of the elevated metal concentrations. If overexcavation is necessary as a result of confirmation sampling for naphthalene, most of the metals could then be removed by default. EPA can accept this compromise from the November 7th conference call contingent on IRP Site 1 being used for "like use" by the FBI. If the site is closed in the future and the FBI has only used it for a firing range and is responsible for lead issues only, the Navy would still be responsible for any other contamination remaining on site.

2. EPA assessed that a remedial action that addresses the identified anomalies for MEC would also remove some of the elevated metal detections. It is possible that some or all of the elevated metal detections located away from the naphthalene "hot spot" area would be part of MEC removal.

3. A naphthalene cleanup to the EPA residential PRG (1.7 mg/kg) would address the ecological concerns; a naphthalene cleanup to the industrial PRG (4.47 mg/kg) by default would not be as good from an ecological standpoint.

Feel free to contact me with any questions on this response.

Rich

Rich Muza
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State of California

Memorandum

To: Quang Than
Remedial Project Manager
Department of Toxic Substances Control
Office of Military Facilities
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Date: November 15, 2006

From: Regina Donohoe, Ph.D. Julie Yamamoto for
Staff Toxicologist
California Department of Fish and Game
Office of Spill Prevention and Response
20 Lower Ragsdale Dr., Suite 100
Monterey, CA 93940

Subject: **Response to Comments on the Draft Final Phase II Remedial Investigation Report for Installation Restoration Program Site 1 – Explosive Ordnance Disposal Range, Former Marine Corps Air Station, El Toro, California (SITE: 400055)**

Introduction

The Department of Fish and Game-Office of Spill Prevention and Response (DFG-OSPR) received the Department of Navy (DoN) responses to comments (RTCs) on the "Draft Final Phase II Remedial Investigation (RI) Report for Installation Restoration Program (IRP) Site 1 – Explosive Ordnance Disposal Range, Former Marine Corps Air Station (MCAS), El Toro, California (June 2006)" by electronic mail on November 2, 2006.

Background

IRP Site 1 covers approximately 73 acres, and is located in the northeast portion of the former MCAS, El Toro in Orange County, California. The site, located within a tributary canyon of Borrego Canyon Wash, was used as an explosive ordnance disposal (EOD) area from 1952 to 1999. A variety of military ordnance and explosives were detonated in trenches. Habitat at the site consists of grassland, coastal scrub (9.7 acres), chaparral (2.6 acres), and a bermed retention pond that provides seasonal wetland habitat (0.29 acres). A number of special status species have been observed at Site 1, including the Riverside fairy shrimp and the Coastal California Gnatcatcher.

DFG-OSPR provided comments on the Draft Phase II RI in an August 11, 2005 memorandum to Frank Cheng, Department of Toxic Substances Control (DTSC). The Navy provided RTCs in December 2005 and DFG-OSPR commented on these responses in a January 23, 2006 memorandum to Frank Cheng, DTSC. Appendix I of the subject report contains the Navy's final RTC on the Draft RI report. DFG-OSPR reviewed Appendix I, and associated text in Appendix H and Section 7.0 of the Draft Final RI, to determine if our previous concerns had been addressed. Comments on the Draft Final RI and alternate hazard quotients (HQs) were provided to DTSC in an August 1, 2006 memorandum to Sue Hakim. A preliminary discussion of the November

2, 2006 DoN's RTCs to the August 1, 2006 memorandum was conducted at a November 7, 2006 teleconference between the agencies and DoN. During that meeting, it was suggested that removal of naphthalene contaminated soil to address potential human health risks might also address potential ecological risks associated with soil hot spots contaminated by other petroleum constituents, metals and explosive compounds. DFG-OSPR comments on the November 2, 2006 RTCs and November 7, 2006 discussion of remedial alternatives for the soil hot-spots are provided below.

Comments

1. *Elimination of Contaminants of Potential Ecological Concern (COPECs).* For Comments 4, 5, 6, and 9, the RTC states that 5% is used in risk assessment guidance (RAGs Part A; U.S. EPA, 1989) as an example of a low frequency detection that can be used to eliminate a chemical from the chemical of concern (CoC) list. This is not an accurate interpretation or application of the guidance. RAGs Part A, primarily used for human health risk assessment, discusses elimination of CoCs that may be artifacts and specifically states that chemicals expected to be present at the site should not be eliminated. At Site 1, compounds eliminated by the 5% detection criterion included explosive and petroleum-related compounds. These are all known to be site-related and should not have been eliminated from the Tier II ecological risk assessment. The risks associated with these hot-spots should have been evaluated.
2. *Endpoints for Toxicity Reference Values (TRVs).* For Comments 3 and 4, the RTC states that only reduced growth, impaired reproduction or increased mortality should be considered as endpoints when developing TRVs. This is contrary to recent guidance by U.S. EPA (2005) where biochemical, behavioral, physiological and pathological endpoints are also considered to evaluate whether the selected endpoint addresses the mechanism of toxicity of the chemical. DFG-OSPR continues to disagree with the selection of several of the explosive compound TRVs. The values recommended by DFG-OSPR were based on peer-reviewed documents developed by the U.S. Army for the Center of Health Promotion and Preventive Medicine and should have been selected over the non-peer reviewed TRVs developed by the DoN consultants. To address this concern, alternative risk calculations were provided by DFG-OSPR in the August 1, 2006 memorandum.
3. *Risks Associated with Hot Spots.* Contrary to the RTC for Comment 11, the Tier II ecological risk assessment did not quantitatively demonstrate that the hot spot area, estimated to cover approximately 2.2 acres, presented de minimus risk to ecological receptors. A quantitative analysis would have calculated hazard quotients for exposure to all COPECs (see Comment 1) within the hot spot for receptors with a home range less than or equal to the hot spot area, including plants and soil invertebrates. As currently written, the RI report relies on qualitative statements to conclude that no further evaluation is necessary at Site 1. Many of these statements are not supported by data. For example, the RTC states that the risks to individuals would not constitute a population-level risk, but

no data are provided to support this statement. The RTC states that plant roots would not penetrate below two feet, where much of the contamination is found, but does not consider that deeper rooted shrubs may become established in the area. The RTC assumes that metals are not bioavailable and that petroleum compounds are not toxic to plants and soil invertebrates but no site-specific bioavailability tests or bioassays have been completed. DFG-OSPR continues to assert that ecological risks associated with the hot spot in the disposal trench area have not been adequately evaluated in the RI. It is recommended that the conclusions for the ecological risk assessment be modified (Section 7.4.3) to acknowledge that there are potential risks to individuals in the hot spot area associated with the former detonation trenches.

4. *Remediation of Naphthalene in Soil.* In reviewing Figures 4-2 (Section 4) and 3-1 (Appendix H) of the RI report, it appears that the majority of the petroleum and explosive compound soil contamination in the disposal trench area is co-located with the naphthalene contamination. Therefore, removal of naphthalene contaminated soil to address human health concerns will also serve to reduce ecological risks associated with this hot spot area. There are areas of elevated metal contamination that are not co-located with naphthalene that are more widely spread across the site. These elevated concentrations may be associated with metal fragments from munitions debris. Additional investigation and removal of anomalies for munitions of explosive concern (MEC) may serve to further reduce potential metal risks to ecological receptors at the site. DFG-OSPR supports the recommendations to evaluate removal of the naphthalene contaminated soil and MEC in the feasibility study.

Conclusion

The DoN RTCs were largely unresponsive. DFG-OSPR continues to disagree on the selection of several TRVs, elimination of COPECs, and the significance of potential ecological risks associated with the hot spot area. We request that these comments be included in Appendix I to record DFG-OSPR's remaining concerns with the RI. However, due to co-location of soil contamination, removal of naphthalene contaminated soil to address human health concerns will also serve to reduce ecological risks associated with the hot spot area. DFG-OSPR supports evaluation of this remedial alternative, along with removal of MEC items, in the feasibility study. We look forward to reviewing the upcoming draft feasibility study. If you have any questions or require further details, please contact Regina Donohoe by phone (831-649-7150) or email (rdonohoe@ospr.dfg.ca.gov).

Reviewed by: Victoria Lake, Staff Environmental Scientist

References:

U.S. EPA. 1989. Risk Assessment Guidance for Superfund. Volume I, Human Health Evaluation Manual (Part A). Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002.

U.S. EPA. 2005. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs). Office of Solid Waste and Emergency Response.

cc: Sonce de Vries
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