Record of Decision
Ford Island Hazardous Substance and 32 Transformer Sites

FORD ISLAND, PEARL HARBOR NAVAL COMPLEX, OAHU, HAWAII

August 2009

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
Pearl Harbor, HI 96860-3139

NAVFAC
Naval Facilities Engineering Command
NAVFAC HAWAII

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-03-D-1837, CTO HC04

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ACRONYMS AND ABBREVIATIONS

4,4′-DDE	4,4′-dichlorodiphenyldichloroethene
AAS	Army Air Station
ARAR	applicable or relevant and appropriate requirements
AST	aboveground storage tank
AVGAS	aviation gasoline
bgs	below ground surface
Bldg.	Building
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
DOH	Department of Health, State of Hawaii
DRO	diesel range organics
EAL	environmental action level
EE/CA	engineering evaluation/cost analysis
EPA	Environmental Protection Agency, United States
EPC	exposure point concentration
FFA	Federal Facilities Agreement
GRO	gasoline range organics
HI	hazard index
HSS	Hazardous Substance Site
HSSA	Hazardous Substance Storage Area
IAS	initial assessment study
LRO	lube oil range organics
mg/kg	milligram per kilogram
MHHW	mean higher-high water
msl	mean sea level
NAS	Naval Air Station
NAVFAC Hawaii	Naval Facilities Engineering Command, Hawaii
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
No.	number
NPL	National Priority List
NTCRA	non-time-critical removal action
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDF	portable document format
PHNC	Pearl Harbor Naval Complex
PHNHL	Pearl Harbor National Historic Landmark
PP	proposed plan
PRG	preliminary remediation goal
PRE	preliminary risk evaluation
PRL	potential release location
PWC	Public Works Center, Navy
RAB	restoration advisory board
RCRA	Resource Conservation and Recovery Act

RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
RVR	remediation verification report
SARA	Superfund Amendments and Reauthorization Act
SRA	ecological screening risk assessment
SSR	site summary report
SVOC	semivolatile organic chemical
TAL	Target Analyte List
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
U.S.	United States
UST	underground storage tank
VOC	volatile organic chemical

1. Declaration

1.1 Site Name and Location

This record of decision (ROD) has been prepared by the United States (U.S.) Navy (Navy) for five hazardous substance sites (HSSs) and 32 transformer sites located on Ford Island. Ford Island is located within the Pearl Harbor Naval Complex (PHNC), Oahu, Hawaii (Figure 1). The five HSSs include Building (Bldg.) 39, Bldg. 43, Bldg. 217, the Camel Refurbishing Area, and the Hazardous Substance Storage Area (HSSA). The 32 transformer sites include the following:

- PM-212D
- S252D
- TB-01
- TC-02
- TC-03
- TC-05
- TC-06
- TC-08D
- TD-04
- TD-06
- TD-08
- TD-09
- TE-01
- TE-02
- TF-02
- TF-03
- TF-11
- TF-12
- TF-13
- TF-14
- TF-15
- TF-16
- TF-19
- TG-02D
- TG-05
- TG-11
- TG-12
- TI-01
- TI-02
- TI-05D
- TK-01D
- TL-02

The locations of the five HSSs and 32 transformer sites are shown on Figure 2.

The PHNC was added to the National Priority List (NPL) on 14 October 1992. The NPL identifies priorities among known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. PHNC is identified on the NPL as U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System Number (No.) HI4170090076.

This ROD has been prepared for the Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii) under the Comprehensive Long-Term Environmental Action Navy III program, Contract No. N62742-03-D-1837, Contract Task Order No. HC04.

1.2 Statement of Basis and Purpose

This ROD documents, for the Administrative Record, the decision by the U.S. Department of the Navy and the EPA, with concurrence from the State of Hawaii Department of Health (DOH) to select the final remedy of No Further Action (NFA) for these five Ford Island HSSs and 32 transformer sites.

The final remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and to the extent practicable the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and the Office of the President of the U.S. Executive Order 12580. Information supporting the decisions leading to the selected remedy is contained in the Administrative Record file for the site.

This ROD incorporates elements of a streamlined Remedial Action Completion Report (RACR), as described in the *Department of Defense (DoD)/EPA Joint Guidance on Streamlined Closeout and NPL Deletion Process* (DoD 2006). The purpose of a streamlined RACR is to document the achievement of the removal action objectives at a site. A cross reference table that identifies the elements of a RACR and corresponding sections in this ROD where the information can be found is presented in Attachment A.

1.3 ASSESSMENT OF THE SITE

The Navy and EPA, with concurrence from DOH, have determined that Bldg. 39, Bldg. 43, Bldg. 217, the Camel Refurbishing Area, the HSSA, and the 32 transformer sites require NFA to be protective of human health and the environment.

1.4 STATUTORY DETERMINATIONS

The Navy is the lead agency for environmental cleanup at Navy sites. The EPA and DOH provide oversight during environmental investigations and cleanup activities at Navy sites. As a result of successful removal actions, the Navy and EPA, with concurrence from the DOH, have determined that no further remedial action is required at the five HSSs and 32 transformer sites. CERCLA five-year reviews will not be required because there are no hazardous substances, pollutants, or contaminants remaining at the sites above levels that allow for unlimited use and unrestricted exposure.

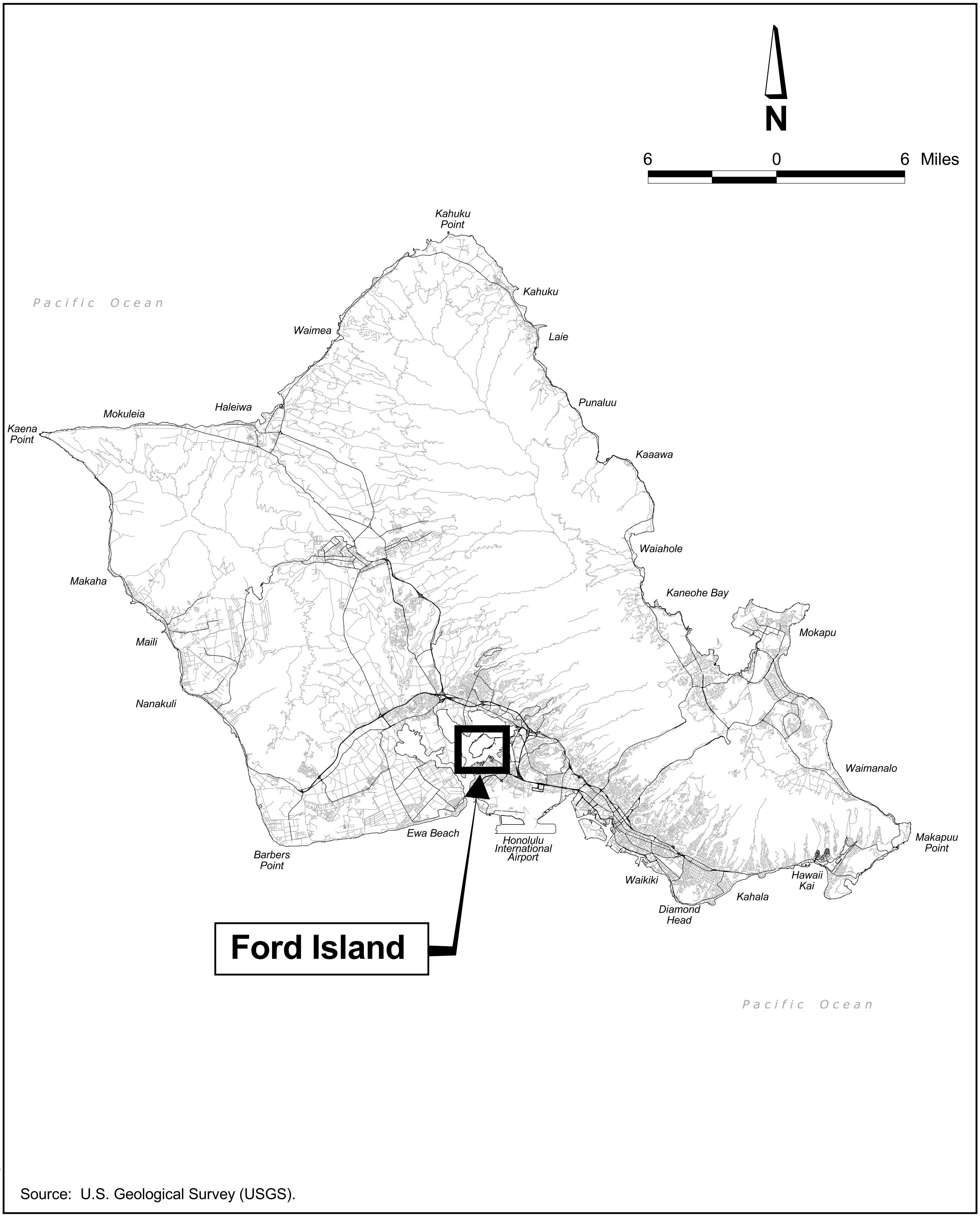
The NCP (40 Code of Federal Regulations [CFR] Section 300.430[a][1][iii][A]) establishes the expectation that treatment will be used to address the principal threats at a site where practicable. The selected remedy for these sites does not satisfy the statutory preference for treatment as a principal element of the final remedy because no additional removal or treatment is required. Because this final remedy will not result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be not be required for this final remedy.

1.5 DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD (Section 2). Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern (COCs) and their respective concentrations (Sections 2.2.2, 2.3.2, 2.4.2, 2.5.2, 2.6.2, and 2.7.2)
- Summary of ecological and human health risks (Sections 2.2.5, 2.3.5, 2.4.5, 2.5.5, 2.6.5, and 2.7.5 and Attachment B)
- Current and reasonably anticipated future land and groundwater use assumptions (Sections 2.2.4, 2.3.4, 2.4.4, 2.5.4, 2.6.4, and 2.7.4)

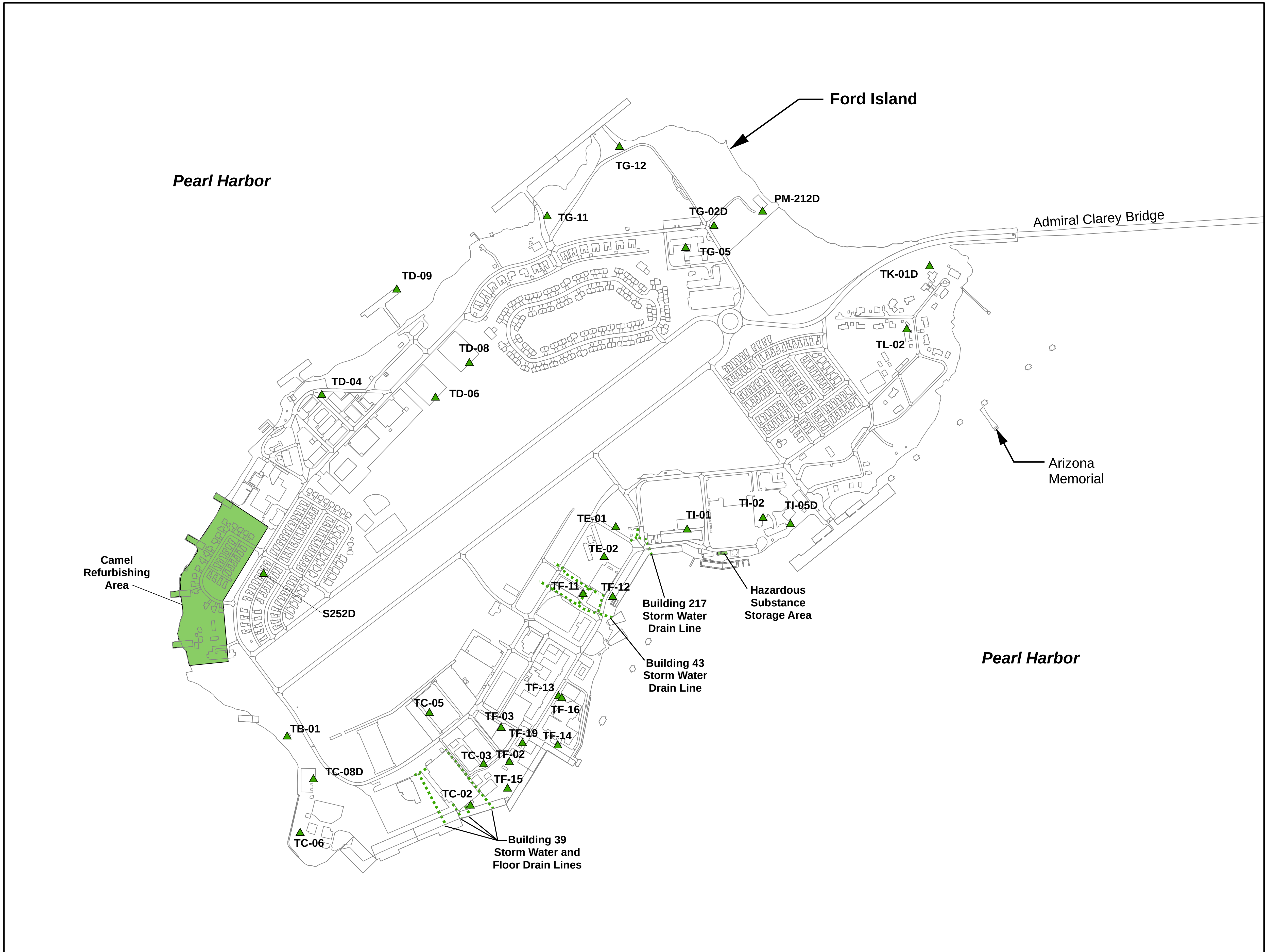
If contamination posing unacceptable risks to human health or the environment is discovered after execution of this ROD, the Navy will undertake all necessary actions to ensure continued protection of human health and the environment.



Source: U.S. Geological Survey (USGS).

FILE REFERENCE: q:\clean iii\gis\hc04\av_project\bldg284_80_302_rod_fig1.apr
LAYOUT: L001_61TCRA_no2_Figure 1
DATE: Apr 29, 2008 4:00 PM

Figure 1
Ford Island Location Map
Record of Decision
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii



LEGEND

(green area)	Hazardous Substance Sites
TL-02	Transformer Location
(dashed line)	Storm Water Drain Line

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

ABBREVIATIONS

PRL	Potential Release Location
RI	Remedial Investigation

Figure 2
PRLs Recommended for No Further Action
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

Map Document: (Q:\CLEAN III\GIS\HC04\MXD\Fig2.mxd)
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1.6 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF FINAL REMEDY

The Navy and EPA, with concurrence from the DOH, jointly select No Further Action as the final remedy for Bldg. 39, Bldg. 43, Bldg. 217, the Camel Refurbishing Area, the HSSA, and 32 transformer sites. This remedy is protective of human health and the environment.

08/20/09
Date

Aaron Y. Poentis
Regional Environmental Program Manager
By direction of: Commander, Navy Region Hawaii

9/29/09
Date

Michael Montgomery
Assistant Director, Federal Facility and Site Cleanup Branch
Superfund Division, U.S. EPA Region 9

The State of Hawaii DOH concurs with the selected remedy as documented in this Record of Decision.

9-30-09
Date

Keith Kawaoka, D. Env.
Program Manager
Hazard Evaluation and Emergency Response Office
State of Hawaii, Department of Health

2. Decision Summary

This section contains decision summary information common to the five Ford Island HSSs and the 32 transformer sites. Site-specific information is included in Section 2.2 for Bldg. 39, Section 2.3 for Bldg. 43, Section 2.4 for Bldg. 217, Section 2.5 for the Camel Refurbishing Area, Section 2.6 for the Hazardous Substance Storage Area, and Section 2.7 for the 32 transformer sites.

Each site of these sites was evaluated for both cancer and non-cancer health risks. Risks were evaluated using both the maximum detected concentration and an average concentration. The latter, termed the reasonable maximum exposure (RME) concentration, is an average concentration that a receptor could reasonably be exposed to at the site. Specifically, the RME concentration is the lesser value between an estimated upper confidence limit of the mean concentration and the maximum detection. For each concentration (maximum detection and RME concentration), chemical-specific cancer and non-cancer risks were determined. The cumulative maximum and RME risks are the summation of chemical-specific cancer or non-cancer risks.

2.1 FORD ISLAND

2.1.1 Site Name, Location, and Description

Ford Island is located in the central portion of Pearl Harbor, on the PHNC, on the southern coast of Oahu (Figure 1). The island encompasses approximately 450 acres and is approximately 1.25 miles long and 0.62 miles wide. Access to the island was expanded in 1998 with construction of the Admiral Bernard Clarey (Ford Island) Bridge, which spans the channel between the island and the eastern shore of Pearl Harbor.

2.1.2 Site History and Enforcement Activities

2.1.2.1 SITE HISTORY

Military development of Pearl Harbor and Ford Island began around 1912, and the Naval Air Station (NAS) Ford Island and Army Air Station (AAS) Luke Field were established on the island by 1917. Hangar and support facilities on the southwest side of the island were developed for the AAS, while similar structures on the southeast side of the island were constructed for the NAS. In addition, a row of 22 housing structures located along the northwest shore of the island, as well as several housing structures and a bachelor's quarters on the northeast tip of the island, were constructed to accommodate the expanding number of Navy personnel on-island. An unpaved runway was also constructed for the Army and Navy shared use. Nine 225,000-gallon aboveground storage tanks (ASTs), with secondary containment, were located in the east-central portion of the island from 1924 to 1954.

Ford Island underwent further development and expansion in the 1930s and 1940s. Efforts to expand the island by filling shallow zones along the east and north shores with dredged material from the harbor channel, increased the size of Ford Island by nearly 20 percent. The central portion of the island was cleared and paved for installation of a 4,000-foot runway, and all but two of the original AAS hangars were demolished in favor of open aircraft parking areas, maintenance facilities, and larger hangars. An area near the western shoreline, which later developed into the Ford Island Landfill, was used as a disposal and burn area. During this time, an underground storage tank (UST) farm was installed in the east-central portion of the island with an extensive underground aviation gasoline (AVGAS) pipeline system to distribute fuel. Bunkers for ordnance storage were built on the north and east sides of the island, the fill area near the north shore, the northeast shore, and the east end of the runway.

Following World War II, the use of Ford Island as a military air station ceased with the advent of jet aircraft. Naval Station assumed ownership of the island when the NAS was deactivated in 1962, and the island was given status as a National Historic Landmark in 1964. The airfield was leased to the State of Hawaii Department of Transportation for limited use by civilian aircraft, however since the state opened Kalaeloa Airport (formerly NAS Barbers Point) in mid-1999, the airfield has remained inactive. Access to the island was improved by construction of the Admiral Bernard Clarey (Ford Island) Bridge in 1998. Ford Island currently hosts several major tenants or commands and provides housing and recreational facilities for Navy personnel. PHNC controls the waters of Pearl Harbor and the adjacent land areas, including Ford Island.

2.1.2.2 Previous Investigations

The five HSSs and 32 transformer sites addressed in this ROD were the subject of the following environmental investigations:

Initial Assessment Study. In 1983, the Naval Energy and Environmental Support Activity conducted an initial assessment study (IAS) at Pearl Harbor Naval Base. The IAS report (NEESA 1983) identified potentially contaminated sites at Pearl Harbor Naval Base and recommended further investigation to determine the nature and extent of contamination and develop recommendations for further action.

Site Summary Report. A site evaluation of Ford Island was performed in 1998 to identify and classify sites with suspected environmental contamination. Results of the site evaluation were presented in the *Site Summary Report (SSR), Ford Island Geographic Study Area* (Earth Tech 2000c). Investigators systematically evaluated the entire island to identify sites where historical activities may have resulted in the release of hazardous substances or petroleum products. Information was obtained through record searches, interviews with current and former employees, and visual site inspections.

Based on analysis of the available data, eight HSSs, 55 transformer sites, and four inactive AVGAS pipeline sites were classified as areas that had not been evaluated or required additional evaluation because hazardous substances or petroleum were known to have been stored or used there and may have been released to soil, sediment, surface water, and groundwater.

Remedial Investigation. From 1999 to 2003, a remedial investigation (RI) was conducted to characterize the nature and extent of contamination at the eight HSSs, 55 transformer sites, and four inactive AVGAS pipeline sites and recommend further action, as necessary, to protect human health and the environment. The eight HSSs included two sites, former Bldg. 80 and former Bldg. 302, which were combined and investigated as one site (the Former Bldgs. 80 and 302 Site) based on their close proximity and similar historical hazardous substance historical use. Soil, sediment, and groundwater samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides, and metals (Earth Tech 2003c). The data collected during the RI were used to conduct risk assessments to evaluate potential risks to human and ecological receptors. Results of the RI are presented in the RI report (Earth Tech 2003c).

Removal actions were recommended for the four inactive AVGAS pipeline sites, 23 of the 55 transformer sites, and five (Bldg. 39, Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA) of the eight HSSs. No further action was recommended for the other 32 transformer sites and three (Bldg. 217 and Former Bldgs. 80 and 302) of the eight HSSs.

Of the sites recommended for further action, two sites were recommended for surface soil removal actions (Camel Refurbishing Area and HSSA), one site (Bldg. 284) was recommended for surface and subsurface soil removal and closure of two oil-water separators, and two sites were recommended for sediment removal actions (Bldg. 39 and Bldg. 43) from storm drain lines and associated structures. No further action was recommended with respect to groundwater.

Removal Actions. *AVGAS Pipeline and Transformer Removal Actions.* Removal actions for the four inactive AVGAS pipeline sites are documented in the. *Remediation Verification Report, Non-Time Critical Removal Action, Ford Island Inactive AVGAS Pipeline, Pearl Harbor Naval Complex, Hawaii* (Shaw 2004). The non-time-critical removal action (NTCRA) field activities were conducted between 2002 and 2004. Of the 55 transformer sites, 23 required NTCRAs that were conducted between 2003 and 2004 and are documented in the *Remediation Verification Report, Thermal Desorption Treatment of PCB Contaminated Soil, Various Navy Transformer Sites, Oahu, Hawaii* (ECC 2007).

Hazardous Substance Sites Removal Action. An engineering evaluation/cost analysis[1] (EE/CA) was prepared as part of a NTCRA for HSSs on Ford Island to mitigate potential threats to human health and the environment (Earth Tech 2003a). The EE/CA evaluated and recommended removal action alternatives for Bldg. 39, Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA.

A removal action Final Site Work Plan for the NTCRA at the Ford Island HSSs was completed in 2003 (Shaw 2003). The removal action Final Site Work Plan was based on the methods and objectives recommended in the EE/CA (Earth Tech 2003a) and documented in the Action Memorandum (DON May 2003a) and Action Memorandum Addendum No.1 (DON September 2003b). NTCRAs were conducted at Ford Island HSSs from June 2003 to June 2004. The final remediation verification report (RVR) documents the removal action activities at Bldg. 39, Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA. No further action was recommended in the RVR for Bldg. 39, Bldg. 43, the Camel Refurbishing Area (excluding sediments along the shoreline), and the HSSA following the removal action. However, the results of confirmation sampling at Bldg. 284 indicated that metals contamination extended beyond the limits of the excavation immediately adjacent to Bldg. 284. Therefore, additional delineation sampling was conducted along the unpaved shoreline. Additional delineation sampling was also conducted at the Former Bldgs. 80 and 302 Site in conjunction with removal action activities since the RI indicated that metals concentrations above background levels remained in subsurface soil and the Navy had plans to redevelop the site. Based on the results of additional delineation sampling, further action was recommended for the Bldg. 284 Site and the Former Bldgs. 80 and 302 Sites.

Proposed Plan. In 2008, a proposed plan (PP) was prepared to present the recommended final site remedy for the five Ford Island HSSs and 32 transformer sites requiring NFA and to facilitate public involvement in the remedy selection process. The *Proposed Plan* (DON 2008b) identified NFA as the recommended alternative and requested public comment.

The remaining three HSSs that require further action are addressed in a separate PP (DON 2008a) and in the *Record of Decision, Building 284 and Former Buildings 80 and 302 Sites* (DON 2009).

[1] Text in blue font identifies where detailed site information is available via hyperlink while viewing this ROD in portable document format (PDF). The detailed information is viewable by clicking on the blue text within the PDF. In the event of any inconsistency between the text in this ROD and the text in any of the included hyperlinks, the text in this ROD will take precedence.

2.1.2.3 ENFORCEMENT ACTIVITIES

There have been no enforcement activities at Bldg. 39, Bldg. 43, Bldg. 217, the Camel Refurbishing Area, the HSSA or the 32 transformer sites.

2.1.2.4 COMMUNITY PARTICIPATION

Public participation in the decision process for environmental activities at Ford Island has continually been encouraged throughout the environmental restoration and site closure processes. In an effort to involve the public in the decision-making process, a Restoration Advisory Board (RAB) was established. The RAB is composed of the DOH, the EPA, the Navy, and community representatives. The Navy has held RAB meetings (typically on a semi-annual basis) and other public meetings, as well as issued fact sheets that summarize the site investigation and cleanup activities. The RAB team has provided review and comment leading to the selection of the final remedy in this ROD. Additionally, the Navy also established a point-of-contact for the public in the NAVFAC Hawaii.

The PP formally presented the recommendation for each site to the public and solicited public comment. A public meeting for the PP was held on 5 March 2008 at the Aiea Public Library. The public comment period for the PP was held between 25 February 2008 and 25 March 2008.

Throughout the investigation process, the Navy has prepared several fact sheets to inform and update the community on the progress of Ford Island environmental investigation and cleanup activities. Project documents, including work plans, technical reports, and other materials relating to the Ford Island investigation activities, can be found in the information repositories at the following addresses:

Aiea Public Library
91-143 Moanalua Road
Aiea, Hawaii 96701
(808) 483-7333

Pearl City Library
1138 Waimano Home Road
Pearl City, Hawaii 96782
(808) 453-6566

Hamilton Library at the University of Hawaii at Manoa
Hawaiian and Pacific Collection
2550 McCarthy Mall
Honolulu, Hawaii 96822
(808) 956-8264

Additional project information is located in the Administrative Record file located at Naval Facilities Engineering Command, Pacific in Pearl Harbor. The address for the Administrative Record file is provided below:

Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Attn: NAVFAC PAC EV4
Pearl Harbor, Hawaii 96860-3134

2.1.3 Scope and Role of the No Further Action Decision

The five HSSs and 32 transformer sites addressed in this ROD are located on Ford Island, which is within the PHNC. The PHNC is listed on the NPL, which identifies priorities among known or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The Navy and EPA, through a Federal Facilities Agreement (FFA) (EPA, State of Hawaii, and DON 1994), and with concurrence from the DOH, have agreed to:

- Ensure that environmental impacts associated with past and present activities are thoroughly investigated and that appropriate remedial actions are taken, as necessary, to protect human health and the environment;
- Establish a procedural framework and schedule for developing, implementing, and monitoring appropriate remedial actions in accordance with CERCLA, SARA, NCP, Superfund guidance and policy, Resource Conservation and Recovery Act (RCRA) guidance and policy, and applicable State of Hawaii law;
- Facilitate cooperation, exchange of information, and participation of the Navy, EPA, and DOH; and
- Ensure adequate assessment of potential injury to natural resources necessary to ensure the implementation of remedial actions appropriate for achieving suitable cleanup levels.

Based on cleanup activities previously conducted, the NFA decision for Bldgs. 39, 43 and 217, the Camel Refurbishing Area, HSSA and the 32 transformer sites is designed to fulfill the objectives of the FFA for PHNC. The DOH, EPA Region 9, and the Navy concluded that the CERCLA removal actions have successfully lowered risk to human health and the environment to levels that allow unrestricted use of these sites and no further action is required, based on sampling results presented in the *Final Remedial Investigation Report* (Earth Tech 2003c), results of removal actions presented in the *Final Remediation Verification Report* (RVR) (Shaw 2005), and the *Proposed Plan* (Earth Tech 2008b).

2.1.4 Ford Island Site Characteristics

2.1.4.1 Topography

With the exception of the northeast corner of the island, the land surface of Ford Island is generally less than 20 feet above mean sea level (msl). In the northeast corner of the island, the land surface rises to over 27 feet above msl. The highest elevations occur along a line running from the northeast to southwest corners of the island.

2.1.4.2 Wildlife and Sensitive Ecosystems

Details regarding biological resources on Ford Island are discussed in the RI report (Earth Tech 2003c). Buildings and vegetation on Ford Island may be used as refuge by common urban species, such as the house mouse, mongoose, Norway and black rats, house sparrow, Java sparrow, and common mynah. The paved and industrial areas of Ford Island have little habitat value.

The birds that frequent the nearby wildlife refuges are the most important form of wildlife at PHNC. Four federally listed endemic and endangered wading birds and waterfowl are associated with these refuges: the Hawaiian stilt, Hawaiian gallinule, Hawaiian coot, and Hawaiian duck.

The endemic short-eared owl, state-listed as endangered on Oahu, has been observed hunting in the area. In addition, 28 other bird species, including indigenous, migratory, and exotics, are found on the Pearl Harbor refuges and surrounding areas.

Common fish at the refuges include the mullet (*Mugil* sp.) and the awa (*Chanos chanos*) (Nakai 1997). The quiet waters in the upper regions of all the Pearl Harbor lochs surrounding Ford Island provide excellent habitat for the Hawaiian anchovy (*nehu*) (*Encrasicholina purpurea*), a species used as a baitfish in the offshore tuna (*aku*) fishery. This species is the most important baitfish resource in Hawaii, and Pearl Harbor represents an important spawning ground and harvesting area (Smith 1993; Somerton 1989). The green sea turtle (*honu*) (*Chelonia mydas*) is a threatened indigenous reptile that is occasionally observed within Pearl Harbor.

2.1.4.3 CULTURAL RESOURCES

A summary of the information regarding archaeological resources and the historic buildings and structures on Ford Island is provided below.

Prehistoric and Historic Archaeological Resources. Very little specific information is available regarding how Ford Island was used in the pre-contact and early post-contact periods. Given the island's lack of water, there may have been little pre-contact habitation, except short-term occupation for fishing, collecting pili grass, and possibly seasonal cultivation of dryland crops such as gourd and sweet potato.

There are no known archaeological sites on Ford Island. A review of site potential (Earth Tech 2003c) suggests that sugarcane cultivation and military construction destroyed any sites that may have existed, except for what might be buried in limestone sinkholes or caves. Despite the extensive construction that has occurred on Ford Island, no human remains or subsurface archaeological sites have been reported on the island.

Historic Buildings and Structures. Ford Island is located within the boundaries of the Pearl Harbor National Historic Landmark (PHNHL). The island currently has 154 historic buildings and structures that are deemed contributing properties to the PHNHL. Historic resources on Ford Island represent military development of the Navy and Army in Hawaii spanning two world wars.

2.1.4.4 GEOLOGY

The geological materials that compose Ford Island include fill material, volcanic material, lagoonal deposits, and coralline deposits. The fill material, consisting of mixtures of gravels, sands, silts, and clays, appear to be thickest where the shoreline has been reclaimed and thinnest where tuff deposits are near the surface (Munro 1981). The fill material consists primarily of on-island materials, and the nature of fill deposits varies according to its source, placement method, and its compaction. Surface sediments are generally classified as fill material based on composition, consistency, and placement. Changes in the composition, consistency, or placement of the fill material delineate the boundary between fill and in-situ material.

The volcanic material includes tuff (cemented aeolian ash), weathered tuff, and basalt. Weathered tuff primarily includes decomposed tuffaceous rock consisting of stiff to very stiff, silt-sized particles, which were weathered in place or reworked, transported, and redeposited (Munro 1981). Additionally, the weathered tuff includes unoxidized gray clay layers that are thought, in part, to be of submarine deposition (Wentworth 1951). The weathered tuff is sometimes mixed with coral sand. Basalt underlies the PHNC below msl and beneath hundreds of feet of sediment, according to well records (Stearns and Vaksvik 1938).

The lagoonal deposits include consolidated and unconsolidated deposits of soft or loose silt to clay-sized particles that were formed in low energy environments including lagoons, swamps, estuaries, and drowned streams and channels. These deposits are often mixed with loose materials including sand and coral debris. Unconsolidated lagoonal deposits are highly compressible, having an average soil penetration number of less than four blows per foot, whereas consolidated materials are slightly stiffer (Munro 1981).

Surface soil types on Ford Island are generally classified as silty sands or sandy silts with varying amounts of gravel, owing to the high degree of development and the associated usage of fill material throughout the island. Ford Island itself is classified as coral outcrop (USDA SCS 1972), which consists of coral or cemented calcareous sand. However, many of the characteristics of the surface soil indicate that silt, sand, and graded coral gravel make up much of the fill material. The surface and near surface soils at the HSSs are predominately varying mixtures of inorganic, low plasticity clays and silts with varying amounts of sand and gravel-sized materials. The sand and gravel are poorly graded and sub-angular. A significant portion of Ford Island is covered by concrete and asphalt, which overlie the fill material.

2.1.4.5 HYDROGEOLOGY

Ford Island is located in the Honolulu–Pearl Harbor basal groundwater aquifer area. The shallow groundwater in the surficial caprock aquifer beneath Ford Island is encountered at approximately sea level. Shallow groundwater on Ford Island is not used for potable purposes and is not hydraulically connected to the basal aquifer of Oahu, which is approximately 460 feet below ground surface (bgs). A direct correlation exists between changes in shallow groundwater elevation underlying Ford Island and tidal fluctuations. The source of shallow Ford Island groundwater is believed to originate from infiltration of precipitation combined with intrusion of seawater. As a result, the shallow groundwater is generally brackish.

Depth to groundwater at Ford Island ranges from approximately 3 feet bgs in wells located along the shoreline to 19 feet bgs in wells located inland. The surficial cap rock aquifer occurs from the water table to the first underlying aquitard. Its lower limits were not encountered during the RI; however, it is estimated that it is approximately 16 feet thick (Ogden 1995). The aquifer is generally encountered within the weathered volcanic material, coralline debris, and lagoonal deposits.

Groundwater at Ford Island (including the site) is not currently used for drinking water purposes nor is it considered a potential source of drinking water. The shallow caprock groundwater at Ford Island is classified by the DOH as "ecologically important" since it discharges to Pearl Harbor (Mink and Lau 1990). Groundwater classification at Ford Island is discussed in detail in the RI report (Earth Tech 2003c).

2.2 BUILDING 39 SITE

2.2.1 Site Name, Location, and Description

The Bldg. 39 location is on the southern shoreline of Ford Island (Figure 2 and Attachment C, [Figure C-2]). The Pearl Harbor shoreline is about 80 feet from the nearest corner of Bldg. 39. The area around the Bldg. 39 site is covered with concrete to the south and west, and asphalt to the north and east. The ground surface slopes toward Pearl Harbor resulting in surface water runoff that flows directly to the harbor or to grated catchment basins and drain lines located on both sides of Bldg. 39, which also discharge to the harbor.

2.2.2 Site History, Previous Investigations, and Removal Actions Completed

2.2.2.1 SITE HISTORY

Bldg. 39 is a former engine and aircraft overhaul facility built before 1942. No record of water collection or treatment systems for former engine repair, sandblasting, foundry, plating, hydraulics, machining, or painting operations within Bldg. 39 has been identified. Without such collection or treatment systems in place, wastes may have entered storm water drainage systems and Bldg. 39

floor drains that discharge to Pearl Harbor. If these drainage systems are structurally compromised, they may have released hazardous substances to the surrounding environmental media. Therefore, the storm water drainage system and floor drain system were considered a potential release location (PRL) during the RI investigation (Earth Tech 2003c).

In addition, a sump pit exists near the southern corner of Bldg. 39. This sump is a concrete vault that measures 5 feet by 5 feet, and is 15 feet deep from ground surface to the bottom of the pit. According to Navy personnel, the sump pit was connected to miscellaneous drain lines that collected liquid wastes generated from within the Bldg. 39. Historically, these wastes were pumped from the sump through a subsurface discharge line directly to Pearl Harbor. The sump pit is no longer active and is no longer connected to any surrounding piping. Standing water was observed within the sump to approximately 2 feet below grade during initial RI inspections.

2.2.2.2 UST Removal

In 1993, the Navy Public Works Center (PWC) removed UST PW-29, located approximately 150 feet northeast of the southeastern corner of Bldg. 39 (Ogden 1997). Following removal, two soil samples were collected from the initial excavation at a depth of 8 feet bgs and analyzed for total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, and xylene (BTEX), and total lead. Only total lead was detected, at concentrations (6.6 milligram per kilogram [mg/kg] and 28 mg/kg) below its soil screening criterion (400 mg/kg).

From 1996 to 1997, the Navy PWC Environmental Remediation Branch removed UST No. 68 located near the northeastern corner of Bldg. 39 (PWC 1997a). Contaminated soil at the UST site was also removed followed by soil sampling at depths of 5 to 10 feet bgs to confirm cleanup. Soil samples were analyzed for TPH as gasoline range organics (GRO), and TPH as diesel range organics (DRO), BTEX, and polynuclear aromatic hydrocarbons (PAHs). TPH-DRO/lube oil range organics (LRO), the only analyte detected, was present at concentrations ranging from 15 to 2,090 mg/kg, which were below its screening criterion.

2.2.2.3 Remedial Investigation

Investigation activities to assess potential impacts from the storm water drain lines and the floor drain lines and sump pit were conducted as part of the RI (Earth Tech 2003c) during sampling efforts in June 2000 and February 2001. Subsurface soil, groundwater, and sediment samples were collected to assess potential impacts from the exterior storm water drainage system located on the east and west sides of Bldg. 39. One sump liquid sample was also collected. Subsurface soil samples were collected to determine whether chemicals of potential concern (COPCs) from the storm water drainage system have impacted surrounding soil. Groundwater samples were collected to assess any impacts of potential releases from the lines to the underlying shallow groundwater. Liquid in the Bldg. 39 sump was collected to determine the potential for release of contaminated wastewater to the storm water drainage system. Sediment samples were collected from storm water drain line catch basins to determine whether historical activities at Bldg. 39 resulted in the discharge of site-related COPCs to the storm water drainage system. All soil, groundwater, sediment, and sump liquid samples were analyzed for the site-related COPCs (VOCs, SVOCs, TPH-GRO, TPH-DRO/LRO, and Target Analyte List [TAL] metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc). Additionally, groundwater was analyzed for total dissolved solids (TDS) and chlorides. In addition, investigation of the Bldg. 39 floor drains included organic tin and hexavalent chromium since a plating shop had been located in the vicinity of the floor drains, and groundwater was analyzed for TDS and chlorides. Investigation results are presented in the RI report (Earth Tech 2003c). A human health preliminary risk evaluation (PRE) and ecological screening risk assessment (SRA)[2] were conducted to evaluate risks to potential receptors and make recommendations for no further action or further response actions.

Based on the PRE, NFA was recommended for soil located adjacent to the storm water drain lines and associated structures and groundwater underlying the site. Hot spot removal of lead-contaminated sediment was recommended for the storm water drain lines. The maximum concentration of lead (1,000 mg/kg) exceeded both the residential preliminary remediation goals (PRG) of 400 mg/kg and the industrial PRG of 750 mg/kg, which was based on the 2002 PRG and later changed to 800 mg/kg (EPA Region 9 2004). Although the sump pit liquid would not be used for drinking water purposes, it was recommended that the sump pit liquid be removed and disposed of to prevent incidental exposure since the carcinogenic risk was estimated to be 1E-03 and the cumulative hazard index (HI) exceeded 1 when compared to tap water PRGs. The carcinogenic risk was attributed to arsenic, trichloroethylene, and vinyl chloride. Non-carcinogenic risks primarily attributed to arsenic and naphthalene.

Based on the results of the ecological SRA detailed in the RI report (Earth Tech 2003c), no unacceptable risk to ecological receptors was posed by contamination of soil and groundwater at Bldg. 39. The results of the ecological SRA indicated that drainage system catch basin sediments contained concentrations of antimony, cadmium, chromium, copper, lead, nickel, silver, and zinc that exceeded their respective ecological screening criterion. The concentration of 2-methylphenol in the sump liquid was found to exceed the ecological screening criterion. The RI report recommended removal or stabilization of sediment from the Bldg. 39 storm water and floor drain lines and removal of the sump pit liquid to allow unrestricted land use and for the protection of aquatic ecological receptors.

2.2.2.4 NON-TIME-CRITICAL REMOVAL ACTION

The EE/CA (Earth Tech 2003a) included an evaluation of cleanup alternatives for areas at Bldg. 39 requiring further action based on the RI results. Based on the screening of potential removal action alternatives, comparative analysis of retained alternatives, and the intended potential reuse of the Bldg. 39 portion of Ford Island, the EE/CA recommended removal action alternative included jet-flushing, in situ grouting (sump pit and floor drain lines), onsite filtration, on-island disposal of liquid and off-island disposal of solid wastes as documented in the EE/CA. The Action Memorandum (DON 2003a) selected the recommended alternative for the removal action.

Removal action activities at Bldg. 39 were conducted between July 2003 and June 2004. The *Final Remedial Verification Report* (Shaw 2005) documents the removal action activities including the removal actions, waste characterization, and waste disposal in accordance with applicable or relevant and appropriate requirements (ARARs). The revised post-removal risk assessment is presented in Attachment B to this ROD. In summary, the removal action included the following:

Sump Pit. Approximately 700 gallons of liquid and 20 gallons of sludge were removed from the sump pit and properly disposed of off site. The sump pit was then pressure washed and the rinsate was collected and discharged to the Navy PWC, Pearl Harbor Sanitary Sewer System. Following these activities, the sump pit was completely back filled with grout.

Floor Drain Lines. One floor drain line was taken out of service by plugging the openings in the floor of the former plating shop with non-shrink grout. The second floor drain line identified in the

[2] Previous documents may refer to the ecological SRA as the SERA, or screening ecological risk assessment.

RI report could not be verified in the field, and the facility manager suspected that the line was closed after the fieldwork for the RI was completed but before the response action.

Sediment from Catch Basins. Approximately 4 tons of accumulated sediments were removed from the Bldg. 39 catch basin, sampled and characterized, and disposed of off-island at a CERCLA-approved landfill in Arlington, Oregon.

Sediment from Storm Water Drain Lines. The storm water drain lines were de-watered using a vacuum truck and then jet-flushed to remove sediment. Prior to the jet-flushing, temporary, inflatable plugs were installed in the outfalls of the storm drain system to prevent discharge of jet-flushed water and sediment into the harbor. Wastewater and sediment generated were collected, stored in fractionating tanks, separated, characterized, and properly disposed of off site. The wastewater and rinsate water were discharged to the Navy PWC, Pearl Harbor Sanitary Sewer System. Approximately 2.1 tons of sediment was disposed of off-island at a CERCLA-approved landfill in Arlington, Oregon.

Camera inspections were used to verify that all sediments were removed from the storm water drain lines and that there were no significant breaks in the lines where contamination of subsurface media could have occurred.

2.2.3 Current Site Characteristics

As a result of the removal actions, all contaminated media have been removed from the site. The sump pit and floor drain lines have been plugged and therefore cannot be used for waste disposal or provide a conduit for future releases of hazardous substances to migrate to subsurface media. The storm water drain lines are clean and operational.

2.2.4 Current and Potential Future Site and Resource Uses

2.2.4.1 Current Land Use

Currently, Bldg. 39 is used as an office building and training center by the submarine fleet. The Navy SEALs use Bldg. 39 for training and boat storage, and maintain a water storage tank on the exterior southwestern side of the building. The water within the tank (presumed to be potable) is drained on occasion and runs directly into the grated storm water drain inlets or down the sloped concrete ground surface to Pearl Harbor (Earth Tech 2003c).

2.2.4.2 Potential Future Land Use

Planned future development at Ford Island includes an increase in residential and commercial land use and reductions in industrial land uses. Bldg. 39 has been proposed for renovation to a consolidated training campus. There is no planned future use of groundwater at the site.

2.2.5 Current Site Risks

The contaminated sediments and sump liquid have been removed from the site. Therefore, there is no remaining risk of exposure to this contamination or health threats to potential human and ecological receptors.

2.2.6 No Further Action Required

No further action is required at Bldg. 39 to be protective of human health and the environment. The removal actions have met the objective of removing all contaminated media with constituent concentrations above remedial goals from the site (Shaw 2004) and properly disposing of the waste streams generated by the removal actions (Shaw 2005).

2.3 BUILDING 43 SITE

2.3.1 Site Name, Location, and Description

Bldg. 43 is located approximately 300 feet from the southeastern shoreline of Ford Island, 1,600 feet northeast of Bldg. 39, and 600 feet southwest of Bldg. 217 (Figure 2 and Attachment C [Figure C-3]). The area immediately adjacent to the Bldg. 43 site is covered with concrete to the south and east and asphalt to the north and west. The foundation of former Bldg. 190 is about 50 feet from the southeastern side of Bldg. 43. The area of former Bldg. 190 that is in proximity to Bldg. 43 is covered with gravel and old asphalt pavement.

The mostly nonporous ground surface is graded toward Pearl Harbor on the eastern, western, and southern sides of Bldg. 43. This causes surface runoff to flow into Pearl Harbor or directly to the grated storm water catch basins surrounding Bldg. 43, which also direct runoff to Pearl Harbor.

2.3.2 Site History, Previous Investigations, and Removal Actions Completed

2.3.2.1 Site History

Bldg. 43 is a former paint and oil storehouse and 90-day waste accumulation site that was built prior to 1963. Visible signs of paint staining in the storm water drainage system inlets near Bldg. 43 indicate that contaminants may have been released to the storm water drainage system.

No record of a water collection or treatment system for Bldg. 43 has been identified. Without such a collection or treatment system in place, wastes may have entered the storm water drainage system that discharges to Pearl Harbor; therefore, the storm water drainage system and floor drain system were considered a PRL during RI activities.

2.3.2.2 Remedial Investigation

During the RI, soil, groundwater, and sediment samples were collected to assess potential impacts from potential hazardous substance releases to and from the Bldg. 43 storm water drainage system (Earth Tech 2003c). Surface and subsurface soil samples were collected to determine whether a release from the storm water drainage system has impacted the surrounding soil. A groundwater monitoring well was installed, and a groundwater sample collected to assess any impacts from potential releases to the underlying shallow groundwater and to supplement the investigation of the inactive AVGAS pipeline system. Sediment samples were collected from storm water drain line catch basins to determine whether historical activities conducted at Bldg. 43 resulted in the discharge of site-related COPCs to the storm water drainage system. Soil, groundwater, and sediment samples were analyzed for the site-related COPCs (VOCs, SVOCs, pesticides [organochlorine, organophosphorus, and urea], PCBs, chlorinated herbicides, carbamates, TPH-GRO, TPH-DRO/LRO, and TAL metals). Groundwater samples were also analyzed for TDS and chlorides. A human health PRE and ecological SRA were conducted to evaluate risks to potential receptors and make recommendations for no further action or further response actions.

Results of the PRE and ecological SRA indicated that NFA was recommended for surface soil and groundwater near the storm water drain lines at Bldg. 43. For subsurface soil, further characterization was recommended to delineate the extent of benzo(a)pyrene contamination collected in a soil sample at a depth of 3 feet bgs to provide sufficient data to evaluate if a potential further response action was necessary. Based upon the results of the ecological SRA, it was recommended that sediment within the storm water drain line be removed or stabilized due to elevated concentrations of arsenic, copper, lead, mercury, nickel, silver, and zinc above their ecological screening criteria to prevent migration of the sediment to Pearl Harbor.

2.3.2.3 NON-TIME-CRITICAL REMOVAL ACTION

The EE/CA (Earth Tech 2003a) included an evaluation of cleanup alternatives for areas at Bldg. 43 requiring further action based on the RI results. Based on the screening of removal action alternatives, the evaluation and comparative analysis of retained alternatives, and the intended potential reuse of Bldg. 43, the recommended alternative included jet-flushing of the storm water drain lines, onsite filtration, on-island disposal of liquid, and off-island disposal of solid wastes. The selected removal action alternative was documented in the Action Memorandum (DON 2003a).

Following completion of the EE/CA and prior to conducting removal actions, additional investigation that was conducted to delineate benzo(a)pyrene contamination at the site (Shaw 2005). Based on the results of the additional investigation, a removal action, as documented in Action Memorandum Addendum No. 1, was recommended to address benzo(a)pyrene in the soil at the site (Earth Tech 2003b).

Removal action activities at Bldg. 43 were conducted between July 2003 and June 2004. The Final Remedial Verification Report (Shaw 2005) documents the removal action activities and management of removal action wastes in accordance with the removal action ARARs. The revised post-removal risk assessment is presented in Attachment B. The removal action activities are summarized below.

Soil Removal. Approximately 130 tons of soil impacted with benzo(a)pyrene was removed from an excavation area approximately 100 feet by 85 feet and between 1.5 and 7 feet deep. The limits of excavation were determined by delineation and confirmation sampling. The excavation was backfilled with import material from an Oahu site source. The contaminated soil was properly disposed of off-island in a CERCLA-approved facility on the U.S. mainland.

Four confirmation soil samples still showed benzo(a)pyrene above the project cleanup level of 0.062 mg/kg. The project cleanup level was based on the EPA Region 9 residential soil PRG, which is below the DOH Tier 1 Environmental Action Level (EAL) of 0.15 mg/kg. Because these four samples were at the practical limits of excavation (adjacent to roads, around concrete utility jackets, and/or tie-backs to sheet pilings), no further excavation activities were conducted.

Based on data from adjacent confirmation samples, data from previous RI sampling results, and site characteristics, the extent of soil with benzo(a)pyrene remaining at the site at concentrations above the project cleanup level appears to be limited. Risks from exposure to various media (i.e., surface soil and subsurface soil) were evaluated using the maximum detected concentrations and the RME concentration. The RME (calculated using the results of all the final confirmation soil samples) was below the project cleanup level (Shaw 2005). Three of the four samples with concentrations exceeding the cleanup goal had detected concentrations of 0.14 mg/kg or less. Two of these samples were collected within 10 feet east of the harbor at depths of 2.25 feet and 3 feet and at the base of sheet piling located along the shoreline. Adjacent samples collected north, southwest, and east of these locations had concentrations below the cleanup level. The third sample, which had a concentration of 0.14 mg/kg, was collected at a depth of 1 foot and along the edge of Hornet Avenue, which bordered the western limits of the excavation. Adjacent confirmation samples collected north, south, and east of this location, and samples collected on the west side of Hornet Avenue during the RI, had detected concentrations below the cleanup goal. The fourth sample contained benzo(a)pyrene at 0.20 mg/kg and was collected from the northeast corner of the excavation at a depth of 0.75 feet. The sample was collected adjacent to asphalt pavement located to the north and sheet piling located along the shoreline to the east. The concentration in a sample from the same approximate location collected at a depth of 3.6 feet was 0.021 mg/kg. Benzo(a)pyrene concentrations in adjacent samples collected northwest and southwest of this location were below the project cleanup level.

Sediment from Catch Basins. Approximately 2.2 tons of sediments were removed from the Bldg. 43 catch basin, sampled, characterized, and disposed of off-island in a CERCLA-approved facility on the U.S. mainland.

Sediment from Storm Water Drain Lines. The storm water drain lines were de-watered using a vacuum truck and then jet-flushed to remove sediment. Wastewater and sediment generated during the removal action were collected and stored in fractionation tanks. Approximately 0.1 ton of sediment was separated from the wastewater and disposed of at a CERCLA-approved landfill in Arlington, Oregon. Approximately 19,950 gallons of wastewater was transferred into bulk tanks for storage. Analytical results indicated that the wastewater met the discharge requirements of the NAVFAC Hawaii Sanitary Sewer System. Approval was obtained to discharge the wastewater to sewer manhole I-7 on Ford Island (Shaw 2005).

Camera inspections were used to verify that all sediments were removed from the storm water drain lines and that there were no significant breaks in the lines where contamination of subsurface media could have occurred.

2.3.3 Current Site Characteristics

As a result of the removal action, contaminated soil has been removed from open, uncovered areas of the site where direct exposure to this contamination had the highest potential. Benzo(a)pyrene remains in soil at levels above the cleanup level of 0.062 mg/kg beneath structures at the site (i.e., roads, concrete utility jackets, and tie-backs to sheet pilings); however, the RME concentration calculated using all the final post-excavation sampling results was below the project cleanup level and the areas of soil with benzo(a)pyrene remaining at the site at concentrations above the project cleanup level appear to be limited. The storm water drain lines are clean and operational.

2.3.4 Current and Potential Future Site and Resource Uses

2.3.4.1 Current Use

Currently, Bldg. 43 is vacant and no longer in use.

2.3.4.2 Future Use

Planned future development at Ford Island includes an increase of residential and commercial land use and reductions in industrial land uses. There is no planned future use of groundwater at the site.

2.3.5 Current Site Risks

The revised post-removal action human health and ecological screening risk assessment for the Bldg. 43 site is summarized below and presented in its entirety in Attachment B. Table 3-2 and Table 3-3 in Attachment B present a comparison of summary statistics to human and ecological cleanup levels, respectively. These tables also include maximum detected contaminant concentrations in soil after the removal action, associated Oahu caprock soil background concentrations in soil (Earth Tech 2006), RME concentrations, and the removal action cleanup levels.

2.3.5.1 Human Health Risk

As described in Section 2.3.2.3, subsurface soil with concentrations of benzo(a)pyrene (0.088 mg/kg to 0.2 mg/kg) above the cleanup level (EPA Region 9 residential soil PRG) remained at four sampling locations at the practical limits of excavation (i.e., adjacent to roads, around concrete utility jackets, and/or tie-backs to sheet pilings) and, therefore, was not excavated. The benzo(a)pyrene concentrations detected at three of the four locations (0.088 mg/kg to 0.14 mg/kg) were below the DOH Tier 1 EAL (0.15 mg/kg) and none of the concentrations exceeded the EPA Region 9 industrial soil PRG (0.21 mg/kg). As described for subsurface soil below, the maximum detected concentration (0.2 mg/kg) results in a carcinogenic risk (3E–06) under a residential scenario that slightly exceeds the 1E–06 point of departure. Under an industrial scenario, the maximum detected concentration results in a carcinogenic risk (1E–06) that does not exceed the 1E–06 point of departure. Based on available data, the areas of soil with concentrations exceeding the cleanup level appear to be limited. Potential exposure pathways to soil with benzo(a)pyrene concentrations above the cleanup level include excavation and exposure to subsurface soil by future residents or current and future industrial workers and construction workers. Based on the limited areal extent of remaining contamination, limited accessibility to the impacted areas, and carcinogenic risk from exposure to the maximum detected concentration under a residential scenario that slightly exceeds the point of departure, the remaining soil with benzo(a)pyrene concentrations above the cleanup goal does not pose an unacceptable risk.

Surface Soil. The RME based exposure point concentration (EPC) for benzo(a)pyrene was below its cleanup level, which was the EPA Region 9 residential soil PRG (0.062 mg/kg) (EPA Region 9 2004).

The cumulative maximum and RME carcinogenic risk for surface soil under an assumed residential land use is 7E–07, which is less than the 1E–06 point of departure. The carcinogenic risks given are the excess lifetime cancer risks. Neither the maximum nor the RME EPC for benzo(a)pyrene exceeds its carcinogenic residential PRG for soil. The cumulative maximum and RME carcinogenic risk for surface soil under an assumed industrial land use is 2E–07, which is less than the 1E–06 point of departure. Neither the maximum nor the RME based EPC for benzo(a)pyrene exceeds its carcinogenic industrial PRG for soil.

There were no non-carcinogenic COCs evaluated for surface soil.

Subsurface Soil. The RME based EPC for benzo(a)pyrene was below its cleanup level (0.062 mg/kg). However, the maximum concentration for benzo(a)pyrene (0.2 mg/kg) was greater than its respective cleanup level.

The cumulative maximum carcinogenic risk (excess lifetime cancer risk) for subsurface soil under an assumed residential land use is 3E–06, which exceeds the 1E–06 point of departure. The cumulative carcinogenic risk associated with exposure to the RME based EPC for benzo(a)pyrene for subsurface soil (0.054 mg/kg) under an assumed residential land use is 9E–07, which is below the 1E–06 point of departure. The maximum EPC for benzo(a)pyrene exceeds its carcinogenic residential PRG (0.062 mg/kg) for soil. The cumulative carcinogenic risks associated with maximum and RME EPCs in subsurface soil under an assumed industrial land use are 1E–06 and 3E–07, which do not exceed the 1E–06 point of departure.

There were no non-carcinogenic COCs evaluated for subsurface soil.

2.3.5.2 Ecological Risk

There are no contaminated sediments remaining at the site that could migrate to the harbor. Since this exposure pathway has been eliminated, the sediment no longer presents a health risk to ecological receptors.

None of the site soil COCs had RME EPCs that exceeded their respective project-specific ecological cleanup levels.

2.3.5.3 RISK ASSESSMENT SUMMARY

The human health PRE indicated the RME based EPCs for benzo(a)pyrene in surface and subsurface soil at Bldg. 43 are well below its project-specific cleanup level. Additionally, the carcinogenic risks associated with RME based EPCs for benzo(a)pyrene in surface and subsurface soil for both the residential and industrial land use scenarios are less than the 1E–06 point of departure. Site soil COCs do not present an unacceptable risk to ecological receptors.

2.3.6 No Further Action Required

No further action is required at Bldg. 43 for the protection of human health and the environment. Removal actions have met the objectives of removing contaminants from the site to acceptable risk levels and properly disposing of contaminated media (Shaw 2005).

2.4 BUILDING 217

2.4.1 Site Name, Location, and Description

The Bldg. 217 location is approximately 100 feet from the southern shoreline of Ford Island (Figure 2 and Attachment C [Figure C-3]). Approximately 300 feet northeast of Bldg. 217 is Bldg. 80, and approximately 600 feet southwest of Bldg. 217 is Bldg. 43. The area immediately surrounding the Bldg. 217 site is covered with asphalt; however, a small grass patch is present at the corner of Hornet Avenue and Hammonds Port Street.

Because of site grade and the non-porous surface surrounding the building, the majority of surface runoff near Bldg. 217 flows into Pearl Harbor or into storm drain lines. On the southern and eastern sides of Bldg. 217, the ground surface slopes toward Pearl Harbor, allowing the surface runoff to flow directly into Pearl Harbor. On the northern and western sides of the building, the ground surface slopes to the west, allowing surface runoff to flow into grated storm water catchment basins located west of the building. Surface runoff entering the storm water catchment basins is also directed into Pearl Harbor.

2.4.2 Site History, Previous Investigations, and Removal Actions Completed

2.4.2.1 SITE HISTORY

Bldg. 217 is a former auto hobby shop that was built prior to 1963. An oily sheen was observed in a storm water drain inlet adjacent to the building, during a 1996 visual site inspection (Earth Tech 1998). This visible evidence suggests that contaminants may have been released into the storm water drain.

2.4.2.2 REMEDIAL INVESTIGATION

Bldg. 217 was included in the Ford Island RI (Earth Tech 2003c) because the site was formerly used as an auto hobby shop and for storing hazardous waste. During a 1996 visual site inspection, an oily sheen was observed in one of the storm drain line inlets indicating that contaminants may have been released to the storm drain line catchment basins. Therefore, the RI included an investigation of subsurface structures associated with the storm water drain line. During the RI, subsurface soil and groundwater samples were collected to assess potential impacts from the Bldg. 217 storm water drain line to surrounding subsurface soil and groundwater. Subsurface soil samples were collected to determine whether releases from the storm water drain line had impacted surrounding soil. A groundwater sample was collected to assess any impacts of potential releases from the lines to the underlying shallow groundwater and to supplement the investigation of the inactive AVGAS pipeline system. Collection of sediment samples from the Bldg. 217 storm water drain line catchment basins was planned, however, no sediment was observed in the catchment basins. Soil and groundwater samples were analyzed for the site-related COPCs, which includes VOCs, SVOCs, TPH-GRO, TPH-

DRO, and TAL metals. Additionally, groundwater was analyzed for TDS and chlorides. A human health PRE and ecological SRA were conducted to evaluate risks to potential receptors and make recommendations for no further action or further response actions.

Results of the human health PRE indicated that no unacceptable risks are estimated for surface or subsurface soil media. The maximum concentration of arsenic in the groundwater at Ford Island was compared to and exceeded the EPA Region 9 tap water PRG. Because it did not exceed the maximum contaminant level, no further action was recommended for groundwater. Groundwater at Ford Island is neither currently used for drinking water purposes nor is it considered a potential source of drinking water.

Results of the ecological SRA indicated that terrestrial exposure pathways are considered incomplete and concentrations of COCs in groundwater were determined to not pose a threat to organisms in Pearl Harbor that may come into contact with groundwater seeps. Although visible evidence suggests that potential contaminants may have been released to the storm water drain lines, no sediment was available for sampling. Therefore, it was assumed that contaminated sediment is not being discharged to Pearl Harbor.

Based on the results of the RI, NFA was recommended for subsurface soil, sediment and groundwater at the Bldg. 217 site.

2.4.3 Current Site Characteristics

No records of water collection or treatment systems for Bldg. 217 were identified. Without such collection or treatment systems in place, wastes may have entered storm water drainage systems that discharge to Pearl Harbor. However, no sediment was present in the storm water drainage system and no further action was necessary for subsurface soil and groundwater based on the results of the RI and risk assessment. The storm drains were determined during the RI to be clean and remain operational (Earth Tech 2003c).

2.4.4 Current and Potential Future Site and Resource Uses

Current Use. Currently, Bldg. 217 is being used as a hazardous waste storage area. Materials stored at Bldg. 217 include oil, grease, and antifreeze. Absorbent booms that have been used to contain oil spills are also stored on spill pallets within the building, while the oil remaining in the absorbent booms is squeezed into 55-gallon drums. A satellite accumulation point for storage of these drums of recovered oil is located inside the building (Earth Tech 2000a). A RCRA permit is not required for the hazardous waste storage activities at Bldg. 217 on Ford Island, provided that the hazardous waste storage activities comply with applicable RCRA requirements.

Future Use. Planned future development at Ford Island includes an increase of residential and commercial land use and reductions in industrial land uses. There is no planned use of groundwater at the site.

2.4.5 Current Site Risks

Results of the human health PRE and ecological SRA indicate that risks are within acceptable levels and NFA is recommended for subsurface soil, sediment, and groundwater near the storm water drain lines at Bldg. 217.

2.4.6 No Further Action Required

No further action is required at Bldg. 217 to be protective of human health and the environment.

2.5 CAMEL REFURBISHING AREA

2.5.1 Site Name, Location, and Description

The Camel Refurbishing Area is located on the northwestern shoreline of Ford Island. The Ford Island Landfill borders the site to the south (Figure 2 and Attachment C [Figure C-4]).

The entire Camel Refurbishing Area site is covered with concrete, but an unpaved, vegetated strip approximately 50 feet wide lies between the concrete covered area and Pearl Harbor. The entire Camel Refurbishing Area is graded towards Pearl Harbor, allowing all surface runoff to flow directly onto the soil along the vegetated area and into Pearl Harbor.

2.5.2 Site History, Previous Investigations, and Removal Actions

2.5.2.1 SITE HISTORY

The Camel Refurbishing Area was initially used as a seaplane parking and fueling area. Prior to 1990, the Camel Refurbishing Area was used for refurbishing portable marine piers known as camels. Refurbishing operations conducted at this site included removal of dilapidated creosote timber from the camels, camel sandblasting and painting, and reinstalling new creosote-treated timber on the camels.

2.5.2.2 REMEDIAL INVESTIGATION

The Camel Refurbishing Area was included in the Ford Island RI to evaluate potential contamination resulting from the historical sandblasting and painting activities. During the RI, surface soil, subsurface soil, and groundwater samples were collected. The samples were analyzed for SVOCs and metals. In addition, soil samples collected from hollow stem auger borings were analyzed for VOCs, TPH-GRO, and TPH-DRO/LRO to supplement the investigation of an inactive AVGAS pipeline. Groundwater samples were also analyzed for TDS and chlorides.

Based on the human health PRE presented in the RI report (Earth Tech 2003c), potential risks to human health from exposure to surface soil contaminants at the Camel Refurbishing Area were below the risk level typically requiring remediation for both residential and industrial scenarios. At one boring location (CRA-DP15), arsenic was detected in soil at a depth of 1.5 feet bgs under concrete pavement at a concentration (38 mg/kg) and further action was recommended to address soil contamination at this location. NFA was recommended for groundwater.

Results of the ecological SRA indicated that exposure pathways to terrestrial receptors in subsurface soil were incomplete and concentrations of chemicals in groundwater did not pose unacceptable risks to organisms in Pearl Harbor. However, the concentrations of four metals (copper, lead, selenium, and zinc) located in surface soil along the unpaved area located between the lower edge of the Camel refurbishing Area pavement and Pearl Harbor, and the unpaved, vegetated area near Bldgs. 445 and 142 posed unacceptable risk to terrestrial animals. Therefore, further action to address surface soil contamination in these areas was recommended.

2.5.2.3 NON-TIME-CRITICAL REMOVAL ACTION

The EE/CA (Earth Tech 2003a) included an evaluation of cleanup alternatives for areas at the Camel Refurbishing Area requiring further action based on the RI results. Based on the screening of removal action alternatives, the evaluation and comparative analysis of retained alternatives, and the intended potential reuse of the Camel Refurbishing Area, the recommended alternative included soil excavation and off-island disposal. The Action Memorandum (DON 2003a) documented the selected alternative for the removal action.

Removal action activities at the Camel Refurbishing Area were conducted between July 2003 and June 2004. The Final Remedial Verification Report (Shaw 2005) documents the removal action activities including delineation sampling, removal actions, waste characterization, and waste disposal in accordance with ARARs. The revised post-removal risk assessment is presented in Attachment B.

Surface and subsurface soil delineation and confirmation samples were collected and analyzed for arsenic, copper, lead, selenium, and zinc to determine the excavation limits for three locations at the Camel Refurbishing Area: along the unpaved shoreline, in the paved area where a soil boring (CRA-DP15) was advanced, and in the unpaved area by Bldgs. 445 and 142 where a soil boring (CRA-DP21) was advanced (Figure 2). The removal action activities are summarized below.

CRA-DP15 Excavation. Approximately 12.5 tons of soil impacted with arsenic was removed from the excavation at RI sampling location CRA-DP15. The excavation was approximately 10 feet by 10 feet and 3 feet deep, including an 8-inch thick concrete cover.

CRA-DP21 Excavation. Approximately 18.6 tons of soil impacted with arsenic were removed from the excavation at RI sampling location CRA-DP21. The excavation was located in an unpaved area and was approximately 10 feet by 10 feet and 3 feet deep.

Camel Refurbishing Area Shoreline. Approximately 2,977 tons of soil impacted with arsenic, copper, lead, selenium, and zinc were removed from the excavation along the CRA shoreline. The excavation was approximately 1,000 feet by 35 feet (average) with a depth of 1 foot and/or to mean higher-high water (MHHW). The excavations were backfilled with import material from an offsite Oahu source. The contaminated soil was disposed of off-island in a CERCLA-approved landfill on the U.S. mainland as detailed in the RVR (Shaw 2005).

Three confirmation samples collected along the Pearl Harbor shoreline still indicated copper, selenium, and lead above the project cleanup levels. However, calculated RME concentrations were below project cleanup levels; therefore, no further excavation was conducted. One confirmation subsurface soil sample collected from a depth of 3.5 feet bgs along the shoreline and adjacent to the concrete pavement located to the west still indicated arsenic at a concentration of 52.1 mg/kg, which exceeded the project cleanup level of 22 mg/kg (maximum concentration); however because this sample was collected at the practical limits of excavation (below MHHW), no further excavation activities were conducted. Confirmation samples collected adjacent to this location to the north, south and west had arsenic concentrations below the project cleanup level, indicating the soil with elevated concentrations of arsenic is of limited extent. In addition, RME concentrations calculated using both RI and removal action confirmation data were below project cleanup levels. The revised post-removal risk assessment is presented in Attachment B.

2.5.3 Current Site Characteristics

As a result of the removal actions, RME concentrations for site-related COCs (arsenic, copper, lead, selenium, and zinc) were below the project cleanup levels. The excavations were backfilled and concrete was used to restore the area around CRA-DP15.

2.5.4 Current and Potential Future Site and Resource Uses

Current Use. The Camel Refurbishing Area is no longer used to refurbish camels. A section of the paved area is currently used for passenger car storage or parking. Boat Launch S368, located on the western side of the Camel Refurbishing Area, is used by the Navy SEALs to commence exercises. Some buildings are located centrally within the Camel Refurbishing Area, but they are no longer in use. A sewer pump station at Bldg. 450 within the Camel Refurbishing Area (Attachment C [Figure C-4]) is still active and checked routinely.

Future Use. Planned future development at Ford Island includes an increase of residential and commercial land use and reductions in industrial land uses. There is no planned use of groundwater at the site.

2.5.5 Current Site Risks

The revised post-removal action human health and ecological screening risk assessment is summarized below and presented in its entirety in Attachment B. Table 3-2 and Table 3-3 in Attachment B present a comparison of summary statistics to human and ecological cleanup levels, respectively. These tables also include maximum detected contaminant concentrations in soil after the removal action, associated Oahu caprock soil background concentrations in soil (Earth Tech 2006), RME concentrations, and the removal action cleanup levels.

As described in Section 2.5.2.3, three confirmation samples collected along the Pearl Harbor shoreline still indicated copper, selenium, and lead above the project cleanup levels. However, concentrations of these metals were all below their respective EPA Region 9 residential soil PRG. Arsenic was also detected in subsurface soil within the unpaved area along the Pearl Harbor shoreline in one sample at 52.1 mg/kg, which exceeded its cleanup level of 22 mg/kg (maximum concentration) and EPA Region 9 residential and industrial soil PRGs. However, the confirmation sampling results indicated that the extent of soil with elevated arsenic concentrations is of limited extent.

2.5.5.1 Human Health Risk Summary

Potential exposure pathways to soil with arsenic concentrations above the cleanup level include excavation and exposure to subsurface soil by future residents or current and future industrial workers and construction workers.

Surface Soil. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. However, the maximum concentrations of copper (150 mg/kg) and selenium (12.5 mg/kg) were greater than their respective cleanup levels of 130 mg/kg and 12 mg/kg, respectively.

The cumulative maximum and RME carcinogenic risks (excess lifetime cancer risks) for surface soil under an assumed residential land use are 5E–05 and 1E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed industrial land use are 1E–05 and 4E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. Arsenic background levels for caprock soils on Oahu include 16 mg/kg as the 95th percentile and 29 mg/kg as the maximum estimated background concentration (Earth Tech 2006), which exceed the carcinogenic PRGs of 0.39 mg/kg for residential soil and 1.6 mg/kg for industrial soil. Therefore, risks from arsenic in caprock soil will almost always exceed the 1E–06 point of departure under naturally occurring conditions. The maximum and RME EPCs for arsenic in surface soil exceed its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 17.6 and 5.6 mg/kg, respectively, are well below the arsenic cleanup levels (17 mg/kg site average and 22 mg/kg maximum concentration) that were established in the Ford Island RI (Earth Tech 2003c) and below the maximum estimated background value of 29 mg/kg for caprock soil on Oahu.

The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for residential land use are expressed as HIs of 0.9 and 0.3, respectively, which are below 1. The RME EPCs for copper and selenium in surface soil were 56 mg/kg and 2.2 mg/kg, respectively. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for industrial land use are expressed as HIs of 0.07 and 0.02, respectively, which are below 1. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Paved Subsurface Soil. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. Additionally, the maximum concentrations for all chemicals were less than their respective cleanup levels.

The cumulative maximum and RME carcinogenic risks (excess lifetime cancer risks) for subsurface soil under an assumed residential land use are 5E–05 and 2E–05, respectively, which exceed the 1E-06 point of departure. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed industrial land use are 1E–05 and 5E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. As described above, risks from arsenic in caprock soil will almost always exceed the 1E–06 point of departure under naturally occurring conditions. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 17.7 and 7.47 mg/kg, respectively, are well below the arsenic cleanup levels (17 mg/kg site average and 22 mg/kg maximum concentration) that were established in the Ford Island RI (Earth Tech 2003c) and below the maximum background value (29 mg/kg) for caprock soil on Oahu (Earth Tech 2006).

The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for residential land use are expressed as HIs of 0.8 and 0.4, respectively, which are below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for industrial land use are expressed as HIs of 0.07 and 0.03, respectively, which are below 1. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Unpaved Subsurface Soil. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. However, the maximum concentrations for arsenic (52.1 mg/kg) and lead (207 mg/kg) were greater than their respective cleanup levels. The cleanup level for arsenic of 22 mg/kg (maximum concentration at the site) and the cleanup level of 170 mg/kg for lead were exceeded. A cleanup level of 200 mg/kg for lead in soil was established during the RI; however, this value was reduced to 170 mg/kg after additional data were collected during delineation sampling conducted prior to the removal action (Shaw 2005).

The cumulative maximum and RME carcinogenic risks (excess lifetime cancer risks) for unpaved subsurface soil under an assumed residential land use are 1E–04 and 2E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for unpaved subsurface soil under an assumed industrial land use are 3E–05 and 5E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. As described above, risks from arsenic in caprock soil will almost always exceed the 1E–06 point of departure under naturally occurring conditions. The maximum EPC (52.1 mg/kg) and RME EPC (8.5 mg/kg) for arsenic exceeded its carcinogenic residential and industrial PRGs for soil. However, the RME EPC for arsenic is well below the arsenic cleanup levels (17 mg/kg site average and 22 mg/kg maximum concentration) that were established in the Ford Island RI (Earth Tech 2003c) and below the maximum background value (29 mg/kg) for caprock soil on Oahu (Earth Tech 2006).

The cumulative non-cancer hazard associated with potential exposure to maximum EPCs for residential land use is expressed as an HI of 2, which is greater than 1. The cumulative non-cancer hazard associated with potential exposure to RME EPCs for residential land use is expressed as an HI of 0.4, which is less than 1. The cumulative non-cancer hazards associated with potential exposure to maximum and RME EPCs for industrial land use are expressed as HIs of 0.2 and 0.03, respectively, which are less than 1. The maximum EPC for arsenic exceeded its non-cancer residential soil PRG; however, the RME EPC is below the cleanup level established for arsenic on Ford Island and below its maximum background value for caprock soil on Oahu as described above.

2.5.5.2 ECOLOGICAL RISK SUMMARY

Maximum EPCs for copper (150 mg/kg) and selenium (12.5 mg/kg) in surface soil (Attachment B, Table 3-3) exceeded their removal action cleanup levels of 130 mg/kg and 12 mg/kg, respectively. Maximum EPCs for arsenic (52.1 mg/kg) and lead (207 mg/kg) in unpaved subsurface soil exceeded their removal action cleanup levels of 22 mg/kg (maximum concentration at the site) and 170 mg/kg, respectively. However, RME EPCs for copper (56 mg/kg) and selenium (2.2 mg/kg) in surface soil and RME EPCs for arsenic (8.5 mg/kg) and lead (54 mg/kg) in unpaved subsurface soil were below their removal action cleanup levels. None of the site soil COCs had RME EPCs that exceeded their removal action cleanup levels.

Maximum and RME EPCs for COCs were also compared to DOH soil EALs (Attachment B, Table 3-3). The maximum EPC for selenium (12.5 mg/kg) in surface soil and the maximum EPC for arsenic (52.1 mg/kg), lead (207 mg/kg), and selenium (10.7 mg/kg) in the unpaved subsurface soil exceeded the DOH EAL. The DOH soil EALs for arsenic, lead, and selenium are 20 mg/kg, 200 mg/kg, and 10 mg/kg, respectively. However, none of the COCs had RME EPCs that exceeded their respective DOH soil EAL.

2.5.5.3 RISK ASSESSMENT SUMMARY

The RME EPCs for arsenic, copper, lead, selenium, and zinc in surface, paved subsurface soil, and unpaved subsurface soil were all below their respective cleanup levels. The carcinogenic risks associated with RME EPCs in surface, paved subsurface, and unpaved subsurface soil for residential and industrial land use were all greater than the 1E–06 point of departure. Almost all of the cumulative carcinogenic risk can be attributed to the RME EPC for arsenic. However, the RME EPC for arsenic is well below its cleanup goal. The non-cancer hazards associated with RME EPCs in surface, paved subsurface, and unpaved subsurface soil for residential and industrial land use were all below the point of departure of 1.

Maximum EPCs for arsenic, lead, and selenium exceeded their respective project-specific ecological cleanup levels. However, none of the site soil COCs had RME EPCs that exceeded their respective project-specific ecological cleanup levels.

2.5.6 No Further Action Required

No further action is required at the Camel Refurbishing Area to be protective of human health and the environment. Removal actions have met the objective of removing contaminants to acceptable cleanup levels and disposing of the waste streams generated by the removal actions (Shaw 2005).

2.6 HAZARDOUS SUBSTANCE STORAGE AREA

2.6.1 Site Name, Location, and Description

The HSSA location is on the southeastern shoreline of Ford Island (Figure 2 and Attachment C [Figure C-3]). The HSSA is built on the foundation of former Bldg. 204. To the north of the concrete foundation, the surface cover is asphalt. Grass surrounds the HSSA site on the southern, eastern, and western sides of the concrete foundation. A layer of asphalt about 6 inches thick, which could have been a former parking lot, was found at about 6 inches bgs. The entire area around the HSSA is graded toward the harbor, allowing the surface runoff to flow directly into Pearl Harbor. Even in the grassy area, the underlying layer of asphalt helps to prevent surface runoff from migrating into the subsurface soil.

2.6.2 Site History, Previous Investigations, and Removal Actions Completed

2.6.2.1 Site History

The HSSA was formerly used to store small quantities of paint, used batteries, oil, used oil, and various lubricants. A 6-inch concrete berm surrounds and divides the HSSA roughly in half. During the initial visual site inspection (Earth Tech 1998), the HSSA contained a portable lubricating oil AST and pipes used to transport this oil. There were several patched breaks in the concrete berm and epoxy-sealed cracks in the concrete foundation. An unpatched break in one berm was observed. Operational logs providing dates of hazardous material storage, berm installation, berm breaks, and berm repairs were unavailable. Field team personnel were unable to determine how the breaks occurred.

Because of the types of materials stored at the HSSA, the lack of information about the historic operations, and the current and former maintenance of the facility, the structure was considered a PRL during RI activities.

2.6.2.2 Remedial Investigation

RI activities included the collection of surface soil, subsurface soil, and groundwater samples. Surface and subsurface soil samples were collected to determine whether historical activities, including the storage and use of various chemicals, have impacted the surrounding soil. Groundwater samples were collected to assess any site impacts from historical activities to the underlying shallow groundwater. All subsurface soil and groundwater samples were analyzed for the site-related COPCs (VOCs, SVOCs, pesticides [organochlorine, organophosphorus, and urea], PCBs, chlorinated herbicides, carbamates, TPH-GRO, TPH-DRO/LRO, and TAL metals). The surface soil samples were analyzed for all site-related COPCs, except VOCs. The surface soil samples were not analyzed for VOCs because the surface soil has been exposed to physical conditions (sunlight, heat, wind, and rain) that enhance the attenuation of VOCs.

Results of the human health PRE indicated that NFA was required for subsurface soil and groundwater at the HSSA. However, further action was recommended to address elevated concentrations of lead detected at one surface soil sampling location.

Results of the ecological SRA indicated that NFA was required for subsurface soil and groundwater. However, further action was recommended to address the elevated concentration of 4,4′-dichlorodiphenyldichloroethene (4,4′-DDE) in surface soils at one sampling location, and elevated concentrations of lead, selenium, and zinc at the same location recommended for further action during the human health PRE.

In addition to 4,4′-DDE, lead, selenium, and zinc in surface soil, arsenic was identified as a COC in surface soil since it was detected above the average cleanup level established for Ford Island cleanup activities.

2.6.2.3 UST Removal Activities

In 1997, the PWC Remediation Branch removed UST No. 98 and the associated fuel piping from north of Bldg. 44 and adjacent to the HSSA (PWC 1997b) (Attachment B, Figure 1-4). After the UST was removed, the Navy PWC collected soil samples and analyzed them for TPH, BTEX, PAH compounds (naphthalene, acenaphthene, fluoranthene, benzo(a)pyrene), and total lead.

TPH, BTEX, and total lead were detected in soil samples collected during the initial PWC excavation activities for UST No. 98. Initially, two soil samples were collected from the excavated pit and one soil sample was collected from the stockpiled soil for a site assessment. The two soil samples collected from the pit were collected at a depth of approximately 4 feet bgs. One compound, ethylbenzene, was detected at a concentration (2.08 mg/kg) exceeding the screening criteria (0.5 mg/kg) used in this report. The detected concentration of total lead (750 mg/kg) also exceeds its screening criterion (400 mg/kg). The location was excavated further to a total depth of approximately 6 feet bgs. Three confirmation samples were collected from the excavated pit at an approximate depth of 6 feet bgs. During the final excavation and soil sampling activities, only total lead was detected in the soil. The detected concentration of total lead (41 mg/kg) is below its screening criterion (Earth Tech 2003c).

2.6.2.4 Non-Time-Critical Removal Action

The EE/CA (Earth Tech 2003a) included an evaluation of cleanup alternatives for areas at the HSSA requiring further action based on the RI results. Based on the screening of removal action alternatives, the evaluation and comparative analysis of retained alternatives, and the intended potential reuse of the HSSA, the recommended alternative included soil excavation and off-island disposal. The Action Memorandum (DON 2003a) documented the selected alternative for the removal action.

Removal action activities at the HSSA were conducted between July 2003 and June 2004. The Final Remedial Verification Report (Shaw 2005) documents the removal action activities and management of removal action wastes in accordance with ARARs. In summary, the removal action included the following:

Surface and subsurface delineation and confirmation samples were collected and analyzed for antimony, arsenic, lead, selenium, zinc, and 4,4′-DDE to determine the excavation limits for two locations at the HSSA: RI sampling locations HSS-DP03 and HSS-DP07.

Approximately 36.2 tons of soil impacted with 4,4′-DDE and antimony were removed from the excavation at RI sampling location HSS-DP03. The excavation was approximately 25 feet by 13 feet and 2.5 to 4.5 feet deep. Antimony was added as a COC for the HSS-DP03 location after completion of the Action Memorandum due to its presence at a concentration above the estimated background level.

Approximately 91.2 tons of soil impacted with metals were removed from the excavation at RI sampling location HSS-DP07. The excavation was approximately 30 feet by 25 feet and 1.5 to 5 feet deep.

The excavations were backfilled with import material from an on-island, offsite source. The contaminated soil was disposed of at a CERCLA-approved landfill in Arlington, Oregon.

One confirmation sample still indicated lead above the project cleanup level; however, because this sample was collected inside a fence surrounding a diesel fuel aboveground storage tank and surrounding soil samples were below the project cleanup level, no further excavation activities were conducted. In addition, confirmation sampling results indicated that the maximum concentration for lead remaining in soil is below its EPA Region 9 PRGs and maximum estimated background level as described in Section 2.6.5.1. The RME concentration calculated based on the results of the confirmation soil samples was below the project cleanup level. The revised post-removal risk assessment is presented in Attachment B.

2.6.3 Current Site Characteristics

As a result of the removal actions, RME concentrations for site-related COCs (antimony, arsenic, 4,4′-DDE, lead, selenium, and zinc) were below the project cleanup levels. The excavations were backfilled and vegetated with grass to match their original conditions.

2.6.4 Current and Potential Future Site and Resource Uses

Current Use. Currently, the HSSA has multiple flammable and hazardous materials storage lockers containing gasoline, paint, grease, oil, coolant, lubricants, and corrosives. A spill pallet containing batteries and one 55-gallon drum of oil is stored in this area. An aboveground diesel fuel storage tank and an aboveground diesel fuel pipeline are located adjacent to the HSSA.

Future Use. Planned future development at Ford Island includes an increase of residential and commercial land use and a reduction in industrial land use. There is no planned use of groundwater at the site.

2.6.5 Current Site Risks

The revised post-removal action human health and ecological screening risk assessment is summarized below and are presented in its entirety in Attachment B. Table 3-2 and Table 3-3 in Attachment B present a comparison of summary statistics to human and ecological cleanup levels, respectively. These tables also include maximum detected contaminant concentrations in soil after the removal action, associated Oahu caprock soil background concentrations in soil (Earth Tech 2006), RME concentrations, and the removal action cleanup levels.

2.6.5.1 Human Health Risk Summary

Confirmation sampling results indicated that maximum detected concentrations for all COCs, except arsenic, were below their respective EPA Region 9 residential and industrial soil PRGs. However, the maximum detected concentrations for arsenic in surface and subsurface soil were below its project cleanup level and background concentrations as described below.

Surface Soil. The RME based EPC for lead of 189 mg/kg exceeded its cleanup level of 170 mg/kg, which is below the residential PRG of 400 mg/kg for soil and maximum estimated background level of 203 mg/kg for caprock soil on Oahu (Earth Tech 2006). Cleanup levels for lead and arsenic were established during the Ford Island RI (Earth Tech 2003). As described in Section 2.5.5.1, the cleanup level of 200 mg/kg for lead in soil established during the RI was reduced to 170 mg/kg during the removal action (Shaw 2005). The maximum and RME based EPCs for 4,4′-DDE, antimony, arsenic, and selenium were all below their respective cleanup levels.

The cumulative maximum and RME carcinogenic risks (excess lifetime cancer risks) for surface soil under an assumed residential land use are 3E–05 and 2E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed industrial land use are 8E–06 and 5E–06, respectively, which exceed the 1E–06 point of departure. The maximum and RME based EPCs for arsenic exceeded the carcinogenic residential and industrial PRGs for soil. Arsenic accounts for nearly all of the carcinogenic risk but is present at background levels. As described in Section 2.5.5.1, carcinogenic risks from arsenic in caprock soil will almost always exceed the 1E–06 point of departure under naturally occurring conditions. However, the maximum and RME based EPC for arsenic of 13.3 and 8.53 mg/kg, respectively, are below the cleanup levels for arsenic (17 mg/kg site average and 22 mg/kg maximum concentration) that were established in the Ford Island RI (Earth Tech 2003c) and below the maximum background value (29 mg/kg) for caprock soil on Oahu (Earth Tech 2006).

The cumulative non-cancer hazards associated with potential exposure to the maximum and RME based EPCs in surface soil for residential land use are expressed as HIs of 0.8 and 0.6, respectively, which are below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME based EPCs in surface soil for industrial land use are expressed as HIs of 0.07 and 0.05, respectively, which are below 1. None of the chemicals had maximum or RME based EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Subsurface Soil. The maximum and RME based EPCs for 4,4′-DDE, antimony, arsenic, lead, selenium, and zinc were all below their respective cleanup levels.

The cumulative maximum and RME carcinogenic risks (excess lifetime cancer risks) for subsurface soil under an assumed residential land use are 4E–05 and 2E–05, respectively, which exceed the 1E-06 point of departure. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed industrial land use are 1E–05 and 4E–06, respectively, which exceed the 1E–06 point of departure. The maximum and RME based EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. Arsenic accounts for nearly all of the carcinogenic risk but is present at background levels. As described in Section 2.5.5.1, carcinogenic risks from arsenic in caprock soil will almost always exceed the 1E–06 point of departure under naturally occurring conditions. However, the maximum and RME based EPC for arsenic of 15.8 and 6.91 mg/kg, respectively, are below the cleanup values for arsenic (17 mg/kg site average and 22 mg/kg maximum concentration) that were established in the Ford Island RI (Earth Tech 2003c) and below the maximum background value (29 mg/kg) for caprock soil on Oahu (Earth Tech 2006).

The cumulative non-cancer hazards associated with potential exposure to the maximum and RME based EPCs for residential land use are expressed as HIs of 1 and 0.4, respectively, which do not exceed 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME based EPCs for industrial land use are expressed as HIs of 0.08 and 0.04, respectively, which do not exceed 1. None of the chemicals had maximum or RME based EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

2.6.5.2 *Ecological Risk Summary*

RME based EPCs for COCs for which confirmatory samples were collected were compared to project-specific ecological cleanup levels. Except for lead, none of the COCs had maximum or RME based EPCs that exceeded their respective project-specific soil cleanup levels; however, the maximum detected concentration for lead is below the upper estimated background concentration for caprock soil on Oahu (203 mg/kg) and DOH EAL (200 mg/kg). Lead is addressed in the risk summary found in Section 2.6.5.3. Although the maximum EPC for zinc did not exceed its cleanup level (620 mg/kg), the cleanup level for the 2003 removal action is higher than the maximum estimated background value of 193 mg/kg for zinc in caprock soil that was established after the removal action. However, both the maximum and RME based EPC for zinc are below the DOH soil EAL of 600 mg/kg.

2.6.5.3 *Overall Risk Summary*

The RME based EPCs for 4,4′-DDE, antimony, arsenic, selenium, and zinc in surface and subsurface soil and lead in subsurface soil were all below their respective cleanup levels. However, the RME EPC for lead in surface soil exceeded its cleanup level. The maximum concentration was used as the RME for lead. Although the maximum lead concentration exceeded the cleanup level of 170 mg/kg dry weight, the mean exposure is expected to be approximately 85 mg/kg dry weight, which is below the cleanup level. The carcinogenic risks associated with RME based EPCs in surface and subsurface soil for residential and industrial land use were greater than the 1E–06 point of departure. Almost all of the cumulative carcinogenic risk can be attributed to the RME based EPC for arsenic. However, the maximum and RME based EPC for arsenic is well below its cleanup level. The non-cancer hazards associated with RME based EPCs in surface and subsurface soil for residential and industrial land use were all below the point of departure of 1.

Except for lead as discussed above, none of the site soil COCs had maximum or RME based EPCs that exceeded their respective project-specific cleanup levels.

2.6.6 No Further Action Required

No further action is required at the HSSA to be protective of human health and the environment. Removal actions have met the objective of removing contaminants to acceptable cleanup levels and disposing of the waste streams generated by the removal actions (Shaw 2005).

2.7 32 TRANSFORMERS

2.7.1 Site Name, Location, and Description

Between December 1999 and April 2000, 55 Ford Island transformer sites were investigated (Earth Tech 2003c) to evaluate whether any PCB-containing dielectric fluid had been released to surface soil or concrete surfaces. Additional sampling was conducted in February 2001. RI fieldwork included the collection of surface soil and concrete wipe samples for PCB analysis. Only outdoor (non-restricted) areas were evaluated during the RI. Potentially impacted areas within buildings or other restricted areas are addressed by separate investigations through the PWC. Of the 55 transformers investigated during the RI, 32 transformer sites were determined to require NFA. The 32 transformers requiring NFA are:

- PM-212D
- S252D
- TB-01
- TC-02
- TC-03
- TC-05
- TC-06
- TC-08D
- TD-04
- TD-06
- TD-08
- TD-09
- TE-01
- TE-02
- TF-02
- TF-03
- TF-11
- TF-12
- TF-13
- TF-14
- TF-15
- TF-16
- TF-19
- TG-02D
- TG-05
- TG-11
- TG-12
- TI-01
- TI-02
- TI-05D
- TK-01D
- TL-02

2.7.2 Site History, Previous Investigations, and Removal Actions Completed

2.7.2.1 SITE HISTORY

Available historical records indicate that PCBs were present in the dielectric fluid used in many of the former and existing transformers on Ford Island. All the transformers on Ford Island have been replaced or retrofitted with non-PCB-containing dielectric fluid. The Revised WP (Earth Tech 2000b, Part 1) presents additional historical information regarding the Ford Island transformer PRLs.

2.7.2.2 REMEDIAL INVESTIGATION

During the RI, concrete wipe samples were collected in areas where the transformer or transformer building is surrounded by concrete (Earth Tech 2003c). Surface soil samples were collected from transformer sites not surrounded by concrete and from sites where the concrete apron stops within roughly 15 feet of the access point to the transformer or former transformer. To evaluate the presence of contaminants below adjacent asphalt surfaces, the asphalt was cored or chipped away, and a sample of the underlying surface soil was collected. A minimum of three sampling locations within each type of medium (surface soil, including soil underneath asphalt, and concrete) were located within 15 feet of each existing or former transformer location.

Sampling for PCBs in surface soil and/or on concrete was conducted at 55 transformer sites. PCBs were detected in surface soil at all 46 transformer sites where surface soil was collected, with total PCB concentrations exceeding the 1,000 micrograms per kilogram surface soil screening criterion at 23 transformer sites. PCBs were detected on concrete surfaces at 15 transformer sites, but all at concentrations below the 10 micrograms per 100 square centimeter concrete screening criterion.

Results of the human health PRE indicated that further action was required at 23 transformer sites due to PCB concentrations in soil. NFA was recommended for the remaining 32 transformer sites. The transformer sites recommended for NFA are listed above, and can be seen in Figure 2 and Attachment C (Figures C-2 through C-5).

2.7.2.3 Removal Actions Completed

No removal actions were necessary for these 32 transformer sites.

2.7.3 Current Site Characteristics

All surface soil and concrete surfaces had concentrations of PCBs below the project cleanup criteria (Toxic Substance Control Act [TSCA] high-occupancy screening level). Therefore there is no excess risk to human or ecological receptors and no further action is necessary.

2.7.4 Current and Potential Future Site and Resource Uses

Current Use. The transformer PRLs are located in locations of varying current residential and industrial land use.

Future Use. Planned future development at Ford Island includes an increase of residential and commercial land use and reductions in industrial land uses. There is no planned use of groundwater at the sites.

2.7.5 Current Site Risks

Results of the human health PRE and ecological SRA indicate that total PCB concentrations in surface soil at 32 transformer PRLs are below the TSCA high-occupancy screening level for unrestricted use; therefore, these PRLs are recommended for NFA. In addition, the potential risk to ecological receptors from the surface soil at all transformer PRLs is considered acceptable.

Based on the results of concrete wipe sampling, no concrete surface is impacted by PCBs at the transformer PRLs investigated. All concentrations of PCBs on concrete surfaces were below the screening criteria. Based on the preliminary risk screenings, no unacceptable risk to human or ecological receptors are associated with exposure to PCBs on concrete surfaces. Therefore, all concrete located at the transformer PRLs is recommended for NFA.

2.7.6 No Further Action Required

No further action is required to be protective of human health and the environment at the 32 transformer PRLs.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes to the proposed plan were required based on the public comments received (see Attachment D).

3. Responsiveness Summary

The public comment period for the PP was held between 25 February and 25 March 2008. The public meeting for the PP was held on 5 March 2008 at the Aiea Public Library. Responses to the written and verbal comments received during the comment period and public meeting are presented as a Responsiveness Summary in Attachment D of this ROD. The complete transcript of the public meeting is available in the Administrative Record file.

3.1 Stakeholder Issues and Lead Agency Responses

A written transcript of the public meeting conducted on 5 March 2008 was thoroughly reviewed by the Navy to prepare the Responsiveness Summary. The comments and questions from the public have been condensed to provide a better understanding of each specific issue. The Navy, in coordination with the EPA, and with concurrence from the DOH, has selected the final remedy for Bldg. 39, Bldg. 43, Bldg. 217, the Camel Refurbishing Area, the HSSA, and 32 transformer sites only after careful consideration of the public's comments on the PP.

3.2 Technical and Legal Issues

There are no technical or legal issues associated with the recommendation of NFA for the five HSSs and 32 transformer sites.

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Attachment A
RACR-Record of Decision Cross Reference Table

Table A-1: RACR-Record of Decision Cross-Reference Table

RACR Section Contents	Corresponding Record of Decision Section(s)
Overview- A brief discussion of: Site characteristics, Chemicals of potential concern, and Major findings and results of site investigation activities	2.1.2: Site History and Enforcement Activities Building 39 Site 2.2.1: Site Name, Location, and Description 2.2.2: Site History, Previous Investigations, and Removal Actions Completed 2.2.3: Current Site Characteristics Building 43 Site 2.3.1: Site Name, Location, and Description 2.3.2: Site History, Previous Investigations, and Removal Actions Completed 2.3.3: Current Site Characteristics Building 217 Site 2.4.1: Site Name, Location, and Description 2.4.2: Site History, Previous Investigations, and Removal Actions Completed 2.4.3: Current Site Characteristics Camel Refurbishing Area 2.5.1: Site Name, Location, and Description 2.5.2: Site History, Previous Investigations, and Removal Actions 2.5.3: Current Site Characteristics Hazardous Substance Storage Area 2.6.1: Site Name, Location, and Description 2.6.2: Site History, Previous Investigations, and Removal Actions Completed 2.6.3: Current Site Characteristics 32 Transformers 2.7.1: Site Name, Location, and Description 2.7.2: Site History, Previous Investigations, and Removal Actions Completed 2.7.3: Current Site Characteristics

RACR Section Contents	Corresponding Record of Decision Section(s)
B. Remedial Action Objectives- Identifies the remedial action objectives and cleanup standards specified in the Record of Decision, and subsequent modifications, if any.	Building 39 Site 2.2.2: Site History, Previous Investigations, and Removal Actions Completed Building 43 Site 2.3.2: Site History, Previous Investigations, and Removal Actions Completed Building 217 Site 2.4.2: Site History, Previous Investigations, and Removal Actions Completed Camel Refurbishing Area 2.5.2: Site History, Previous Investigations, and Removal Actions Hazardous Substance Storage Area 2.6.2: Site History, Previous Investigations, and Removal Actions Completed 32 Transformers 2.7.2: Site History, Previous Investigations, and Removal Actions Completed
C. Remedial Actions- Briefly discuss the remedial actions taken to meet the remedial objectives.	Building 39 Site 2.2.2: Site History, Previous Investigations, and Removal Actions Completed Building 43 Site 2.3.2: Site History, Previous Investigations, and Removal Actions Completed Building 217 Site 2.4.2: Site History, Previous Investigations, and Removal Actions Completed Camel Refurbishing Area 2.5.2: Site History, Previous Investigations, and Removal Actions Hazardous Substance Storage Area 2.6.2: Site History, Previous Investigations, and Removal Actions Completed 32 Transformers 2.7.2: Site History, Previous Investigations, and Removal Actions Completed

RACR Section Contents	Corresponding Record of Decision Section(s)
D. Demonstration of Completion- Presents information needed to demonstrate attainment of remedial objectives; e.g., final sampling report, visual inspection report.	Building 39 Site 2.2.2: Site History, Previous Investigations, and Removal Actions Completed Building 43 Site 2.3.2: Site History, Previous Investigations, and Removal Actions Completed Building 217 Site 2.4.2: Site History, Previous Investigations, and Removal Actions Completed Camel Refurbishing Area 2.5.2: Site History, Previous Investigations, and Removal Actions Hazardous Substance Storage Area 2.6.2: Site History, Previous Investigations, and Removal Actions Completed 32 Transformers 2.7.2: Site History, Previous Investigations, and Removal Actions Completed
E. Ongoing Activities- Describes the activities, if any, still being performed or to be performed, e.g., operations and maintenance, Five-Year Reviews.	Not Applicable.
F. Community Relations- Briefly summarizes the public outreach activities conducted at the site, e.g., community relations plan; the date the RAB was formed and terminated; the dates of public meetings; environmental justice initiatives.	2.1.2.4: Community Participation 3: Responsiveness Summary Attachment D, Responsiveness Summary
G. Certification Statement- A statement by a U.S. Navy representative authorized to sign Records of Decision, certifying that the RACR memorializes the completion of the remedial action objectives.	1.6: Signature and Support Agency Acceptance of Final Remedy

Attachment B
Revised Post-Removal Risk Assessment

Revised Post-Removal Risk Assessment, Hazardous Substance Sites

FORD ISLAND, PEARL HARBOR, HAWAII

March 2009

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
Pearl Harbor, HI 96860-3139

Naval Facilities Engineering Command
NAVFAC HAWAII

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-03-D-1837, CTO HC04

Revised Post-Removal Risk Assessment, Hazardous Substance Sites

FORD ISLAND, PEARL HARBOR, HAWAII

March 2009

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
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Prepared under:

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-03-D-1837, CTO HC04

CONTENTS

APPENDIX

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

4,4′-DDE	4,4′-dichlorodiphenyldichloroethene
Bldg.	Building
COC	contaminant of concern
EPA	Environmental Protection Agency, U.S.
EAL	Environmental Action Level
EPC	exposure point concentration
HI	hazard index
HSS	Hazardous Substance Site
HSSA	Hazardous Substance Storage Area
LUC	land use control
mg/kg	milligrams per kilogram
MDL	method detection limit
PRG	preliminary remediation goal
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	record of decision
SUF	site use factor
UCL	upper confidence level
U.S.	United States

1. Introduction

1.1 PURPOSE AND OBJECTIVES

Non-time-critical removal actions were conducted in 2003 at five Hazardous Substance Sites (HSSs): Building (Bldg.) 39, Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the Hazardous Substance Storage Area (HSSA). The removal actions included the removal of sediment from Bldgs. 39 and 43 storm drains, and soil from Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA. This report presents the post-removal human health and ecological risk assessments that document the estimated health risks associated with potential exposure to soil remaining after the 2003 removal actions taken at Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA located on Ford Island, Pearl Harbor Naval Complex, Hawaii. The purpose of this revised post-removal risk assessment is to demonstrate that the remaining soil at the five HSSs within the areas where the removal actions were conducted meets the project-specific cleanup levels, and does not present unacceptable risk to human or ecological receptors.

This risk assessment was originally completed in 2004 and included as an appendix to the *Final Remediation Verification Report, Non-Time Critical Removal Action, Ford Island Hazardous Substance Sites, Pearl Harbor Naval Complex, Hawaii* (Shaw 2005). The initial risk assessment included an evaluation of site data with background metals concentrations established during the Ford Island RI; however, background metals concentrations for Navy sites on Oahu were later established and agreed to by the Navy, EPA Region 9, and DOH in 2006 (Earth Tech 2006). In addition, DOH established Tier 1 Environmental Action Levels (EALs) in 2005, which were updated in 2008 (DOH 2008) and provide additional criteria that can be used to screen data and make recommendations for further action or no further action. This risk assessment is an update to the risk assessment originally completed in 2004 and includes an evaluation of site data with current Oahu background metals concentrations and Tier 1 Environmental Action Levels.

Although Bldg. 284 is not included in this record of decision (ROD), it has been retained in this revised post-removal risk assessment for consistency to document risks for all areas where the 2003 non-time-critical removal action was conducted. The 2003 non-time critical removal action included the removal (i.e., excavation and off-island disposal) of soil within a small area (approximately 60 feet × 30 feet × 9 feet) immediately adjacent to the north side of Bldg. 284 that was impacted by Bldg. 284 former industrial operations. It was determined that the 2003 cleanup goals were met and the soil remaining adjacent to the building does not present unacceptable risks to human and ecological receptors. However, samples collected during the 2003 removal action and subsequent sampling events indicated that elevated metals concentrations were present in surface and subsurface soil in the unpaved area between the limits of the 2003 excavation and a historic seaplane ramp located approximately 500 feet northwest of Bldg. 284. The contamination along the shoreline was attributed to concrete and metal debris disposed of along the shoreline and not the former Bldg. 284 industrial operations. Therefore, an additional removal action that included the construction of a cap and shoreline revetment was conducted along the entire unpaved area between Bldg. 284 and the historic seaplane ramp. Land use controls and long-term groundwater monitoring will be required at Bldg. 284 to ensure the cap and revetment remain protective of human and ecological receptors as described in *Record of Decision, Building 284 and Former Buildings 80 and 302, Ford Island, Pearl Harbor Naval Complex, Oahu, Hawaii* (DON 2009).

1.2 BACKGROUND

Detailed information regarding the remedial investigation (RI) (e.g., nature and extent of contamination, contaminant transport and fate) is contained in the Ford Island RI Report (Earth Tech 2003) and details regarding the activities and confirmation sampling conducted during the removal actions are presented in the Remediation Verification Report (Shaw 2005). However, where appropriate, information that is relevant to the interpretation of the risk evaluation has been summarized and included herein to provide the facts that were considered prior to completing the risk evaluation.

1.2.1 Bldg. 39, Former Engine and Aircraft Overhaul Facility

Unacceptable risks associated with contaminants in the sediment within the storm drain lines at Bldg. 39 were reported in the RI (Earth Tech 2003). The contaminants of concern (COC) that posed unacceptable risk in the sediment samples from the Bldg. 39 storm drain lines were antimony, cadmium, chromium, copper, lead, nickel, silver, and zinc. Additionally, 2-methylphenol was a COC in a liquid sample from a sump pit at Bldg. 39. Because of the unacceptable risks, the sediment in storm drain lines and liquid in the sump pit associated with Bldg. 39 were removed from the floor drain lines and the floor drains were grouted to prevent migration of contaminated sediments and liquids to Pearl Harbor (Shaw 2005). Because COCs were not identified in the soil at Bldg. 39, confirmatory soil samples were not collected and, therefore, not evaluated in this risk assessment.

1.2.2 Bldg. 43, Former Paint and Oil Storehouse

Unacceptable risks associated with the contaminants in the sediment in the storm drain line at Bldg. 43 were reported in the RI (Earth Tech 2003). The COCs that posed unacceptable risk in sediment from the Bldg. 43 storm drain line were arsenic, copper, lead, mercury, nickel, silver, and zinc. Because of the unacceptable risks, the sediment in storm drain line associated with Bldg. 43 was removed to prevent migration of contaminated sediments to Pearl Harbor. In addition to the contaminants in the sediment, benzo(a)pyrene was detected in a subsurface soil sample collected adjacent to the storm drain line at a concentration of 190 micrograms per kilogram(µg/kg). Because of potential human health risks associated with benzo(a)pyrene, soils with benzo(a)pyrene concentrations exceeding the project cleanup level were removed and additional soil samples were collected to confirm that concentrations of benzo(a)pyrene were below the cleanup level of 62 ug/kg, which was based on the EPA Region 9 residential soil preliminary remediation goal (PRG). Confirmation and RI soil sampling locations at Bldg. 43 are shown on Figure 1-1 and the analytical results are listed in Table A-1, Appendix A.

1.2.3 Bldg. 284, Former Aviation Engine Test Cell Facility

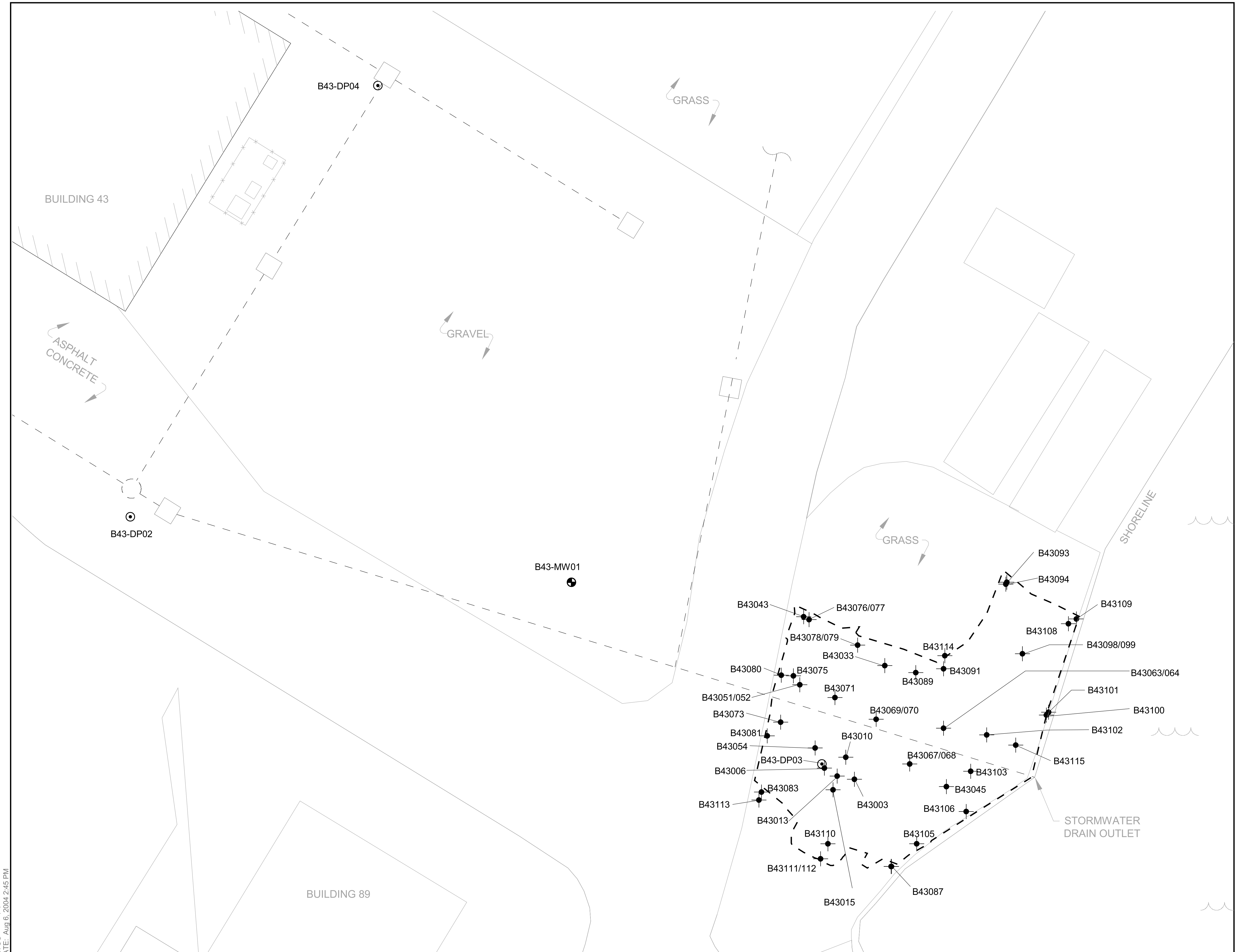
Unacceptable risks associated with the contaminants in the surface and subsurface soils at Bldg. 284 were reported in the RI (Earth Tech 2003). The COCs in the surface and subsurface soils at Bldg. 284 were arsenic, beryllium, cadmium, lead, mercury, and selenium. Because of the unacceptable risks associated with these contaminants, soils with concentrations of COCs exceeding project cleanup levels were removed and additional soil samples were collected to confirm that concentrations of COCs were below cleanup levels. Confirmation and RI soil sampling locations at Bldg. 284 are shown on Figure 1-2 and the analytical results are listed in Table A-2, Appendix A. The portion of the Bldg 284 site discussed herein is specific to the area addressed in the 2004 non-time-critical removal action. This area is located within the land use control (LUC) boundary for the entire Bldg 284 Site, which includes the area adjacent to Bldg. 284 and the unpaved area along the shoreline to the northwest.

1.2.4 Camel Refurbishing Area

Unacceptable risks associated with contaminants in the soil at the Camel Refurbishing Area were reported in the RI (Earth Tech 2003). The COCs in the soil were arsenic, copper, lead, selenium, and zinc. Because of the unacceptable risk associated with these contaminants, soils with concentrations of COCs exceeding project-specific cleanup levels were removed and additional soil samples were collected to confirm that concentrations of COCs are below cleanup levels. Confirmation and RI soil sampling locations at the Camel Refurbishing Area are shown on Figure 1-3 and the analytical results are listed in Table A-3, Appendix A.

1.2.5 Hazardous Substance Storage Area

Unacceptable risks associated with contaminants in the soil at the HSSA were reported in the RI (Earth Tech 2003). The COCs in the soil were 4,4′-dichlorodiphenyldichloroethene (4,4′-DDE), arsenic, lead, selenium, and zinc. Because of the unacceptable risk associated with these contaminants, soils with concentrations exceeding project-specific cleanup levels were removed. Additionally, subsurface soil containing concentrations of antimony above background was removed. Antimony was initially detected in the subsurface soil at levels above background. However, antimony was not considered a COC at the site because subsurface soil was not considered a complete exposure pathway. However, during the course of the investigation, it was determined that antimony could potentially pose an ecological risk and, therefore, was evaluated as a COC at the HSSA. Confirmation and RI soil sampling locations at the HSSA are shown on Figure 1-4 and the analytical results are listed in Table A-4, Appendix A..



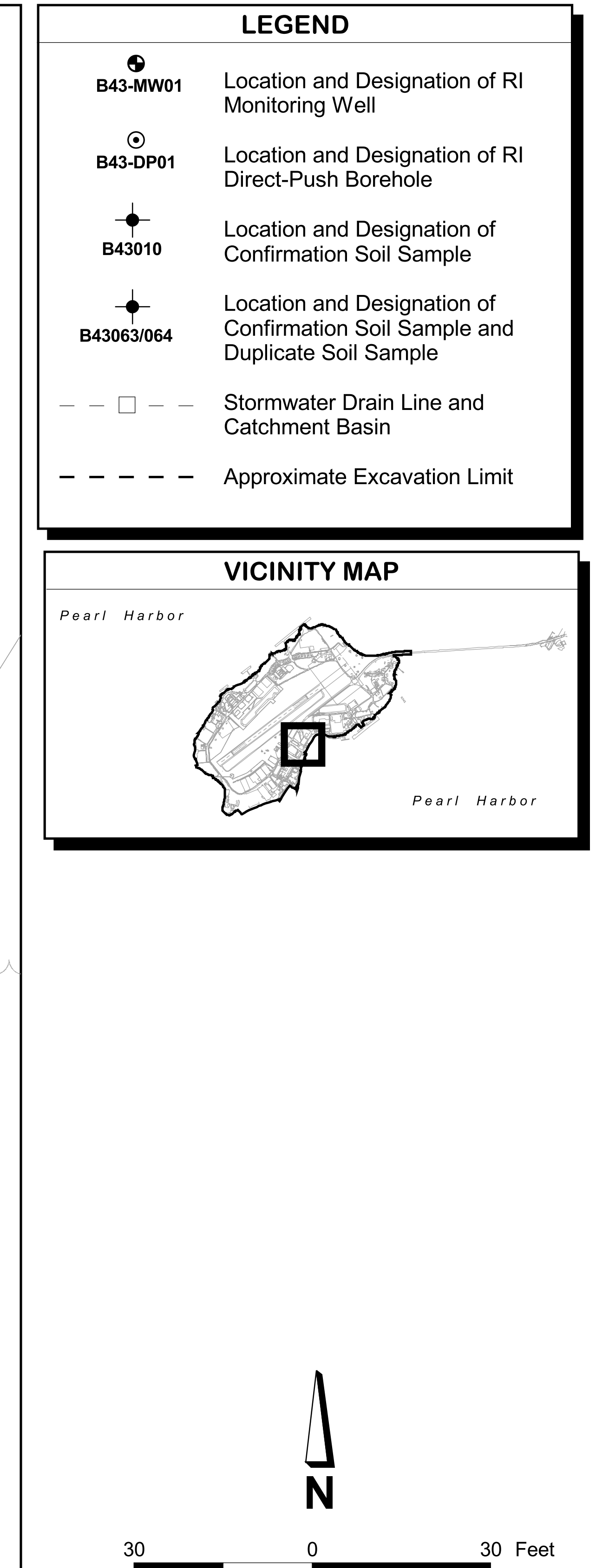


Figure 1-1
Site Map and Sampling Locations
Building 43, Stormwater Drain Line
Ford Island, Pearl Harbor Naval Complex
Oahu, Hawaii

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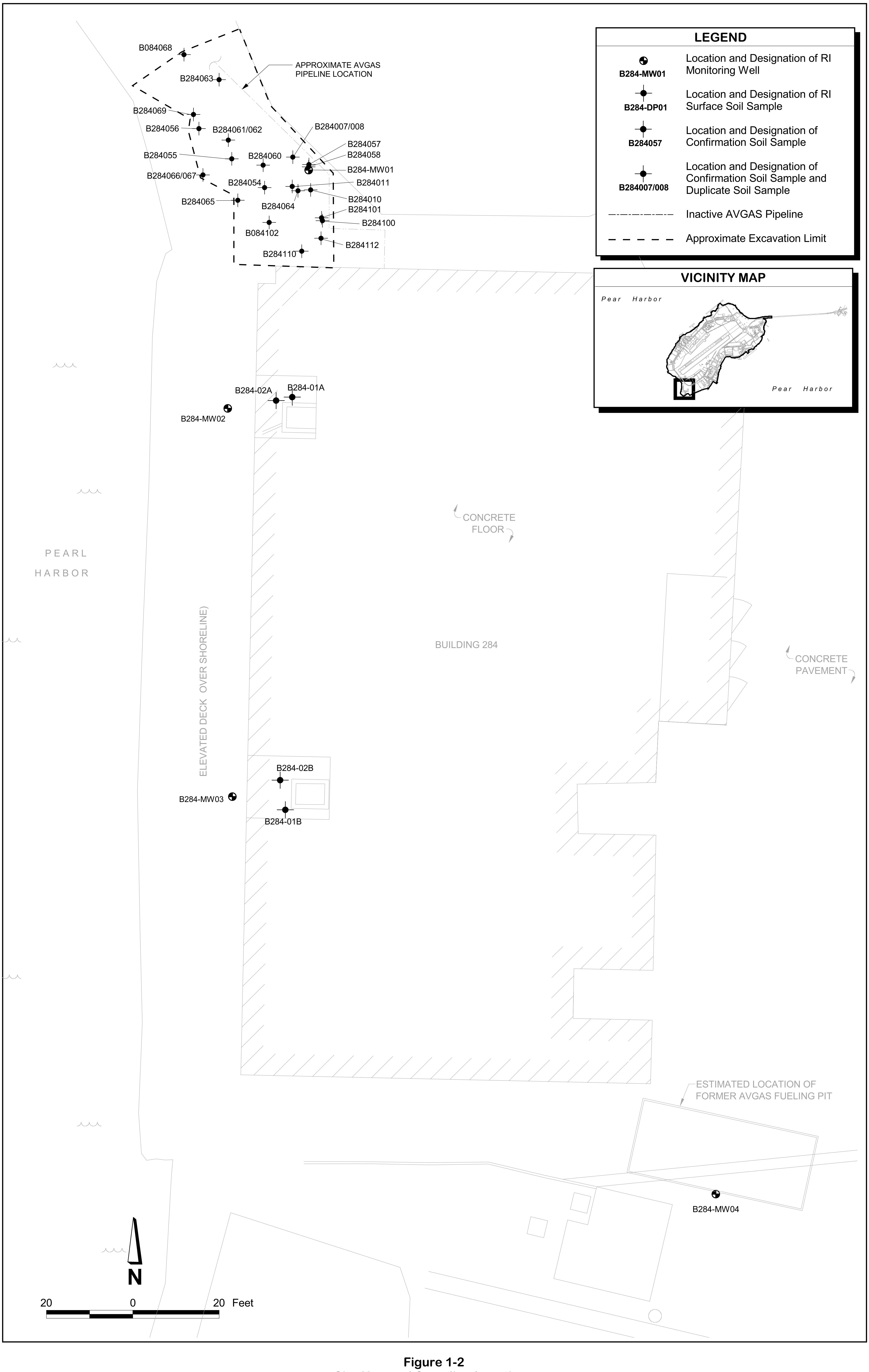

Figure 1-2
Site Map and Sampling Locations
Building 284 Engine Test Cell
Ford Island, Pearl Harbor Naval Complex
Oahu, Hawaii

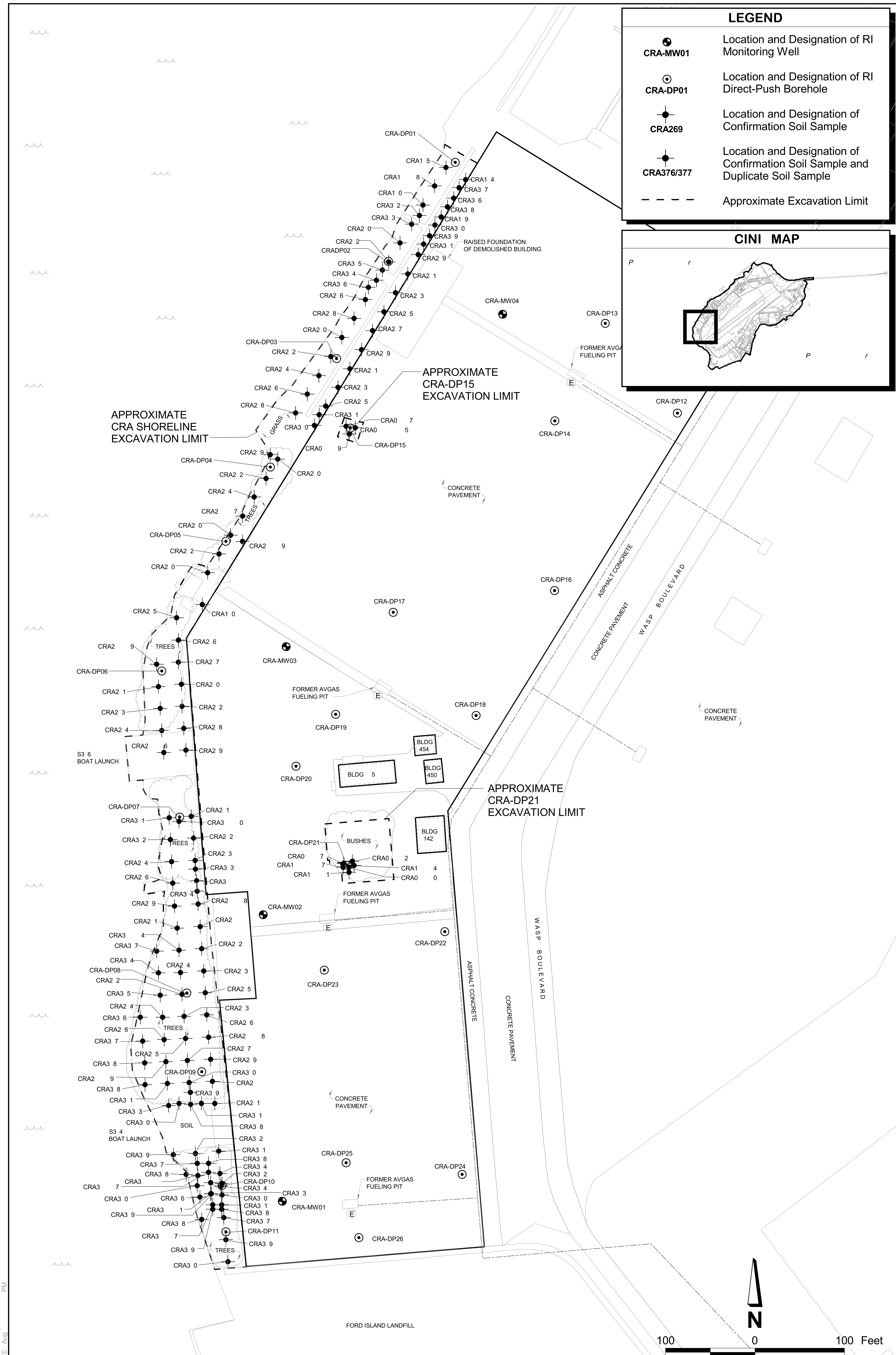

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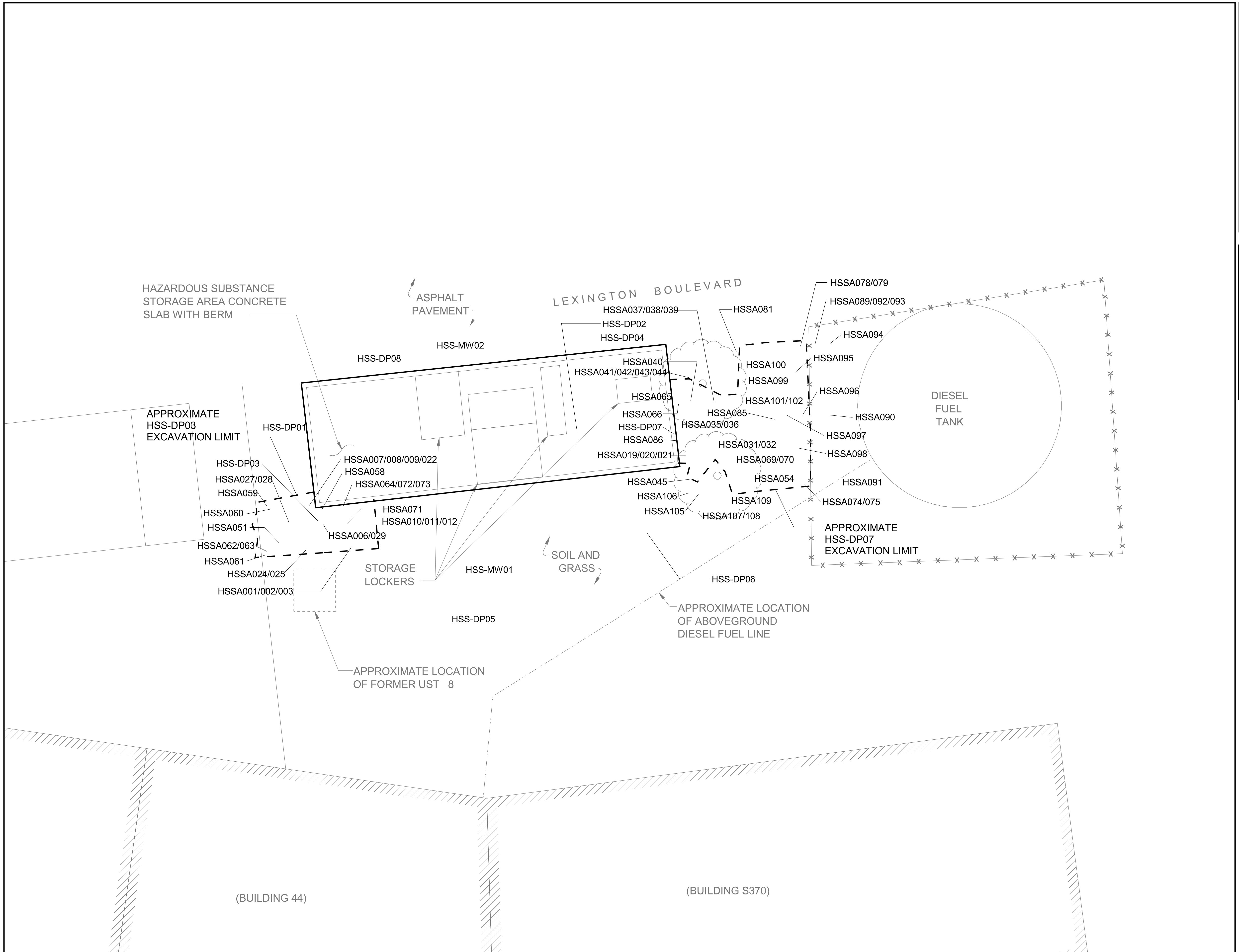
Figure 1-3
Site Map and Sample Locations
Camel Refurbishing Area
Ford sland, Pearl Harbor Naval Complex
Oahu, Hawaii



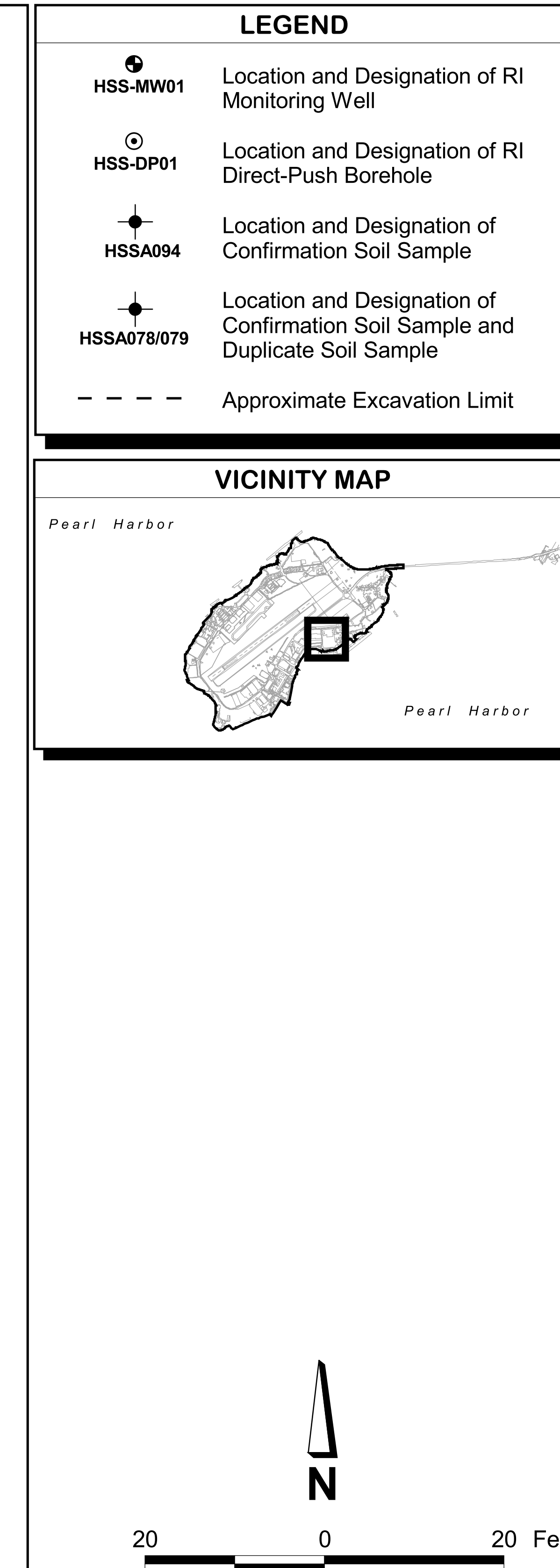


Figure 1-4
Site Map and Sampling Locations
Hazardous Substance Storage Area
Ford Island, Pearl Harbor Naval Complex
Oahu, Hawaii

1.2.6 Summary

As described in the Final Remediation Verification Report (Shaw 2005), contaminated sediment was removed from storm drain lines at Bldgs. 39 and 43; contaminated liquid in the sump at Bldg. 39 was removed; contaminated liquid from the oil/water separators at Bldg. 284 was removed; and contaminated soils from Bldgs. 43 and 284, the Camel Refurbishing Area, and the HSSA were removed. The remaining unremediated soil at Bldg. 284, Bldg. 43, the Camel Refurbishing Area, and the HSSA was sampled and analyzed for the COCs.

1.3 SAMPLING

Confirmatory samples of soils at Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA were collected to confirm the removal of contaminated soil above project-specific cleanup levels.

1.4 HUMAN HEALTH RISK EVALUATION

The human health risk evaluation quantitatively focused on the potential for human exposure to remaining unremediated surface and subsurface soil at Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA. Confirmatory data were compared to project-specific cleanup levels to determine whether the cleanup goals were met. Cleanup levels are discussed in Section 3.

Additionally, the confirmatory data were compared to the United States (U.S.) Environmental Protection Agency (EPA) Region 9 residential and industrial PRGs (EPA Region 9 2004) to ascertain the cancer risks and non-cancer hazards associated with the remaining unremediated soil.

1.5 ECOLOGICAL RISK EVALUATION

The ecological risk evaluation quantitatively focused on the potential for exposure of ecological receptors to unremediated surface and subsurface soil at Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA and sediments in storm drains at Bldgs. 39 and 43. Confirmatory data were compared to project-specific cleanup levels (Section 3) to determine whether the ecological cleanup goals were met. In addition, the data have been compared to background levels for caprock soil on Oahu (Earth Tech 2006), which were developed after completion of the removal actions and agreed upon by the Navy, EPA Region 9, and DOH in 2006 for use on all Navy sites on Oahu. No sediments remained in the storm drains to sample.

1.5.1 Sediments

Sediments containing chemicals that could migrate to Pearl Harbor and contribute to the risk of the benthic community were identified in the storm drains associated with Bldgs. 39 and 43 during the RI. These sediments were removed and disposed of off site. After completion of the 2003 removal actions, no sediments were present in the storm drains that can migrate to the harbor. Since this exposure pathway has been removed, risk associated with the former sediments is considered acceptable.

1.5.2 Soils

Confirmatory analytical results from surface and subsurface soil samples collected during the 2003 removal actions and remaining RI soil samples were combined to estimate potential future exposure concentrations for ecological receptors. Only metals were identified as a potential source of risk to terrestrial receptors at Ford Island. Confirmatory data (i.e., 95 percent upper confidence level [UCL] or the maximum detected concentration) were used to represent chronic exposure concentrations that were compared to project-specific cleanup levels to determine whether the cleanup goals were met.

2. Data Evaluation

Following the collection of the confirmatory soil samples, statistics were generated for all data reflecting the remaining soil conditions at each site. These data include all confirmatory soil samples and all data from the RI (Earth Tech 2003) for all sampling locations that were not excavated. Analytical results for each site were subdivided into surface soil (soil samples collected at depths less than 0.5 feet below ground surface) or subsurface soil (soil samples collected at depths greater than 0.5 feet below ground surface) and analyzed accordingly. For the Camel Refurbishing Area, subsurface soil data were further subdivided into paved and unpaved conditions to account for future land use scenarios. Below is a description of the statistical methodology, data reduction, and summary of the generated statistics.

2.1 Statistical Methodology

For both human health and ecological risk assessments, exposure to chemicals detected in site media is generally quantified using average chemical concentrations. Results from field sampling provide a method of estimating the true average concentration of the entire population of infinite sampling points. Because the sample set is only a portion of the true population, uncertainty exists in the accuracy of the estimated average. To account for this uncertainty, the 95 percent UCL of the sample set is often used as a conservative estimate of the true population mean (or average). The accuracy of risk estimates, and ultimately proper risk management decisions, depend in part on the ability to compute a reliable, conservative, and stable 95 percent UCL of the population arithmetic average using the available data. As described in Section 1.1, this risk assessment was initially completed in 2004 and has been updated to include background concentrations established in 2006 for metals in soil at Navy sites on Oahu (Earth Tech 2006) as well as Tier 1 EALs established by DOH (DOH 2008). The 95 percent UCL was calculated using ProUCL version 3.0, which was available in 2004 and has since been replaced by ProUCL version 4.00.02. Although a newer version of ProUCL is available, use of the newer version should not significantly change risk estimates or risk management decisions because of the following:

- The main risk driver is arsenic, which had few non-detections; therefore, both versions should produce similar UCL estimates of the mean;
- Estimates of exposure point concentrations (EPCs) is likely conservative when one-half the reporting limit is used as proxy values for non-detections (as mentioned by Singh in the User's Guide of ProUCL Version 4.00.02);
- Management recommendation for the site is for No Further Action (NFA), which would not change had the newer version been used.

Computation of a 95 percent UCL of the population mean depends upon the distribution of the data. Because many environmental data sets are positively skewed, data were previously assumed to follow a lognormal distribution (EPA 1992b; EPA 2002). Standard protocol had been to compute the 95 percent UCL based on the lognormal distribution using the H-statistic developed by Land (1971, 1975). Recent evaluation of the accuracy in using the H-statistic has identified certain circumstances (as when the data are highly skewed), in which the H-statistic exceeded the maximum detection or the 99th (or 95th) data quantile by orders of magnitude (Hardin and Gilbert 1993, Singh 1999, Singh et al. 1997, as reported in the ProUCL user guide [EPA 2001]). The H-statistic provided too conservative an estimate of the average chemical concentration. In these circumstances, maximum chemical concentrations were used as representative exposure point concentrations (EPCs).

The EPA developed the ProUCL software (version 3) to test for data distribution and avoid the shortcomings of assuming all environmental data are lognormally distributed (EPA 2001) and to streamline assumptions being made by those evaluating site data across various sites and regions of the United States. Several parametric and non-parametric UCL computation procedures are provided in the program to compute a conservative and stable UCL of the population mean (Singh 1999, Singh et al. 1997). The ProUCL software computes the various summary statistics for raw and natural log-transformed data.

Because the ProUCL software (version 3) currently cannot handle non-detected values or missing data, or make judgments on the "usability" of the data, a number of data evaluation (or reduction) procedures are required before the data are input for processing. The following steps were conducted on the raw data to process the data before input into the ProUCL program:

- Data sets with 10 or fewer detected results automatically default to the maximum detection as the EPC, with no calculation of the 95 percent UCL using ProUCL. This step is taken to help reduce the uncertainty in the 95 percent UCL because a small sample data set with a small number of detections provides a poor estimate of the mean or average concentration (that is, the EPC [EPA 1992b]).
- Any rejected (or R-flagged) data of a set with at least 11 detections are removed from the data set and replaced by a "dummy" value (i.e., 1E+99) that represents a necessary placeholder in a column of data values. This step is taken because R-qualified (or rejected) data are not used in the quantitative risk assessment (EPA 1992a).
- Any reporting limit for a nondetection that is twice as great as the maximum detected concentration is removed as a rejected datum and replaced with a "dummy" value. This step is taken to reduce the uncertainty and bias of the 95 percent UCL because the use of nondetections that are twice the value of the maximum detected concentration would bias high the value of the 95 percent UCL.
- When a sample result is a nondetection, the sample reporting limit (RL) is replaced with a proxy value of one-half the RL for purposes of computing the 95 percent UCL. This step is a conservative measure because it assigns a value of one-half the RL to a result that was reported as a nondetection; this step is standard procedure when handling nondetections in quantitative risk assessment (EPA 1989).
- An original sample and its duplicate sample result (where taken) for a given chemical are averaged to yield a single datum. This step is taken to reduce any bias that results from including both an original sample and its duplicate result. The duplicate pair, or "Duplicates," were treated in the following manner:
  - When both the original sample and field duplicate results for the chemical were above the RL, both values were averaged to obtain an average concentration for the sample pair before the statistical summary was performed.
  - When one sample of the duplicate pair had a concentration that was a nondetection for the chemical while the other exceeded the RL, the nondetection value was assigned a value of one-half its RL and was then averaged with the detected concentration. If a qualifier existed on the detected concentration, that qualifier remained with the "averaged" value.
  - When both the original sample and field duplicate results for a given chemical were nondetections, the two values (i.e., the RLs) were averaged to obtain an average RL for the sample pair. Because the sample pair result is a nondetection, a proxy value of one-half the RL is assigned as the sample value used in the 95 percent UCL; the assignation of this proxy value is standard risk assessment procedure and is used as a conservative measure because it presumes/assumes the chemical is present in the sample at a

concentration of one-half the RL, when in fact no detection was reported. In this case, the underestimation of risk due to use of a “biased low” data set (resulting from assigning the proxy concentration twice during the process for both the original sample and its duplicate) was minimized.

The most recent version of ProUCL (Version 4.0) developed in 2007 has the capability of working with censored data (EPA 2007). The greatest change in its application is the ability to accommodate non-detections and to estimate UCL concentrations for data sets with as few as 2 or 4 detections. However, summary statistics for the site were not re-calculated using the newer version of ProUCL. The use of maximum detected concentrations for those COPCs with fewer than 11 detections is likely conservative (i.e., result in higher EPCs) in estimating human health risks than the use of average concentration (or UCL of the mean concentrations) as modeled by the newer version.

Once the data have been properly processed and entered into the program, ProUCL provides a recommended value for the UCL of each chemical based upon the data distribution. For a data set that poorly follows any of the theoretical distributions (termed non-parametric), a recommended non-parametric UCL is provided. Summary statistics, including the number of observations, maximum and minimum values, and standard deviation, are available for raw and log-transformed data sets.

2.2 PROXY VALUES FOR NON-DETECTIONS

The ProUCL methodology described above in Section 2.1 indicates that one-half the RL is used as a proxy value for those samples that are non-detections in the generation of statistics. However, in some instances, a RL was not available for a sample. In these instances, one half the method detection limit (MDL) was used as the proxy value. Additionally, some sample results that were originally designated as estimated detections between the MDL and RL were later qualified as non-detections due to the presence of the analyte in associated laboratory blanks. In these instances, one half the formerly estimated detection, but subsequently qualified as a non-detection, was used. Sample results having proxy values other than one half the RL for non-detections are presented in Table 2-1. The uncertainty associated with these samples is discussed in further detail in the uncertainty section.

2.3 SUMMARY STATISTICS

Summary statistics (e.g., frequency of detection, maximum values, available 95 percent UCL) for the COCs in the four areas of this evaluation in surface and subsurface soil are summarized in Table 3-2 and Table 3-3. A 95 percent UCL was not estimated for some of the COCs at the four areas of concern because of the low number of samples and detections. Based on an interpretation of the EPA’s guidance on calculating UCLs for EPCs (EPA 2002 and 1992a), it was determined that the maximum detected value would be used as the reasonable maximum exposure (RME) EPC for chemicals with less than 11 detections in the data set.

Table 2-1: Non-Detect Samples with Alternate Proxy Values

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
Samples using Proxy Values that are 1/2 the MDL					
BERYLLIUM	B284007	Bldg. 284	0.005	0.0049	UJ
BERYLLIUM	B284010	Bldg. 284	0.005	0.0052	UJ
BERYLLIUM	B284011	Bldg. 284	0.004	0.0045	UJ
BERYLLIUM	B284054	Bldg. 284	0.005	0.0052	UJ
BERYLLIUM	B284055	Bldg. 284	0.005	0.005	UJ
BERYLLIUM	B284056	Bldg. 284	0.005	0.0048	UJ

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
BERYLLIUM	B284057	Bldg. 284	0.005	0.0046	UJ
BERYLLIUM	B284058	Bldg. 284	0.005	0.0049	UJ
BERYLLIUM	B284060	Bldg. 284	0.005	0.0049	UJ
BERYLLIUM	B284061	Bldg. 284	0.005	0.0049	UJ
BERYLLIUM	B284062	Bldg. 284	0.005	0.0048	UJ
BERYLLIUM	B284063	Bldg. 284	0.005	0.0049	UJ
BERYLLIUM	B284064	Bldg. 284	0.004	0.0041	UJ
BERYLLIUM	B284065	Bldg. 284	0.005	0.005	UJ
BERYLLIUM	B284066	Bldg. 284	0.004	0.0041	UJ
BERYLLIUM	B284067	Bldg. 284	0.004	0.0041	UJ
BERYLLIUM	B284068	Bldg. 284	0.004	0.0041	UJ
BERYLLIUM	B284069	Bldg. 284	0.005	0.0047	UJ
CADMIUM	B284010	Bldg. 284	0.014	0.014	UJ
CADMIUM	B284011	Bldg. 284	0.012	0.012	UJ
CADMIUM	B284055	Bldg. 284	0.014	0.014	UJ
CADMIUM	B284061	Bldg. 284	0.013	0.013	UJ
CADMIUM	B284067	Bldg. 284	0.011	0.011	UJ
CADMIUM	B284068	Bldg. 284	0.011	0.011	UJ
LEAD	B284064	Bldg. 284	0.51	0.51	UJ
LEAD	B284066	Bldg. 284	0.51	0.51	UJ
LEAD	B284067	Bldg. 284	0.51	0.51	U
LEAD	B284068	Bldg. 284	0.51	0.51	UJ
SELENIUM	B284008	Bldg. 284	1.6	1.6	U
SELENIUM	B284010	Bldg. 284	0.091	0.091	U
SELENIUM	B284011	Bldg. 284	0.077	0.077	UJ
SELENIUM	B284054	Bldg. 284	1.4	1.4	UJ
SELENIUM	B284055	Bldg. 284	1.4	1.4	UJ
SELENIUM	B284056	Bldg. 284	1.3	1.3	UJ
SELENIUM	B284057	Bldg. 284	1.3	1.3	UJ
SELENIUM	B284058	Bldg. 284	1.3	1.3	UJ
SELENIUM	B284061	Bldg. 284	1.3	1.3	UJ
SELENIUM	B284063	Bldg. 284	1.4	1.4	UJ
SELENIUM	B284064	Bldg. 284	1.1	1.1	UJ
SELENIUM	B284066	Bldg. 284	1.1	1.1	UJ
SELENIUM	B284067	Bldg. 284	1.1	1.1	UJ
SELENIUM	B284068	Bldg. 284	1.1	1.1	UJ
SELENIUM	B284069	Bldg. 284	1.3	1.3	UJ
SELENIUM	B284100	Bldg. 284	1.3	5.9	UJ
ARSENIC	CRA069	CRA	2	2	U
ARSENIC	CRA219	CRA	1.3	1.3	UJ
ARSENIC	CRA220	CRA	1.3	1.3	U
ARSENIC	CRA226	CRA	1.4	1.4	U
ARSENIC	CRA227	CRA	1.2	1.2	U
ARSENIC	CRA228	CRA	1.3	1.3	U
ARSENIC	CRA232	CRA	1.3	1.3	UJ

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
ARSENIC	CRA234	CRA	1.3	1.3	UJ
ARSENIC	CRA235	CRA	1.2	1.2	UJ
ARSENIC	CRA236	CRA	1.3	1.3	UJ
ARSENIC	CRA238	CRA	1.3	1.3	UJ
ARSENIC	CRA240	CRA	1.3	1.3	UJ
ARSENIC	CRA248	CRA	1.2	1.2	UJ
ARSENIC	CRA249	CRA	1.2	1.2	UJ
ARSENIC	CRA250	CRA	1.3	1.3	UJ
ARSENIC	CRA252	CRA	1.3	1.3	UJ
ARSENIC	CRA255	CRA	1.2	1.2	UJ
ARSENIC	CRA256	CRA	1.2	1.2	UJ
ARSENIC	CRA257	CRA	1.2	1.2	UJ
ARSENIC	CRA263	CRA	1.1	1.1	UJ
ARSENIC	CRA265	CRA	1.2	1.2	UJ
ARSENIC	CRA266	CRA	1.2	1.2	UJ
ARSENIC	CRA268	CRA	1.1	1.1	UJ
ARSENIC	CRA270	CRA	1.2	1.2	UJ
ARSENIC	CRA271	CRA	1.2	1.2	UJ
ARSENIC	CRA272	CRA	1.2	1.2	UJ
ARSENIC	CRA273	CRA	1.1	1.1	UJ
ARSENIC	CRA274	CRA	1.2	1.2	UJ
ARSENIC	CRA276	CRA	1.1	1.1	UJ
ARSENIC	CRA277	CRA	1.1	1.1	UJ
ARSENIC	CRA278	CRA	1.1	1.1	UJ
ARSENIC	CRA279	CRA	1.1	1.1	UJ
ARSENIC	CRA280	CRA	1.1	1.1	UJ
ARSENIC	CRA281	CRA	1.1	1.1	UJ
ARSENIC	CRA282	CRA	1.1	1.1	UJ
ARSENIC	CRA283	CRA	1.1	1.1	UJ
ARSENIC	CRA296	CRA	1.1	1.1	UJ
ARSENIC	CRA300	CRA	1.1	1.1	UJ
ARSENIC	CRA301	CRA	1.1	1.1	UJ
ARSENIC	CRA304	CRA	1.1	1.1	UJ
ARSENIC	CRA305	CRA	0.11	0.11	UJ
ARSENIC	CRA306	CRA	1.3	1.3	UJ
ARSENIC	CRA307	CRA	0.084	0.084	UJ
ARSENIC	CRA331	CRA	0.88	0.88	UJ
ARSENIC	CRA339	CRA	0.85	0.85	UJ
ARSENIC	CRA341	CRA	0.92	0.92	UJ
ARSENIC	CRA356	CRA	1.1	1.1	UJ
ARSENIC	CRA357	CRA	0.95	0.95	UJ
ARSENIC	CRA358	CRA	0.87	0.87	UJ
ARSENIC	CRA359	CRA	1	1	UJ
LEAD	CRA233	CRA	0.61	0.61	UJ
LEAD	CRA279	CRA	0.57	0.57	UJ

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
LEAD	CRA285	CRA	0.57	0.57	UJ
SELENIUM	CRA159	CRA	1.4	1.4	UJ
SELENIUM	CRA160	CRA	1.5	1.5	UJ
SELENIUM	CRA219	CRA	1.4	1.4	U
SELENIUM	CRA221	CRA	1.4	1.4	U
SELENIUM	CRA223	CRA	1.4	1.4	U
SELENIUM	CRA225	CRA	1.3	1.3	U
SELENIUM	CRA226	CRA	1.5	1.5	U
SELENIUM	CRA227	CRA	1.4	1.4	U
SELENIUM	CRA228	CRA	1.4	1.4	U
SELENIUM	CRA229	CRA	1.4	1.4	U
SELENIUM	CRA231	CRA	1.4	1.4	UJ
SELENIUM	CRA232	CRA	1.4	1.4	UJ
SELENIUM	CRA233	CRA	1.3	1.3	UJ
SELENIUM	CRA234	CRA	1.5	1.5	UJ
SELENIUM	CRA235	CRA	1.3	1.3	UJ
SELENIUM	CRA236	CRA	1.4	1.4	UJ
SELENIUM	CRA238	CRA	1.4	1.4	UJ
SELENIUM	CRA239	CRA	1.4	1.4	UJ
SELENIUM	CRA240	CRA	1.4	1.4	UJ
SELENIUM	CRA242	CRA	1.3	1.3	UJ
SELENIUM	CRA244	CRA	1.3	1.3	UJ
SELENIUM	CRA246	CRA	1.4	1.4	UJ
SELENIUM	CRA247	CRA	1.5	1.5	UJ
SELENIUM	CRA248	CRA	1.3	1.3	UJ
SELENIUM	CRA249	CRA	0.82	0.82	UJ
SELENIUM	CRA250	CRA	0.88	0.88	U
SELENIUM	CRA252	CRA	0.89	0.89	UJ
SELENIUM	CRA255	CRA	0.83	0.83	U
SELENIUM	CRA257	CRA	0.85	0.85	UJ
SELENIUM	CRA258	CRA	0.8	0.8	UJ
SELENIUM	CRA259	CRA	0.82	0.82	UJ
SELENIUM	CRA261	CRA	0.83	0.83	UJ
SELENIUM	CRA262	CRA	0.82	0.82	UJ
SELENIUM	CRA263	CRA	0.8	0.8	U
SELENIUM	CRA264	CRA	0.84	0.84	UJ
SELENIUM	CRA268	CRA	0.8	0.8	U
SELENIUM	CRA269	CRA	0.82	0.82	U
SELENIUM	CRA270	CRA	0.86	0.86	UJ
SELENIUM	CRA271	CRA	0.83	0.83	U
SELENIUM	CRA272	CRA	0.86	0.86	U
SELENIUM	CRA273	CRA	0.79	0.79	U
SELENIUM	CRA274	CRA	0.82	0.82	U
SELENIUM	CRA276	CRA	0.77	0.77	U
SELENIUM	CRA277	CRA	0.8	0.8	U

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
SELENIUM	CRA278	CRA	0.79	0.79	U
SELENIUM	CRA279	CRA	0.79	0.79	U
SELENIUM	CRA280	CRA	0.77	0.77	U
SELENIUM	CRA281	CRA	0.77	0.77	U
SELENIUM	CRA282	CRA	0.78	0.78	U
SELENIUM	CRA283	CRA	0.76	0.76	U
SELENIUM	CRA284	CRA	0.78	0.78	U
SELENIUM	CRA285	CRA	0.78	0.78	U
SELENIUM	CRA286	CRA	0.87	0.87	U
SELENIUM	CRA287	CRA	0.77	0.77	U
SELENIUM	CRA288	CRA	0.12	0.12	UJ
SELENIUM	CRA289	CRA	0.12	0.12	U
SELENIUM	CRA290	CRA	0.14	0.14	U
SELENIUM	CRA291	CRA	0.13	0.13	U
SELENIUM	CRA292	CRA	0.12	0.12	U
SELENIUM	CRA293	CRA	0.12	0.12	UJ
SELENIUM	CRA294	CRA	0.13	0.13	UJ
SELENIUM	CRA295	CRA	0.12	0.12	UJ
SELENIUM	CRA296	CRA	0.08	0.08	U
SELENIUM	CRA297	CRA	0.076	0.076	U
SELENIUM	CRA298	CRA	0.074	0.074	U
SELENIUM	CRA299	CRA	0.074	0.074	U
SELENIUM	CRA300	CRA	0.075	0.075	U
SELENIUM	CRA301	CRA	0.076	0.076	U
SELENIUM	CRA303	CRA	0.086	0.086	U
SELENIUM	CRA304	CRA	0.08	0.08	U
SELENIUM	CRA305	CRA	0.078	0.078	UJ
SELENIUM	CRA306	CRA	0.088	0.088	U
SELENIUM	CRA307	CRA	0.12	0.12	U
SELENIUM	CRA308	CRA	0.087	0.087	U
SELENIUM	CRA311	CRA	0.097	0.097	U
SELENIUM	CRA312	CRA	0.088	0.088	U
SELENIUM	CRA313	CRA	0.13	0.13	UJ
SELENIUM	CRA314	CRA	0.12	0.12	U
SELENIUM	CRA329	CRA	0.14	0.14	U
SELENIUM	CRA332	CRA	0.14	0.14	UJ
SELENIUM	CRA339	CRA	0.12	0.12	UJ
SELENIUM	CRA341	CRA	0.13	0.13	UJ
SELENIUM	CRA352	CRA	1.5	1.5	UJ
SELENIUM	CRA354	CRA	1.6	1.6	UJ
SELENIUM	CRA355	CRA	1.5	1.5	UJ
SELENIUM	CRA356	CRA	1.5	1.5	UJ
SELENIUM	CRA357	CRA	0.13	0.13	UJ
SELENIUM	CRA358	CRA	0.12	0.12	UJ
SELENIUM	CRA365	CRA	0.15	0.7	UJ

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
ANTIMONY	HSSA003	HSSA	1.3	1.3	UJ
ANTIMONY	HSSA006	HSSA	1.4	1.4	U
ANTIMONY	HSSA012	HSSA	1.3	1.3	U
ANTIMONY	HSSA071	HSSA	1.8	1.8	UJ
ANTIMONY	HSSA072	HSSA	1.6	1.6	UJ
ANTIMONY	HSSA073	HSSA	1.5	1.5	UJ
ARSENIC	HSSA041	HSSA	2.3	2.3	UJ
ARSENIC	HSSA043	HSSA	2.4	2.4	UJ
ARSENIC	HSSA095	HSSA	0.89	0.89	UJ
ARSENIC	HSSA096	HSSA	0.94	0.94	UJ
ARSENIC	HSSA097	HSSA	0.93	0.93	UJ
ARSENIC	HSSA098	HSSA	0.84	0.84	UJ
ARSENIC	HSSA099	HSSA	0.94	0.94	UJ
ARSENIC	HSSA100	HSSA	0.93	0.93	UJ
ARSENIC	HSSA101	HSSA	0.92	0.92	UJ
ARSENIC	HSSA102	HSSA	0.93	0.93	UJ
LEAD	HSSA075	HSSA	0.52	0.52	UJ
LEAD	HSSA085	HSSA	0.59	0.59	UJ
LEAD	HSSA086	HSSA	0.54	0.54	U
LEAD	HSSA095	HSSA	0.071	0.071	UJ
LEAD	HSSA098	HSSA	0.066	0.066	UJ
LEAD	HSSA099	HSSA	0.075	0.075	UJ
SELENIUM	HSSA032	HSSA	1.7	1.7	U
SELENIUM	HSSA035	HSSA	1.5	1.5	U
SELENIUM	HSSA036	HSSA	1.9	1.9	U
SELENIUM	HSSA037	HSSA	1.8	1.8	U
SELENIUM	HSSA038	HSSA	1.6	1.6	U
SELENIUM	HSSA039	HSSA	1.5	1.5	U
SELENIUM	HSSA040	HSSA	1.6	1.6	U
SELENIUM	HSSA042	HSSA	1.5	1.5	U
SELENIUM	HSSA043	HSSA	1.7	1.7	U
SELENIUM	HSSA044	HSSA	2.4	2.4	U
SELENIUM	HSSA065	HSSA	0.79	0.79	UJ
SELENIUM	HSSA066	HSSA	0.82	0.82	UJ
SELENIUM	HSSA069	HSSA	0.76	0.76	UJ
SELENIUM	HSSA070	HSSA	0.75	0.75	UJ
SELENIUM	HSSA074	HSSA	0.79	0.79	UJ
SELENIUM	HSSA075	HSSA	0.72	0.72	UJ
SELENIUM	HSSA078	HSSA	0.77	0.77	U
SELENIUM	HSSA079	HSSA	0.85	0.85	U
SELENIUM	HSSA080	HSSA	0.8	0.8	U
SELENIUM	HSSA081	HSSA	0.88	0.88	U
SELENIUM	HSSA085	HSSA	0.81	0.81	U
SELENIUM	HSSA086	HSSA	0.74	0.74	UJ
SELENIUM	HSSA089	HSSA	0.74	0.74	U

Contaminant of Concern	Sample ID	Site	MDL (mg/kg)	RL (mg/kg)	valflgs
SELENIUM	HSSA090	HSSA	0.76	0.76	U
SELENIUM	HSSA091	HSSA	0.74	0.74	U
SELENIUM	HSSA092	HSSA	1.3	1.3	U
SELENIUM	HSSA093	HSSA	0.12	0.12	UJ
SELENIUM	HSSA094	HSSA	1.3	1.3	U
SELENIUM	HSSA095	HSSA	1.3	1.3	UJ
SELENIUM	HSSA097	HSSA	1.3	1.3	UJ
SELENIUM	HSSA098	HSSA	0.12	0.12	UJ
SELENIUM	HSSA099	HSSA	0.13	0.13	UJ
SELENIUM	HSSA100	HSSA	1.3	1.3	UJ
SELENIUM	HSSA101	HSSA	0.13	0.13	UJ
Samples using Proxy Values that are 1/2 Estimated Detection					
ARSENIC	B284110	Bldg. 284	1	3.9	UJ
LEAD	HSSA023	HSSA	0.11	0.52	UJ
LEAD	HSSA106	HSSA	0.65	3.2	UJ
LEAD	HSSA107	HSSA	0.66	3.2	UJ
LEAD	HSSA108	HSSA	0.67	3.2	UJ

Notes:
ID = identification
U = non-detection
UJ = estimated non-detect
valflgs = validation flags

3. Cleanup Levels

Cleanup was considered complete for soil at the four sites when confirmation sampling results or calculated RME concentrations for the COCs for this project were below the removal action cleanup levels. The ecological cleanup level for mercury is presented in Table 3-1, and the cleanup levels for the COCs at each of the four sites are listed in Table 3-2 and Table 3-3.

The soil cleanup levels to protect human and ecological receptors at the four sites were based on the following:

- **arsenic**: site-specific cleanup level recommended by EPA Region 9 (Earth Tech 2003)
- **benzo(a)pyrene**: EPA Region 9 residential soil PRG (EPA Region 9 2004)
- **antimony, beryllium, cadmium, copper, nickel, selenium, and zinc:** upper range of estimated background presented in the Ford Island RI report (Earth Tech 2003)
- **lead:** upper estimated background concentration that was lowered after the Ford Island RI and prior to removal action excavation activities after additional analytical data were obtained
- **mercury and 4,4′-DDE:** ecological risk-based cleanup goals.

The soil cleanup level for 4,4′-DDE was established based on a calculated ecological cleanup level (Earth Tech 2003). The cleanup level for mercury at Building 284 was an ecological risk-based cleanup level calculated as shown below.

Eco-Cleanup Goals = (TRV*WT*CF)/((INT*SF)+(BCFp*INT*PF)+(BCFi*INT*IF))*SUF

where: CF = Conversion factor (1,000,000 mg/kg)

TRV = Toxicity Reference Value (mg/kg-day)

INT = Daily food intake (maximum for screening) (mg/kg [dry]) (Nagy 2001)

SF = Diet soil fraction (unitless)

PF = Diet plant fraction (unitless)

IF = Diet invertebrate fraction (unitless)

BCFp = Bioconcentration factor from soil to plants

BCFi = Bioconcentration factor from soil to invertebrates

WT = Weight (wet) of representative species (minimum for screening)

SUF = Site use factor (area of site / species foraging area)

and:

Constant	Units	House Mouse	Northern Cardinal
WT Mean body weight	kg	0.0196	0.0447
INT Mean food intake (dry)	mg/day	2,907	8,443
SF Diet Fraction Soil	unitless	0.02	0.03
PF Diet Fraction Plants	unitless	0.75	0.71
IF Diet Fraction Invertebrates	unitless	0.25	0.29
SUF	unitless	1	1

Table 3-1: Ecological Cleanup Goals for Mercury at Building 284

COPEC	Mammalian TRV [a] (mg/kg-day)	Avian TRV [a] (mg/kg-day)	BCFp 1	BCFi 1	Mammalian Eco-Cleanup Goals[b] (mg/kg)	Avian Eco-Cleanup Goals [c] (mg/kg)	Lowest Eco-Cleanup Goals (mg/kg)
Inorganics							
Mercury	5.99	0.45	3.80E-01	9.60E-01	7.41E+01	4.12E+00	**4.12E+00**

COPEC chemicals of potential ecological concern
TRV toxicity reference value
(a) TRVs are for mercury chloride.
(b) Soil screening concentration for protection of insectivorous small mammals the size of a house mouse.
(c) Soil screening concentration for protection of insectivorous small birds the size of a northern cardinal.
(d) Strenge, D.L. and S.R. Peterson. 1989. Chemical data bases for the multimedia environmental pollutant assessment system (MEPAS): Version 1. PNL-7145. Pacific Northwest Laboratories. Richland, Washington
[1] 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.

EPA Region 9 PRGs were updated since the removal actions in 2003. Additionally, background soils on the island of Oahu were characterized for several soil types found on the island, including caprock soils typical of the shallow soils found on Ford Island. Maximum background soil concentrations and 95th percentiles of metals were presented in the background report (Earth Tech 2006) and have been added to Table 3-2 and Table 3-3 for comparison to site data. The maximum detected concentrations at the sites have been compared to the 95th percentiles and upper estimated background concentration for caprock soil on Oahu.

In May 2005, the Hawaii Department of Health (DOH) published interim final screening values for groundwater, surface water and soil (DOH 2005). These values were updated in August 2008 (DOH 2008). The soil action levels for terrestrial ecotoxicity concerns are now available to serve as cleanup goals for surface soil that are protective of ecological receptors. These values have been added to Table 3-3 and the RME COC concentrations of the post-remediation confirmatory sampling were compared to the DOH EALs for soil. None of the RME values exceed the DOH EALs indicating that the average exposure of ecological receptors to soil, after remediation, is considered acceptable.

Table 3-2: Summary Statistics and RME Comparison to Human Health Cleanup Levels for Soil

Contaminants of Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background-95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	Maximum Detection Exceeds Background 95th % / Max?	95% UCL	95% UCL Rationale	RME[a]	Removal Action Cleanup Level	Does RME exceed Cleanup Level?
Bldg. 43 Surface Soil													
Benzo(a)pyrene	4	2	50	Insufficient Detections	0.046	NA	NA	NA / NA	NA	NA	0.046	0.062	No
Bldg. 43 Subsurface Soil													
Benzo(a)pyrene	51	51	100	Non-parametric	0.2	NA	NA	NA / NA	0.054	95% Chebyshev (Mean, Sd)	0.054	0.062	No
Bldg. 284 Surface Soil													
Arsenic	4	4	100	Insufficient Detections	8.6	16	29	No / No	NA	NA	8.6	17/22[b]	No
Beryllium	4	4	100	Insufficient Detections	0.087	2.5	3.3	No / No	NA	NA	0.087	4	No
Cadmium	4	4	100	Insufficient Detections	2.8	2.3	3.0	Yes / No	NA	NA	2.8	4.3	No
Lead	4	4	100	Insufficient Detections	130	96[e]	203[e]	Yes / No	NA	NA	130	170	No
Mercury	4	4	100	Insufficient Detections	3.2	0.29	0.35	Yes / Yes	NA	NA	3.2	4.12[c]	No
Selenium	4	4	100	Insufficient Detections	9.6	9	11	Yes / No	NA	NA	9.6	12	No
Bldg. 284 Subsurface Soil													
Arsenic	27	26	96	Normal	19.5	16	29	Yes / No	9.9	Student t-test	9.9	17/22[b]	No
Beryllium	27	5	16	Insufficient Detections	0.023	2.5	3.3	No / No	NA	NA	0.023	4	No
Cadmium	27	17	63	Gamma	3.1	2.3	3.0	Yes / Yes	0.94	Approximate gamma	0.94	2.8	No
Lead	27	23	85	Gamma	345	96[e]	203[e]	Yes / Yes	93	Approximate gamma	93	170	No
Mercury	27	23	85	Lognormal	8.2	0.29	0.35	Yes / Yes	2.8	95% Chebyshev (MVUE)	2.8	4.12[c]	No
Selenium	27	9	33	Insufficient Detections	4.4	9	11	No / No	NA	NA	4.4	12	No

Contaminants of Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background- 95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	Maximum Detection Exceeds Background 95th % / Max?	95% UCL	95% UCL Rationale	RME[a]	Removal Action Cleanup Level	Does RME exceed Cleanup Level?
Camel Refurbishing Area Surface Soil													
Arsenic	93	93	100	Non-parametric	17.6	16	29	Yes / No	5.6	97.5% Chebyshev (Mean, Sd)	5.6	17/22[b]	No
Copper	95	95	100	Non-parametric	150	110	230	Yes / No	56	95% Chebyshev (Mean, Sd)	56	130	No
Lead	93	93	100	Gamma	170	96[e]	203[e]	Yes / No	44	Approximate gamma	44	170	No
Selenium	93	11	13	Non-parametric	12.5	9	11	Yes / Yes	2.2	97.5% Chebyshev (Mean, Sd)	2.2	12	No
Zinc	93	88	95	Non-parametric	220	166	193	Yes / Yes	115	95% Chebyshev (Mean, Sd)	115	620	No
Camel Refurbishing Area Paved Subsurface Soil													
Arsenic	41	40	98	Gamma	17.7	16	29	Yes / No	7.5	Approximate gamma	7.5	17/22[b]	No
Copper	35	35	100	Gamma	61.5	110	230	No / No	27	Approximate gamma	27	130	No
Lead	37	37	100	Non-parametric	150	96[e]	203[e]	Yes / No	32	95% Chebyshev (Mean, Sd)	32	170	No
Selenium	37	20	57	Non-parametric	7	9	11	No / No	3.8	95% Chebyshev (Mean, Sd)	3.8	12	No
Zinc	37	37	100	Gamma	170	166	193	Yes / No	49	Approximate gamma	49	620	No
Camel Refurbishing Area Unpaved Subsurface Soil													
Arsenic	57	47	82	Gamma	52.1	16	29	Yes / Yes	8.5	Approximate gamma	8.5	17/22[b]	No
Copper	58	58	100	Gamma	130	110	230	Yes / No	51	Approximate gamma	51	130	No
Lead	48	46	96	Gamma	207	96[e]	203[e]	Yes / Yes	54	Approximate gamma	54	170	No
Selenium	48	22	46	Gamma	10.7	9	11	Yes / No	3.1	Approximate gamma	3.1	12	No

Contaminants of Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background- 95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	Maximum Detection Exceeds Background 95th % / Max?	95% UCL	95% UCL Rationale	RME[a]	Removal Action Cleanup Level	Does RME exceed Cleanup Level?
Zinc	48	48	100	Gamma	244	166	193	Yes / Yes	100	Approximate gamma	100	620	No
HSSA Surface Soil													
4,4'-DDE	7	4	57	Insufficient Detections	0.0091	NA	NA	NA / NA	NA	NA	0.0091	0.023	No
Antimony	3	3	100	Insufficient Detections	5.8	7.3	8.4	No / No	NA	NA	5.8	13	No
Arsenic	15	14	93	Normal	13.3	16	29	No / No	8.5	Student t-test	8.5	17/22[b]	No
Lead	15	15	100	Non-parametric	189	96[e]	203[e]	Yes / No	248	99% Chebyshev (Mean, Sd)	189[d]	170	Yes
Selenium	15	6	40	Insufficient Detections	7.2	9	11	No / No	NA	NA	7.2	12	No
Zinc	15	15	100	Normal	461	166	600	Yes / No	284	Student t-test	284	620	No
HSSA Subsurface Soil													
4,4'-DDE	33	16	48	Non-parametric	0.0091	NA	NA	NA / NA	0.0035	95% Chebyshev (Mean, Sd)	0.0035	0.023	No
Antimony	22	15	68	Gamma	8.4	7.3	8.4	Yes / No	3.4	Approximate gamma	3.4	13	No
Arsenic	50	42	80	Gamma	15.8	16	29	No / No	6.9	Approximate gamma	6.9	17/22[b]	No
Lead	50	42	80	Lognormal	139	96[e]	203[e]	Yes / No	79	95% H	79	170	No
Selenium	50	7	14	Insufficient Detections	7.3	9	11	No / No	NA	NA	7.3	12	No
Zinc	50	50	100	Lognormal	418	166	193	Yes / No	136	95% H	136	620	No

mg/kg milligram per kilogram
NA not available
RME reasonable maximum exposure
[a] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC.
[b] The arsenic cleanup goal of 17 mg/kg is for average concentration, whereas, the cleanup goal of 22 mg/kg is a maximum concentration.
[c] Mercury cleanup value is based on a calculated site-specific ecological risk-based cleanup goal.
[d] An arithmetic mean concentration of 85 mg/kg has been calculated for lead.
[e] Background concentration estimated from combined natural/anthropogenic sources

Table 3-3: Summary Statistics and RME Comparison to Ecological Cleanup Levels for Soil

Contaminants of Ecological Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background-95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	95% UCL Concentration	95% UCL Rationale	RME[a]	DOH Soil Tier 1 EALs (mg/kg)	Removal Action Cleanup Level	Does RME exceed EAL?
Bldg. 43 Surface Soil													
Benzo(a)pyrene	4	2	50	Insufficient Detections	0.046	NA	NA	NA	NA	0.046	0.15	0.062	No
Bldg. 43 Subsurface Soil													
Benzo(a)pyrene	51	51	100	Non parametric	0.2	NA	NA	0.054	95% Chebyshev (Mean, Sd)	0.054	0.15	0.062	No
Bldg. 284 Surface Soil													
Arsenic	4	4	100	Insufficient Detections	8.6	16	29	NA	NA	8.6	20	17 [b]	No
Beryllium	4	4	100	Insufficient Detections	0.087	2.5	3.3	NA	NA	0.087	4	4	No
Cadmium	4	4	100	Insufficient Detections	2.8	2.3	3.0	NA	NA	2.8	12	4.3	No
Lead	4	4	100	Insufficient Detections	130	96[d]	203 [d]	NA	NA	130	200	170	No
Mercury	4	4	100	Insufficient Detections	3.2	0.29	0.35	NA	NA	3.2	4.7	4.12 [c]	No
Selenium	4	4	100	Insufficient Detections	9.6	9	11	NA	NA	9.6	10	12	No
Bldg. 284 Subsurface Soil													
Arsenic	27	26	96	Normal	19.5	16	29	9.9	Student t-test	9.9	20	17 [b]	No
Beryllium	27	5	16	Insufficient Detections	0.023	2.5	3.3	NA	NA	0.023	4	4	No
Cadmium	27	17	63	Gamma	3.1	2.3	3.0	0.94	Approximate gamma	0.94	12	4.3	No
Lead	27	23	85	Gamma	345	96[d]	203 [d]	93	Approximate gamma	93	200	170	No
Mercury	27	23	85	Lognormal	8.2	0.29	0.35	2.8	95% Chebyshev (MVUE)	2.8	4.7	4.12 [c]	No
Selenium	27	9	33	Insufficient Detections	4.4	9	11	NA	NA	4.4	10	12	No

Contaminants of Ecological Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background-95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	95% UCL Concentration	95% UCL Rationale	RME[a]	DOH Soil Tier 1 EALs (mg/kg)	Removal Action Cleanup Level	Does RME exceed EAL?
Camel Refurbishing Area Surface Soil													
Arsenic	93	93	100	Non-parametric	17.6	16	29	5.6	97.5% Chebyshev (Mean, Sd)	5.6	20	17[b]	No
Copper	95	95	100	Non-parametric	150	110	230	56	95% Chebyshev (Mean, Sd)	56	230	130	No
Lead	93	93	100	Gamma	170	96[d]	203[d]	44	Approximate gamma	44	200	170	No
Selenium	93	11	13	Non-parametric	12.5	9	11	2.2	97.5% Chebyshev (Mean, Sd)	2.2	10	12	No
Zinc	93	88	95	Non-parametric	220	166	193	115	95% Chebyshev (Mean, Sd)	115	600	620	No
Camel Refurbishing Area Paved Subsurface Soil													
Arsenic	41	40	98	Gamma	17.7	16	29	7.5	Approximate gamma	7.5	20	17[b]	No
Copper	35	35	100	Gamma	61.5	110	230	27	Approximate gamma	27	230	130	No
Lead	37	37	100	Non-parametric	150	96[d]	203[d]	32	95% Chebyshev (Mean, Sd)	32	200	170	No
Selenium	37	20	57	Non-parametric	7	9	11	3.8	95% Chebyshev (Mean, Sd)	3.8	10	12	No
Zinc	37	37	100	Gamma	170	166	193	49	Approximate gamma	49	600	620	No
Camel Refurbishing Area Unpaved Subsurface Soil													
Arsenic	57	47	82	Gamma	52.1	16	29	8.5	Approximate gamma	8.5	20	17[b]	No
Copper	58	58	100	Gamma	130	110	230	51	Approximate gamma	51	230	130	No
Lead	48	46	96	Gamma	207	96[d]	203[d]	54	Approximate gamma	54	200	170	No
Selenium	48	22	46	Gamma	10.7	9	11	3.1	Approximate gamma	3.1	10	12	No
Zinc	48	48	100	Gamma	244	166	193	100	Approximate gamma	100	600	620	No

Contaminants of Ecological Concern (mg/kg)	Number of Samples	Number of Detections	Percentage of Detections	Distribution Type	Maximum Detected Concentration	Caprock Soil Background-95th percentile (Earth Tech 2006)	Caprock Soil Background – Maximum (Earth Tech 2006)	95% UCL Concentration	95% UCL Rationale	RME[a]	DOH Soil Tier 1 EALs (mg/kg)	Removal Action Cleanup Level	Does RME exceed EAL?
HSSA Surface Soil													
4,4'-DDE	7	4	57	Insufficient Detections	0.0091	NA	NA	NA	NA	0.009	1.4	0.023	No
Antimony	3	3	100	Insufficient Detections	5.8	7.3	8.4	NA	NA	5.8	6.3	13	No
Arsenic	15	14	93	Normal	13.3	16	29	8.5	Student t-test	8.5	20	17[b]	No
Lead	15	15	100	Non-parametric	189	96[d]	203[d]	248	95% Chebyshev (Mean, Sd)	189	200	170	No
Selenium	15	6	40	Insufficient Detections	7.2	9	11	NA	NA	7.2	10	12	No
Zinc	15	15	100	Normal	461	166	193	284	Student t-test	284	600	620	No
HSSA Subsurface Soil													
4,4'-DDE	33	16	48	Non-parametric	0.0091	NA	NA	0.0035	95% Chebyshev (Mean, Sd)	0.0035	1.4	0.023	No
Antimony	22	15	68	Gamma	8.4	7.3	8.4	3.4	Approximate gamma	3.4	6.3	13	No
Arsenic	50	42	80	Gamma	15.8	16	29	6.9	Approximate gamma	6.9	20	17[b]	No
Lead	50	42	80	Lognormal	139	96[d]	203[d]	79	95% H	79	200	170	No
Selenium	50	7	14	Insufficient Detections	7.3	9	11	NA	NA	7.3	10	12	No
Zinc	50	50	100	Lognormal	418	166	193	136	95% H	136	600	620	No

[a] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC.
[b] Background range for arsenic is 0.21 to 29 mg/kg (dry weight); cleanup goal was set to meet human health concerns. The human health cleanup goal is more conservative than background and thus protects ecological receptors.
[c] Mercury cleanup value is based on a calculated site-specific ecological risk-based cleanup goal.
[d] Background concentration estimated from combined natural/anthropogenic sources

4. Results of Confirmatory Data Evaluation

4.1 PROTECTION OF HUMAN HEALTH

Reasonable maximum exposure EPCs for COCs for which confirmatory samples were collected were compared to project-specific cleanup levels in Table 3-2. Maximum and RME EPCs for COCs for which confirmatory samples were collected were compared to EPA Region 9 (EPA Region 9 2004) residential and industrial PRGs. Risk estimates are presented with the inclusion and exclusion of background metals. A metal is determined to exceed background if the maximum detected concentration at the site is above the 95th percentile for background caprock soils on Oahu. All organic chemicals were assumed to be site-related. The following text summarizes the carcinogenic risk and non-cancer hazard estimated for these sites under the residential and industrial land use scenarios.

4.1.1 Bldg. 43

Surface Soil. RME EPCs for surface soil confirmatory sampling data collected from Bldg. 43 are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-1 and Table 4-2, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for surface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPC for benzo(a)pyrene was below its cleanup level.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risk for surface soil under an assumed residential land use is 7E–07, which is less than the 1E–06 point of departure. Neither the maximum nor the RME EPC for benzo(a)pyrene exceeds its carcinogenic residential PRG for soil. The cumulative maximum and RME carcinogenic risk for surface soil under an assumed industrial land use is 2E–07, which is less than the 1E–06 point of departure. Neither the maximum nor the RME EPC for benzo(a)pyrene exceeds its carcinogenic industrial PRG for soil.

Non-Carcinogenic Hazard. There were no non-carcinogenic COCs evaluated for surface soil.

Subsurface Soil. RME EPCs for subsurface soil confirmatory data collected from Bldg. 43 are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-3 and Table 4-4, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for subsurface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPC for benzo(a)pyrene was below its cleanup level. However, the maximum concentration for benzo(a)pyrene was greater than its respective cleanup level.

Carcinogenic Risk. The cumulative maximum carcinogenic risk for subsurface soil under an assumed residential land use is 3E–06, which exceeds the 1E–06 point of departure. The cumulative carcinogenic risk associated with exposure to the RME EPC for benzo(a)pyrene for subsurface soil under an assumed residential land use is 9E–07, which is below the 1E–06 point of departure. The maximum EPC for benzo(a)pyrene exceeds its carcinogenic residential PRG for soil. The cumulative carcinogenic risks associated with maximum and RME EPCs in subsurface soil under an assumed industrial land use are 1E–06 and 3E–07, which do not exceed the 1E–06 point of departure.

Non-Carcinogenic Hazard. There were no non-carcinogenic COCs evaluated for subsurface soil.

4.1.2 Bldg. 284

Surface Soil. RME EPCs for surface soil confirmatory data collected from Bldg. 284 are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-5 and Table 4-6, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for surface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPCs for arsenic, beryllium, cadmium, lead, mercury, and selenium were all well below their respective cleanup levels.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed residential land use are both 2E–05, which exceeds the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed industrial land use are both 5E–06, which also exceeds the 1E–06 point of departure. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. Excluding metals that are present at background concentrations, the maximum and RME carcinogenic risks decrease to 2E–09 under residential use and 9E–10 under industrial use. The reason for the significant reduction in site-related risk is that arsenic is present at background concentrations. The maximum and RME EPC for arsenic of 8.6 mg/kg is below the 95th percentile of 16 mg/kg for arsenic.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for the residential land use are expressed as a hazard index (HI) of 0.6, which is below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for the industrial land use are expressed as an HI of 0.05, which is below 1. Excluding metals that are present at background concentrations, the maximum and RME non-cancer HIs decrease to 0.2 under residential use and 0.02 industrial use. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Subsurface Soil. RME EPCs for subsurface soil confirmatory data collected from Bldg. 284 are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-7 and Table 4-8, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for subsurface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPCs for arsenic, beryllium, cadmium, lead, mercury, and selenium were all well below their respective cleanup levels. However, the maximum concentration for cadmium, lead, and mercury were greater than its cleanup level.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed residential land use are 5E–05 and 3E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed industrial land use are 1E–05 and 6E–06, respectively, which exceed the 1E–06 point of departure. Virtually all of the carcinogenic risk is due to arsenic. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. Because the maximum arsenic concentration of 19.5 mg/kg exceeds the 95th percentile of 16 mg/kg, arsenic was treated as though it is a site-related COC. As such, the cumulative cancer risk excluding metals at background concentrations remains essentially the same. However, the maximum and RME EPC for arsenic of 19.5 and 9.9 mg/kg, respectively, are below the maximum background value for arsenic of 29 mg/kg.

Table 4-1 : Comparison of Confirmatory Surface Soil EPCs to Residential PRGs, Building 43

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[c]	Non-carcino-genic PRG[c]	>PRG (ca)	Excess Cancer Risk[d]	% Con-tribution to Risk	>PRG (nc)	HQ[e]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[f]	% Con-tribution to Risk	>PRG (nc)	HQ[g]	% Con-tribution to HI
PAHs by Method 8270C SIM (mg/kg)																						
Benzo(a)pyrene	2	4	50%	4.60E-02	--	4.60E-02			6.20E-02	--	No	7.42E-07	100%	--	--	--	No	7.42E-07	100%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:												7E-07			--			7E-07			--	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												7E-07			--			7E-07			--	

-- = no data or not applicable

% = percent

> = greater than

ca = carcinogenic

nc = noncarcinogenic

mg/kg = milligrams per kilogram

HI = hazard index

PAH = polycyclic aromatic hydrocarbons

SIM = Selective Ion Monitoring method

[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.

[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.

[c] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).

[d] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)

[e] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG

[f] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)

[g] HQ = RME EPC / Noncarcinogic PRG

Table 4-2 : Comparison of Confirmatory Surface Soil EPCs to Industrial PRGs, Building 43

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[c]	Non-carcino-genic PRG[c]	>PRG (ca)	Excess Cancer Risk[d]	% Con-tribution to Risk	>PRG (nc)	HQ[e]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[f]	% Con-tribution to Risk	>PRG (nc)	HQ[g]	% Con-tribution to HI
PAHs by Method 8270C SIM (mg/kg)																						
Benzo(a)pyrene	2	4	50%	4.60E-02	--	4.60E-02	--	--	2.10E-01	--	No	2.19E-07	100%	--	--	--	No	2.19E-07	100%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:												2E-07			--			2E-07			--	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												2E-07			--			2E-07			--	

-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
PAH = polycyclic aromatic hydrocarbons
SIM = Selective Ion Monitoring method
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[d] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[e] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[f] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[g] HQ = RME EPC / Noncarcinogic PRG

Table 4-3: Comparison of Confirmatory Subsurface Soil EPCs to Residential PRGs, Building 43

Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[c]	Non-carcino-genic PRG[c]	Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
											>PRG (ca)	Excess Cancer Risk[d]	% Con-tribution to Risk	>PRG (nc)	HQ[e]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[f]	% Con-tribution to Risk	>PRG (nc)	HQ[g]	% Con-tribution to HI
PAHs by Method 8270C SIM (mg/kg)																						
Benzo(a)pyrene	51	51	100%	2.00E-01	5.40E-02	5.40E-02	--	--	6.20E-02	--	Yes	3.23E-06	100%	--	--	--	No	8.71E-07	100%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:												3E-06			--			9E-07			--	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												3E-06			--			9E-07			--	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
PAH = polycyclic aromatic hydrocarbons
SIM = Selective Ion Monitoring method
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[d] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[e] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[f] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[g] HQ = RME EPC / Noncarcinogic PRG

Table 4-4: Comparison of Confirmatory Subsurface Soil EPCs to Industrial PRGs, Building 43

Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[c]	Non-carcino-genic PRG[c]	Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
											>PRG (ca)	Excess Cancer Risk[d]	% Con-tribution to Risk	>PRG (nc)	HQ[e]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[f]	% Con-tribution to Risk	>PRG (nc)	HQ[g]	% Con-tribution to HI
PAHs by Method 8270C SIM (mg/kg)																						
Benzo(a)pyrene	51	51	100%	2.00E-01	5.40E-02	5.40E-02	--	--	2.10E-01	--	No	9.52E-07	100%	--	--	--	No	2.57E-07	100%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-06			--			3E-07			--	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-06			--			3E-07			--	

-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
PAH = polycyclic aromatic hydrocarbons
SIM = Selective Ion Monitoring method
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[d] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[e] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[f] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[g] HQ = RME EPC / Noncarcinogic PRG

Table 4-5: Comparison of Confirmatory Surface Soil EPCs to Residential PRGs, Building 284

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	4	4	100%	8.60E+00	--	8.60E+00	1.60E+01	No	3.9E-01	2.2E+01	Yes	2.21E-05	100%	No	3.91E-01	62%	Yes	2.21E-05	100%	No	3.91E-01	62%
Beryllium	4	4	100%	8.70E-02	--	8.70E-02	2.50E+00	No	1.1E+03	1.5E+02	No	7.91E-11	0%	No	5.80E-04	0%	No	7.91E-11	0%	No	5.80E-04	0%
Cadmium	4	4	100%	2.80E+00	--	2.80E+00	2.30E+00	Yes	1.4E+03	3.7E+01	No	2.00E-09	0%	No	7.57E-02	12%	No	2.00E-09	0%	No	7.57E-02	12%
Lead	4	4	100%	1.30E+02	--	1.30E+02	2.90E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Mercury	4	4	100%	3.20E+00	--	3.20E+00	2.90E-01	Yes	--	2.30E+01	--	--	--	No	1.39E-01	22%	--	--	--	No	1.39E-01	22%
Selenium	4	4	100%	9.60E+00	--	9.60E+00	9.00E+00	Yes	--	3.9E+02	--	--	--	No	2.46E-02	4%	--	--	--	No	2.46E-02	4%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												2E-05			6E-01			2E-05			6E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												2E-09			2E-01			2E-09			2E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-6: Comparison of Confirmatory Surface Soil EPCs to Industrial PRGs, Building 284

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	4	4	100%	8.60E+00	--	8.60E+00	1.60E+01	No	1.6E+00	2.6E+02	Yes	5.38E-06	100%	No	3.31E-02	64%	Yes	5.38E-06	100%	No	3.31E-02	64%
Beryllium	4	4	100%	8.70E-02	--	8.70E-02	2.50E+00	No	2.2E+03	1.9E+03	No	3.95E-11	0%	No	4.58E-05	0%	No	3.95E-11	0%	No	4.58E-05	0%
Cadmium	4	4	100%	2.80E+00	--	2.80E+00	2.30E+00	Yes	3.0E+03	4.5E+02	No	9.33E-10	0%	No	6.22E-03	12%	No	9.33E-10	0%	No	6.22E-03	12%
Lead	4	4	100%	1.30E+02	--	1.30E+02	2.90E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Mercury	4	4	100%	3.20E+00	--	3.20E+00	2.90E-01	Yes	--	3.10E+02	--	--	--	No	1.03E-02	20%	--	--	--	No	1.03E-02	20%
Selenium	4	4	100%	9.60E+00	--	9.60E+00	9.00E+00	Yes	--	5.1E+03	--	--	--	No	1.88E-03	4%	--	--	--	No	1.88E-03	4%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												5E-06			5E-02			5E-06			5E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												9E-10			2E-02			9E-10			2E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).

-- = no data or not applicable

% = percent

> = greater than

ca = carcinogenic

nc = noncarcinogenic

mg/kg = milligrams per kilogram

HI = hazard index

[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.

[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.

[c] 95th percentile of Background Caprock Soils (DON 2006)

[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).

[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)

[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG

[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)

[h] HQ = RME EPC / Noncarcinogic PRG

[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-7: Comparison of Confirmatory Subsurface Soil EPCs to Residential PRGs, Building 284

Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	Maximum EPC Comparisons: Carcinogenic: >PRG (ca)	Maximum EPC Comparisons: Carcinogenic: Excess Cancer Risk[e]	Maximum EPC Comparisons: Carcinogenic: % Con-tribution to Risk	Maximum EPC Comparisons: Noncarcinogenic: >PRG (nc)	Maximum EPC Comparisons: Noncarcinogenic: HQ[f]	Maximum EPC Comparisons: Noncarcinogenic: % Con-tribution to HI	RME EPC Comparisons: Carcinogenic: >PRG (ca)	RME EPC Comparisons: Carcinogenic: Excess Cancer Risk[g]	RME EPC Comparisons: Carcinogenic: % Con-tribution to Risk	RME EPC Comparisons: Noncarcinogenic: >PRG (nc)	RME EPC Comparisons: Noncarcinogenic: HQ[h]	RME EPC Comparisons: Noncarcinogenic: % Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	26	27	96%	1.95E+01	9.90E+00	9.90E+00	1.60E+01	Yes	3.9E-01	2.2E+01	Yes	5.00E-05	100%	No	8.86E-01	66%	Yes	2.54E-05	100%	No	4.50E-01	74%
Beryllium	5	27	19%	2.30E-02	--	2.30E-02	2.50E+00	No	1.1E+03	1.5E+02	No	2.09E-11	0%	No	1.53E-04	0%	No	2.09E-11	0%	No	1.53E-04	0%
Cadmium	17	27	63%	3.10E+00	9.39E-01	9.39E-01	2.30E+00	Yes	1.4E+03	3.7E+01	No	2.21E-09	0%	No	8.38E-02	6%	No	6.71E-10	0%	No	2.54E-02	4%
Lead	23	27	85%	3.45E+02	9.29E+01	9.29E+01	2.90E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Mercury	23	27	85%	8.20E+00	2.76E+00	2.76E+00	2.90E-01	Yes	--	2.30E+01	--	--	--	No	3.57E-01	27%	--	--	--	No	1.20E-01	20%
Selenium	9	27	33%	4.40E+00	--	4.40E+00	9.00E+00	No		3.90E+02				No	1.13E-02	1%				No	1.13E-02	2%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												5E-05			1E+00			3E-05			6E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												5E-05			1E+00			3E-05			6E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-8: Comparison of Confirmatory Subsurface Soil EPCs to Industrial PRGs, Building 284

Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
											>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	26	27	96%	1.95E+01	9.90E+00	9.90E+00	1.60E+01	Yes	1.6E+00	2.6E+02	Yes	1.22E-05	100%	No	7.50E-02	69%	Yes	6.19E-06	100%	No	3.81E-02	76%
Beryllium	5	27	19%	2.30E-02	--	2.30E-02	2.50E+00	No	2.2E+03	1.9E+03	No	1.05E-11	0%	No	1.21E-05	0%	No	1.05E-11	0%	No	1.21E-05	0%
Cadmium	17	27	63%	3.10E+00	9.39E-01	9.39E-01	2.30E+00	Yes	3.0E+03	4.5E+02	No	1.03E-09	0%	No	6.89E-03	6%	No	3.13E-10	0%	No	2.09E-03	4%
Lead	23	27	85%	3.45E+02	9.29E+01	9.29E+01	2.90E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Mercury	23	27	85%	8.20E+00	2.76E+00	2.76E+00	2.90E-01	Yes	--	3.10E+02	--	--	--	No	2.65E-02	24%	--	--	--	No	8.91E-03	18%
Selenium	9	27	33%	4.40E+00	--	4.40E+00	9.00E+00	No	--	5.1E+03				No	8.63E-04	1%				No	8.63E-04	2%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-05			1E-01			6E-06			5E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-05			1E-01			6E-06			5E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in subsurface soil for residential land use are expressed as HIs of 1 and 0.6, respectively, which do not exceed 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in subsurface soil for industrial land use are expressed as HIs of 0.1 and 0.05, respectively, which do not exceed 1. Because much of the non-cancer hazard is due to arsenic (the maximum concentration of which exceeds the background 95th percentile), the exclusion of background metals from non-cancer hazard estimates have little effect as estimates remain unchanged. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

4.1.3 Camel Refurbishing Area

Surface Soil. RME EPCs for surface soil confirmatory data collected from the Camel Refurbishing Area are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-9 and Table 4-10, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for surface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. However, the maximum concentrations of copper and selenium were greater than their respective cleanup levels.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed residential land use are 5E–05 and 1E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed industrial land use are 1E–05 and 4E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. Because the maximum arsenic concentration of 17.6 mg/kg exceeds the 95th percentile of 16 mg/kg, arsenic was treated as though it is a site-related COC. As such, the cumulative cancer risk excluding metals at background concentrations remains the same. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 17.6 and 5.6 mg/kg, respectively, are well below the maximum background value for arsenic of 29 mg/kg.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for residential land use are expressed as HIs of 0.9 and 0.3, respectively, which are below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for industrial land use are expressed as HIs of 0.07 and 0.02, respectively, which are below 1. Because much of the non-cancer hazard is due to arsenic (the maximum concentration of which exceeds the background 95th percentile), the exclusion of background metals from non-cancer hazard estimates have little effect as estimates remain unchanged. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Paved Subsurface Soil. RME EPCs for paved subsurface soil confirmatory data collected from the Camel Refurbishing Area are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-11 and Table 4-12, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for subsurface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. Additionally, the maximum concentrations for all chemicals were less than their respective cleanup levels.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed residential land use are 5E–05 and 2E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed industrial land use are 1E–05 and 5E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. Because the maximum arsenic concentration of 17.7 mg/kg exceeds the 95th percentile of 16 mg/kg, arsenic was treated as though it is a site-related COC. As such, the cumulative cancer risk excluding metals at background concentrations remains the same. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 17.7 and 7.47 mg/kg, respectively, are well below the maximum background value for arsenic of 29 mg/kg.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for residential land use are expressed as HIs of 0.8 and 0.4, respectively, which are below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for industrial land use are expressed as HIs of 0.07 and 0.03, respectively, which are below 1. Because much of the non-cancer hazard is due to arsenic (the maximum concentration of which exceeds the background 95th percentile), the exclusion of background metals from non-cancer hazard estimates have little effect as estimates remain unchanged. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Unpaved Subsurface Soil. RME EPCs for unpaved subsurface soil confirmatory data collected from the Camel Refurbishing Area are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Tables 4-13 and 4-14, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for subsurface soil under the residential and industrial land use scenarios.

Cleanup Level Comparison. The RME EPCs for arsenic, copper, lead, selenium, and zinc were all well below their respective cleanup levels. However, the maximum concentrations for arsenic and lead were greater than their respective cleanup levels.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for unpaved subsurface soil under an assumed residential land use are 1E–04 and 2E–05, respectively, which exceed the 1E-06 point of departure. The cumulative maximum and RME carcinogenic risks for unpaved subsurface soil under an assumed industrial land use are 3E–05 and 5E–06, respectively, which exceed the 1E–06 point of departure. All of the carcinogenic risk is due to arsenic. Because the maximum arsenic concentration of 52.1 mg/kg exceeds the 95th percentile of 16 mg/kg, arsenic was treated as though it is a site-related COC. As such, the cumulative cancer risk excluding metals at background concentrations remains the same. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. While the maximum detected concentration of 52.1 mg/kg exceeds the maximum background value of 29 mg/kg, the RME EPC for arsenic of 8.41 mg/kg is below this background value.

Non-Carcinogenic Hazard. The cumulative non-cancer hazard associated with potential exposure to maximum EPCs for residential land use is expressed as an HI of 2, which is greater than 1. The cumulative non-cancer hazard associated with potential exposure to RME EPCs for residential land use is expressed as an HI of 0.4, which is less than 1. The cumulative non-cancer hazards associated with potential exposure to maximum and RME EPCs for industrial land use are expressed as HIs of 0.2 and 0.03, respectively, which are less than 1. Because much of the non-cancer hazard is due to arsenic (the maximum concentration of which exceeds the background 95th percentile), the exclusion of background metals from non-cancer hazard estimates have little effect as estimates remain unchanged. The maximum EPC for arsenic exceeded its non-cancer residential soil PRG.

4.1.4 Hazardous Substance Storage Area

Surface Soil. RME EPCs for surface soil confirmatory data collected from the HSSA are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-15 and Table 4-16, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for surface soil under the residential land use scenario.

Cleanup Level Comparison. The RME EPC for lead of 189 mg/kg exceeded its cleanup level of 170 mg/kg. The RME EPCs for 4,4′-DDE, antimony, arsenic, selenium and zinc were all well below their respective cleanup levels.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed residential land use are 3E–05 and 2E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for surface soil under an assumed industrial land use are 8E–06 and 5E–06, respectively, which exceed the 1E–06 point of departure. Excluding metals that are present at background concentrations, the maximum and RME carcinogenic risks decrease to 5E–09 under residential use and 1E–09 under industrial use. The reason for the significant reduction in site-related risk is that arsenic is present at background concentrations. The maximum arsenic concentration of 13.3 mg/kg is below the 95th percentile of 16 mg/kg for arsenic. The maximum and RME EPCs for arsenic exceeds its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 13.3 and 8.53 mg/kg, respectively, are below the background values for arsenic.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for residential land use are expressed as HIs of 0.8 and 0.6, respectively, which are below 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs in surface soil for industrial land use are expressed as HIs of 0.07 and 0.05, respectively, which are below 1. Because all of the COCs that comprise the non-cancer hazard are metals at background levels (i.e., the maximum concentrations are below respective background 95th percentiles), the exclusion of background metals from non-cancer hazard estimates results in a site-related non-cancer hazard of zero. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

Subsurface Soil. RME EPCs for subsurface soil confirmatory data collected from the HSSA are compared to project-specific cleanup levels in Table 3-2. Additionally, maximum and RME EPCs are compared to EPA Region 9 residential and industrial PRGs in Table 4-17 and Table 4-18, respectively. The following paragraphs summarize the carcinogenic risk and non-cancer hazard estimated for subsurface soil under the residential land use scenario.

Cleanup Level Comparison. The RME EPCs for 4,4′-DDE, antimony, arsenic, lead, selenium, and zinc were all well below their respective cleanup levels. However, the maximum concentration for zinc was greater than the respective cleanup level.

Carcinogenic Risk. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed residential land use are 4E–05 and 2E–05, respectively, which exceed the 1E–06 point of departure. The cumulative maximum and RME carcinogenic risks for subsurface soil under an assumed industrial land use are 1E–05 and 4E–06, respectively, which exceed the 1E–06 point of departure. Excluding metals that are present at background concentrations, the maximum and RME carcinogenic risks decrease to levels between 5E–09 and 2E–09 under residential use and between 1E–09 and 5E–10 under industrial use. The reason for the significant reduction in site-related risk is that arsenic is present at background concentrations. The maximum arsenic concentration of 15.8 mg/kg is below the 95th percentile of 16 mg/kg for arsenic. The maximum and RME EPCs for arsenic exceed its carcinogenic residential and industrial PRGs for soil. However, the maximum and RME EPC for arsenic of 15.8 and 6.91 mg/kg, respectively, are below the background values for arsenic.

Non-Carcinogenic Hazard. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for residential land use are expressed as HIs of 1 and 0.4, respectively, which do not exceed 1. The cumulative non-cancer hazards associated with potential exposure to the maximum and RME EPCs for industrial land use are expressed as HIs of 0.08 and 0.04, respectively, which do not exceed 1. Excluding metals that are present at background concentrations, the maximum and RME non-cancer HIs decrease to between 0.3 and 0.1 under residential use and between 0.02 and 0.008 for industrial use. None of the chemicals had maximum or RME EPCs that exceeded their respective non-cancer residential or industrial soil PRGs.

4.2 PROTECTION OF TERRESTRIAL ECOLOGICAL RECEPTORS

Maximum and RME EPCs for COCs for which confirmatory samples were collected were compared to DOH Tier 1 soil EALs in Table 3-3, which are protective of human and ecological receptors. The maximum detection of selenium in surface soil at the Camel Refurbishing Area (12.5 mg/kg) slightly exceeded its DOH soil EAL of 10 mg/kg. The maximum detection of benzo(a)pyrene in subsurface soil at Bldg. 43 exceeded its DOH EAL. The maximum concentration of lead and mercury in subsurface soil at Bldg. 284 and the maximum concentrations of arsenic, lead and selenium in the unpaved subsurface soil of the Camel Refurbishing Area exceeded DOH soil EALs. In addition, the maximum detected concentration of antimony in subsurface soil at the HSSA exceeded its DOH EAL. However, subsurface soils are not considered an exposure medium for terrestrial ecological receptors.

None of the chemicals in either surface soil or subsurface soil had RME EPCs that exceeded their respective DOH soil EALs. Therefore, average exposure of terrestrial ecological receptors to soil COCs in the 4 areas is not expected to exceed concentrations that may cause adverse effects. No further action is necessary to protect ecological receptors from soil exposure.

Table 4-9: Comparison of Confirmatory Surface Soil Sample EPCs to Residential PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	93	93	100%	1.76E+01	5.60E+00	5.60E+00	1.60E+01	Yes	3.9E-01	2.2E+01	Yes	4.51E-05	100%	No	8.00E-01	90%	Yes	1.44E-05	100%	No	2.55E-01	90%
Copper	95	95	100%	1.50E+02	5.61E+01	5.61E+01	1.10E+02	Yes	--	3.1E+03	--	--	--	No	4.84E-02	5%	--	--	--	No	1.81E-02	6%
Lead	93	93	100%	1.70E+02	4.40E+01	4.40E+01	2.90E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	11	93	12%	1.25E+01	2.20E+00	2.20E+00	9.00E+00	Yes	--	3.9E+02	--	--	--	No	3.21E-02	4%	--	--	--	No	5.63E-03	2%
Zinc	88	93	95%	2.20E+02	1.15E+02	1.15E+02	1.66E+02	Yes	--	2.3E+04	--	--	--	No	9.38E-03	1%	--	--	--	No	4.90E-03	2%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												5E-05			9E-01			1E-05			3E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												5E-05			9E-01			1E-05			3E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g]Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-10: Comparison of Confirmatory Surface Soil Sample EPCs to Industrial PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	93	93	100%	1.76E+01	5.60E+00	5.60E+00	1.60E+01	Yes	1.6E+00	2.6E+02	Yes	1.10E-05	100%	No	6.77E-02	92%	Yes	3.50E-06	100%	No	2.15E-02	92%
Copper	95	95	100%	1.50E+02	5.61E+01	5.61E+01	1.10E+02	Yes	--	4.1E+04	--	--	--	No	3.66E-03	5%	--	--	--	No	1.37E-03	6%
Lead	93	93	100%	1.70E+02	4.40E+01	4.40E+01	2.90E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	11	93	12%	1.25E+01	2.20E+00	2.20E+00	9.00E+00	Yes	--	5.1E+03	--	--	--	No	2.45E-03	3%	--	--	--	No	4.30E-04	2%
Zinc	88	93	95%	2.20E+02	1.15E+02	1.15E+02	1.66E+02	Yes	--	1E-05 (max)	--	--	--	No	--[d]	--[d]	--	--	--	No	--[d]	--[d]
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-05			7E-02			4E-06			2E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-05			7E-02			4E-06			2E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).

-- = no data or not applicable

% = percent

> = greater than

ca = carcinogenic

nc = noncarcinogenic

mg/kg = milligrams per kilogram

HI = hazard index

[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.

[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.

[c] 95th percentile of Background Caprock Soils (DON 2006)

[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004), unless qualified with a "max" (ceiling limit concentration). Excess cancer risks or hazard quotients (HQs) are not calculated for chemicals of potential concern with non-risk-based PRGs (max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)

[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG

[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)

[h] HQ = RME EPC / Noncarcinogic PRG

[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-11: Comparison of Paved Confirmatory Subsurface Soil Sample EPCs to Residential PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	40	41	98%	1.77E+01	7.47E+00	7.47E+00	1.60E+01	Yes	3.9E-01	2.2E+01	Yes	4.54E-05	100%	No	8.05E-01	95%	Yes	1.92E-05	100%	No	3.40E-01	94%
Copper	35	35	100%	6.15E+01	2.66E+01	2.66E+01	1.10E+02	No	--	3.1E+03	--	--	--	No	1.98E-02	2%	--	--	--	No	8.59E-03	2%
Lead	37	37	100%	1.50E+02	3.22E+01	3.22E+01	2.90E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	20	37	54%	7.00E+00	3.84E+00	3.84E+00	9.00E+00	No	--	3.9E+02	--	--	--	No	1.79E-02	2%	--	--	--	No	9.85E-03	3%
Zinc	37	37	100%	1.70E+02	4.89E+01	4.89E+01	1.66E+02	Yes	--	2.3E+04	--	--	--	No	7.25E-03	1%	--	--	--	No	2.08E-03	1%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												5E-05			8E-01			2E-05			4E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												5E-05			8E-01			2E-05			3E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).

-- = no data or not applicable

% = percent

> = greater than

ca = carcinogenic

nc = noncarcinogenic

mg/kg = milligrams per kilogram

HI = hazard index

[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.

[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.

[c] 95th percentile of Background Caprock Soils (DON 2006)

[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).

[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)

[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG

[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)

[h] HQ = RME EPC / Noncarcinogic PRG

Table 4-12: Comparison of Paved Confirmatory Subsurface Soil Sample EPCs to Industrial PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	40	41	98%	1.77E+01	7.47E+00	7.47E+00	1.60E+01	Yes	1.6E+00	2.6E+02	Yes	1.11E-05	100%	No	6.81E-02	96%	Yes	4.67E-06	100%	No	2.87E-02	95%
Copper	35	35	100%	6.15E+01	2.66E+01	2.66E+01	1.10E+02	No	--	4.1E+04	--	--	--	No	1.50E-03	2%	--	--	--	No	6.50E-04	2%
Lead	37	37	100%	1.50E+02	3.22E+01	3.22E+01	2.90E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	20	37	54%	7.00E+00	3.84E+00	3.84E+00	9.00E+00	No	--	5.1E+03	--	--	--	No	1.37E-03	2%	--	--	--	No	7.54E-04	3%
Zinc	37	37	100%	1.70E+02	4.89E+01	4.89E+01	1.66E+02	Yes	--	1E-05 (max)	--	--	--	No	--[d]	--[d]	--	--	--	No	--[d]	--[d]
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-05			7E-02			5E-06			3E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-05			7E-02			5E-06			3E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004), unless qualified with a "max" (ceiling limit concentration). Excess cancer risks or hazard quotients (HQs) are not calculated for chemicals of potential concern with non-risk-based PRGs (max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG

Table 4-13: Comparison of Unpaved Confirmatory Subsurface Soil Sample EPCs to Residential PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	47	57	82%	5.21E+01	8.50E+00	8.50E+00	1.60E+01	Yes	3.9E-01	2.2E+01	Yes	1.34E-04	100%	Yes	2.37E+00	97%	Yes	2.18E-05	100%	No	3.86E-01	93%
Copper	58	58	100%	1.30E+02	5.06E+01	5.06E+01	1.10E+02	Yes	--	3.1E+03	--	--	--	No	4.19E-02	2%	--	--	--	No	1.63E-02	4%
Lead	46	48	96%	2.07E+02	5.44E+01	5.44E+01	2.90E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	22	48	46%	1.07E+01	3.14E+00	3.14E+00	9.00E+00	Yes	--	3.9E+02	--	--	--	No	2.74E-02	1%	--	--	--	No	8.06E-03	2%
Zinc	48	48	100%	2.45E+02	1.00E+02	1.00E+02	1.66E+02	Yes	--	2.3E+04	--	--	--	No	1.04E-02	0%	--	--	--	No	4.26E-03	1%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-04			2E+00			2E-05			4E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-04			2E+00			2E-05			4E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-14: Comparison of Unpaved Confirmatory Subsurface Soil Sample EPCs to Industrial PRGs, Camel Refurbishing Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Metals by Method 6020 (mg/kg)																						
Arsenic	47	57	82%	5.21E+01	8.50E+00	8.50E+00	1.60E+01	Yes	1.6E+00	2.6E+02	Yes	3.26E-05	100%	No	2.00E-01	97%	Yes	5.31E-06	100%	No	3.27E-02	95%
Copper	58	58	100%	1.30E+02	5.06E+01	5.06E+01	1.10E+02	Yes	--	4.1E+04	--	--	--	No	3.17E-03	2%	--	--	--	No	1.23E-03	4%
Lead	46	48	96%	2.07E+02	5.44E+01	5.44E+01	2.90E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	22	48	46%	1.07E+01	3.14E+00	3.14E+00	9.00E+00	Yes	--	5.1E+03	--	--	--	No	2.10E-03	1%	--	--	--	No	6.16E-04	2%
Zinc	48	48	100%	2.45E+02	1.00E+02	1.00E+02	1.66E+02	Yes	--	1E-05 (max)	--	--	--	No	--[d]	--[d]	--	--	--	No	--[d]	--[d]
Cumulative Excess Cancer Risk/Hazard Index Including Background:												3E-05			2E-01			5E-06			3E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												3E-05			2E-01			5E-06			3E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004), unless qualified with a "max" (ceiling limit concentration). Excess cancer risks or hazard quotients (HQs) are not calculated for chemicals of potential concern with non-risk-based PRGs (max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-15: Comparison of Confirmatory Surface Soil EPCs to Residential PRGs, Hazardous Substance Storage Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Organochlorine Pesticides by Method 8081A (mg/kg)																						
4,4-DDE	4	7	57%	9.10E-03	--	9.10E-03	--	--	1.7E+00	--	No	5.35E-09	0%	--	--	--	No	5.35E-09	0%	--	--	--
Metals by Method 6020 (mg/kg)																						
Antimony	3	3	100%	5.80E+00	--	5.80E+00	7.30E+00	No	--	3.1E+01	--	--	--	No	1.87E-01	23%	--	--	--	No	1.87E-01	31%
Arsenic	14	15	93%	1.33E+01	8.53E+00	8.53E+00	1.60E+01	No	3.9E-01	2.2E+01	Yes	3.41E-05	100%	No	6.05E-01	73%	Yes	2.19E-05	100%	No	3.88E-01	64%
Lead	15	15	100%	1.89E+02	2.48E+02	1.89E+02	2.9E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	6	15	40%	7.20E+00	--	7.20E+00	9.0E+00	No	--	3.9E+02	--	--	--	No	1.85E-02	2%	--	--	--	No	1.85E-02	3%
Zinc	15	15	100%	4.61E+02	2.84E+02	2.84E+02	1.7E+02	Yes	--	2.3E+04	--	--	--	No	1.96E-02	2%	--	--	--	No	1.21E-02	2%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												3E-05			8E-01			2E-05			6E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												5E-09			2E-02			5E-09			1E-02	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG

Table 4-16: Comparison of Confirmatory Surface Soil EPCs to Industrial PRGs, Hazardous Substance Storage Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Organochlorine Pesticides by Method 8081A (mg/kg)																						
4,4-DDE	4	7	57%	9.10E-03	--	9.10E-03	--	--	7.0E+00	--	No	1.30E-09	0%	--	--	--	No	1.30E-09	0%	--	--	--
Metals by Method 6020 (mg/kg)																						
Antimony	3	3	100%	5.80E+00	--	5.80E+00	7.30E+00	No	--	4.1E+02	--	--	--	No	1.41E-02	21%	--	--	--	No	1.41E-02	29%
Arsenic	14	15	93%	1.33E+01	8.53E+00	8.53E+00	1.60E+01	No	1.6E+00	2.6E+02	Yes	8.31E-06	100%	No	5.12E-02	77%	Yes	5.33E-06	100%	No	3.28E-02	68%
Lead	15	15	100%	1.89E+02	2.48E+02	1.89E+02	2.9E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	6	15	40%	7.20E+00	--	7.20E+00	9.0E+00	No	--	5.1E+03	--	--	--	No	1.41E-03	2%	--	--	--	No	1.41E-03	3%
Zinc	15	15	100%	4.61E+02	2.84E+02	2.84E+02	1.7E+02	Yes	--	1E-05 (max)	--	--	--	No	--[d]	--[d]	--	--	--	No	--[d]	--[d]
Cumulative Excess Cancer Risk/Hazard Index Including Background:												8E-06			7E-02			5E-06			5E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-09			0E+00			1E-09			0E+00	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004), unless qualified with a "max" (ceiling limit concentration). Excess cancer risks or hazard quotients (HQs) are not calculated for chemicals of potential concern with non-risk-based PRGs (max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-17: Comparison of Confirmatory Subsurface Soil EPCs to Residential PRGs, Hazardous Substance Storage Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcinogenic PRG[d]	Non-carcinogenic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Contribution to Risk	>PRG (nc)	HQ[h]	% Contribution to HI
Organochlorine Pesticides by Method 8081A (mg/kg)																						
4,4-DDE	16	33	48%	9.10E-03	3.50E-03	3.50E-03			1.7E+00	--	No	5.35E-09	0%	--	--	--	No	2.06E-09	0%	--	--	--
Metals by Method 6020 (mg/kg)																						
Antimony	15	22	68%	8.40E+00	3.36E+00	3.36E+00	7.30E+00	Yes	--	3.1E+01	--	--	--	No	2.71E-01	26%	--	--	--	No	1.08E-01	24%
Arsenic	42	50	84%	1.58E+01	6.91E+00	6.91E+00	1.60E+01	No	3.9E-01	2.2E+01	Yes	4.05E-05	100%	No	7.18E-01	70%	Yes	1.77E-05	100%	No	3.14E-01	70%
Lead	42	50	84%	1.39E+02	7.94E+01	7.94E+01	2.9E+01	Yes	--	4.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	7	50	14%	7.30E+00	--	7.30E+00	9.0E+00	No	--	3.9E+02	--	--	--	No	1.87E-02	2%	--	--	--	No	1.87E-02	4%
Zinc	50	50	100%	4.18E+02	1.36E+02	1.36E+02	1.7E+02	Yes	--	2.3E+04	--	--	--	No	1.78E-02	2%	--	--	--	No	5.79E-03	1%
Cumulative Excess Cancer Risk/Hazard Index Including Background:												4E-05			1E+00			2E-05			4E-01	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												5E-09			3E-01			2E-09			1E-01	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).
-- = no data or not applicable
% = percent
> = greater than
ca = carcinogenic
nc = noncarcinogenic
mg/kg = milligrams per kilogram
HI = hazard index
[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.
[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.
[c] 95th percentile of Background Caprock Soils (DON 2006)
[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004).
[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)
[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)
[h] HQ = RME EPC / Noncarcinogic PRG
[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

Table 4-18: Comparison of Confirmatory Subsurface Soil EPCs to Industrial PRGs, Hazardous Substance Storage Area

											Maximum EPC Comparisons						RME EPC Comparisons					
											Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	Frequency of Detection	Max EPC[a]	95% UCL of Arithmetic Mean	RME EPC[b]	Background Concentration[c] (mg/kg)	Site Concentration Exceed Background?	Carcino-genic PRG[d]	Non-carcino-genic PRG[d]	>PRG (ca)	Excess Cancer Risk[e]	% Con-tribution to Risk	>PRG (nc)	HQ[f]	% Con-tribution to HI	>PRG (ca)	Excess Cancer Risk[g]	% Con-tribution to Risk	>PRG (nc)	HQ[h]	% Con-tribution to HI
Organochlorine Pesticides by Method 8081A (mg/kg)																						
4,4-DDE	16	33	48%	9.10E-03	3.50E-03	3.50E-03	--	--	7.0E+00	--	No	1.30E-09	0%	--	--	--	No	5.00E-10	0%	--	--	--
Metals by Method 6020 (mg/kg)																						
Antimony	15	22	68%	8.40E+00	3.36E+00	3.36E+00	7.30E+00	Yes	--	4.1E+02	--	--	--	No	2.05E-02	25%	--	--	--	No	8.18E-03	23%
Arsenic	42	50	84%	1.58E+01	6.91E+00	6.91E+00	1.60E+01	No	1.6E+00	2.6E+02	Yes	9.88E-06	100%	No	6.08E-02	73%	Yes	4.32E-06	100%	No	2.66E-02	73%
Lead	42	50	84%	1.39E+02	7.94E+01	7.94E+01	2.9E+01	Yes	--	8.0E+02	--	--	--	No	--[i]	--[i]	--	--	--	No	--[i]	--[i]
Selenium	7	50	14%	7.30E+00	--	7.30E+00	9.0E+00	No	--	5.1E+03	--	--	--	No	1.43E-03	2%	--	--	--	No	1.43E-03	4%
Zinc	50	50	100%	4.18E+02	1.36E+02	1.36E+02	1.7E+02	Yes	--	1E-05 (max)	--	--	--	No	--[d]	--[d]	--	--	--	No	--[d]	--[d]
Cumulative Excess Cancer Risk/Hazard Index Including Background:												1E-05			8E-02			4E-06			4E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:												1E-09			2E-02			5E-10			8E-03	

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (2004).

-- = no data or not applicable

% = percent

> = greater than

ca = carcinogenic

nc = noncarcinogenic

mg/kg = milligrams per kilogram

HI = hazard index

[a] Maximum exposure point concentration (EPC) is the maximum detected concentration of an analyte.

[b] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC.

[c] 95th percentile of Background Caprock Soils (DON 2006)

[d] Preliminary remediation goals (PRGs) are based on cancer risk or noncarcinogenic health effects (EPA 2004), unless qualified with a "max" (ceiling limit concentration). Excess cancer risks or hazard quotients (HQs) are not calculated for chemicals of potential concern with non-risk-based PRGs (max), which are discussed qualitatively in the Uncertainty Section of the text.

[e] Excess cancer risk = 1E-06 x (Maximum EPC / Carcinogenic PRG)

[f] Hazard Quotient (HQ) = Maximum EPC / Noncarcinogenic PRG

[g] Excess cancer risk = 1E-06 x (RME EPC / Carcinogenic PRG)

[h] HQ = RME EPC / Noncarcinogic PRG

[i] An HI for lead could not be determined because the PRGs for lead were developed using blood-lead levels and an RfD is not available.

5. Summary

Confirmatory samples were collected from unremediated soil at Bldg. 43, Bldg. 284, the Camel Refurbishing Area, and the HSSA located on Ford Island, Pearl Harbor Naval Complex, Hawaii during the 2003 removal actions. These data and data from unremediated soil obtained during the Ford Island RI were used to evaluate existing soil conditions. The results of the comparison of COCs to project-specific cleanup levels as well as the estimated cumulative risks and hazards following comparison to residential and industrial Region 9 PRGs (2004) for each site are summarized below.

5.1 Bldg. 43

The RME EPCs for benzo(a)pyrene in surface and subsurface soil at Bldg. 43 were below its project-specific cleanup level. Additionally, the carcinogenic risks associated with RME EPCs for benzo(a)pyrene in surface and subsurface soil for both the residential and industrial land use are less than the 1E–06 point of departure.

None of the site soil COCs had RME EPCs that exceeded their respective DOH soil EAL.

5.2 Bldg. 284

The RME EPCs for arsenic, beryllium, cadmium, lead, mercury, and selenium in surface and subsurface soil were all below their respective cleanup levels. The carcinogenic risks associated with RME EPCs in surface and subsurface soil for residential and industrial land use were all greater than the 1E–06 point of departure. Almost all of the cumulative carcinogenic risk can be attributed to the RME EPC for arsenic. However, the RME EPC for arsenic is well below its cleanup goal. Additionally, arsenic is present at background concentrations since the maximum detected concentration was below the background 95th percentile value. Excluding metals at background level, carcinogenic risks associated with the maximum EPC or the RME EPC in surface soil decrease to less than the 1E–06 point of departure The non-cancer hazards associated with RME EPCs in surface and subsurface soil for residential and industrial land use did not exceed the point of departure of 1.

None of the site surface soil COCs had maximum or RME EPCs that exceeded their respective DOH soil EALs. The maximum detected concentration of lead and mercury in subsurface soil at Bldg, 284 exceeded the DOH soil EAL. Because subsurface soil is not considered an ecological exposure medium and the RME lead and mercury concentration did not exceed the EAL, risk to terrestrial ecological receptors at Bldg. 284 is considered acceptable.

5.3 Camel Refurbishing Area

The RME EPCs for arsenic, copper, lead, selenium, and zinc in surface, paved subsurface, and unpaved subsurface soil were all below their respective cleanup levels. The carcinogenic risks associated with RME EPCs in surface, paved subsurface, and unpaved subsurface soil for residential and industrial land use were greater than the 1E–06 point of departure. Almost all of the cumulative carcinogenic risk can be attributed to the RME EPC for arsenic. Because arsenic is present at concentrations that exceed the background 95th percentile, arsenic was treated as though it is a site-related COC. As such, the exclusion of background metals affected little change in risk estimates; arsenic continues to drive the carcinogenic risk estimates. The maximum concentration of arsenic in surface soil and paved subsurface soil areas were below the maximum background concentration of 29 mg/kg, suggesting that arsenic in these areas is likely at background concentrations. The maximum concentration of 52.1 mg/kg in unpaved subsurface soil areas exceeded the maximum background concentration of 29 mg/kg. However, the RME EPC for arsenic is well below its background concentration. The non-cancer hazards associated with RME EPCs in surface, paved subsurface, and unpaved subsurface soil for residential and industrial land use were all below the point of departure of 1.

Maximum EPCs for arsenic, lead, and selenium exceeded their respective DOH EALs in subsurface soil. The maximum EPC for selenium exceeded the DOH EAL in surface soil. Because subsurface soil is not considered an ecological exposure medium and no COC RME concentration exceeded its EAL, risk to terrestrial ecological receptors at the Camel Refurbishing Area is considered acceptable.

5.4 HAZARDOUS SUBSTANCE STORAGE AREA

The RME EPCs for 4,4′-DDE, antimony, arsenic, selenium, and zinc in surface and subsurface soil and lead in subsurface soil were all below their respective cleanup levels. However, the RME EPC for lead in surface soil exceeded its cleanup level. The maximum concentration was used as the RME for lead. The maximum lead concentration exceeded the background 95th percentile value of 96 mg/kg but was below the maximum background value of 203 mg/kg for caprock soils (associated with combined natural and anthropogenic sources); a site-related release of lead is considered. However, the mean post-cleanup exposure concentration of 85 mg/kg is below the cleanup value of 170 mg/kg, the federal human health residential screening level of 400 mg/kg, and DOH screening value of 200 mg/kg (based on urban ecotoxicity). The carcinogenic risks associated with RME EPCs in surface and subsurface soil for residential and industrial land use were greater than the 1E–06 point of departure. Almost all of the cumulative carcinogenic risk can be attributed to the RME EPC for arsenic. However, arsenic is present at background concentrations since the maximum detected concentration was below the background 95th percentile value. Excluding metals at background levels, carcinogenic risks associated with the maximum EPC or the RME EPC decrease to less than the 1E–06 point of departure The non-cancer hazards associated with RME EPCs in surface and subsurface soil for residential and industrial land use were all below the point of departure of 1.

None of the site surface or subsurface soil COCs had maximum or RME EPCs that exceeded their respective DOH soil EALs, therefore, risk to terrestrial ecological receptors at HSSA is considered acceptable.

6. Uncertainty

RME EPCs used in the risk assessment were the 95 percent UCL of the arithmetic mean or the maximum detected value (whichever was lower). For a number of the chemicals, a 95 percent UCL was not calculated because the number of detections was below 11. Because a 95 percent UCL was not calculated, the RME EPC was equivalent to the maximum detected concentration. The use of the maximum detected value likely overestimates the average exposure to COCs at the site and, therefore, likely overestimates risk. The use of the RME EPCs is done to more accurately represent the “average” exposure condition. When the maximum detected concentration is used, it is likely that risks associated with the average exposure conditions are overestimated.

When calculating summary statistics, proxy values for non-detections were used. Generally, one half the RL is used as the proxy value. However, in some instances, one half the MDL or one half a formerly estimated value (subsequently qualified as a non-detection) were used as proxy values. Using these lower values could underestimate risks by biasing low the 95 UCL. The degree of underestimation, however, is minimal and of little significance. For example, the majority of the carcinogenic risk associated with the sites was attributable to background levels of arsenic. Regardless of which proxy value is used for non-detections, the overall levels of arsenic and associated risks at the sites will remain at background levels. For non-carcinogens, the HIs were considerably less than one for most sites. The use of one half the RL as a proxy value for all non-detections would not significantly change the resulting concentrations such that hazards become unacceptable. The resulting HIs will remain below one. For those sites with a hazard index near or greater than one, the non-carcinogenic hazard was driven by background levels of arsenic. The selection of a proxy value for non-detections is immaterial as the resulting hazard would likely remain below background levels. Where there are insufficient detections for the calculation of a 95 percent UCL, and maximum detected values are used as RME EPCs, reporting limits for non-detections have no impact. EPA Region 9 has established PRG “max” concentrations for some inorganic chemicals or semivolatile organic compounds 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 zinc. It is not known whether hazards are overestimated or underestimated through use of “max” concentrations.

Risks were presented with and without the inclusion of metals at background levels. Any metal was determined to exceed background if the maximum site concentration exceeded the background 95th percentile for caprock soils. Comparisons to maximum background concentrations were also included. When using the 95th percentile as the background concentration, a 5 percent chance of exceeding this representative value exists for any analytical result for metal (including one from background areas). For those occasions where the site maximum exceeded the background 95th percentile but was below the maximum background concentration (e.g., arsenic at Camel Refurbishing Area), the metal may well be at background levels.

For each of the four sites evaluated in this revised post-removal risk assessment, cumulative carcinogenic risks and non-cancer hazards were calculated. These cumulative cancer risks and non-cancer hazards were only evaluated for chemicals for which confirmatory sampling was conducted. Evaluation of cumulative cancer risks and non-cancer hazards for only chemicals for which confirmatory samples were collected most likely underestimates the cumulative risks and hazards associated with the site because this risk evaluation focused only on chemicals previously identified as posing a risk to human health or the environment. Contamination from the chemicals that previously presented unacceptable risks has been removed from the four sites.

7. References

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Appendix A
Analytical Results for Confirmation and RI Soil Samples

Table A-1: Analytical Results for Confirmation and RI Soil Sampling, Bldg. 43

Sample ID	Description	Sample Type	Result [1]	Qual
Benzo(a) Pyrene				
B43003	Direct Push Boring	subsurface soil	0.039	J
B43006	Direct Push Boring	subsurface soil	0.037	U
B43010	Direct Push Boring	subsurface soil	0.039	U
B43013	Direct Push Boring	subsurface soil	0.038	U
B43016	Direct Push Boring	subsurface soil	0.018	J
B43033	Surface Soil	surface soil	0.026	U
B43043	Surface Soil	surface soil	0.031	J
B43046	Direct Push Boring	subsurface soil	0.013	J
B43047	Direct Push Boring	subsurface soil	0.033	U
B43051	Field Duplicate of B43052	subsurface soil	0.034	U
B43052	Direct Push Boring	subsurface soil	0.033	U
B43055	Direct-Push Boring	subsurface soil	0.029	U
B43056	Direct-Push Boring	subsurface soil	0.035	U
B43063	Floor of Excavation	subsurface soil	0.015	J
B43064	Field duplicate of B43063	subsurface soil	0.042	
B43067	Floor of Excavation	subsurface soil	0.014	J
B43068	Floor of Excavation	subsurface soil	0.033	U
B43069	Floor of Excavation	subsurface soil	0.013	J
B43070	Floor of Excavation	subsurface soil	0.043	J
B43071	Floor of Excavation	subsurface soil	0.028	UJ
B43073	Western Corner	subsurface soil	0.029	U
B43075	Western Sidewall	subsurface soil	0.029	U
B43076	North Corner	subsurface soil	0.031	U
B43077	Field Duplicate of B43076	subsurface soil	0.031	U
B43078	Northeast Sidewall	surface soil	0.046	J
B43079	Northeast Sidewall	subsurface soil	0.029	UJ
B43080	Northwest Sidewall	subsurface soil	0.14	J
B43081	Northwest Sidewall	subsurface soil	0.028	U
B43083	Southwest Corner	subsurface soil	0.021	J
B43086	Southeast Corner at Bulkhead	subsurface soil	0.12	U
B43087	Southeast Corner at Bulkhead	subsurface soil	0.12	U
B43089	Floor South of Tree	subsurface soil	0.03	U
B43091	Northwest Sidewall	subsurface soil	0.029	J
B43093	Northern Middle Sidewall Corner	surface soil	0.029	U
B43094	Northern Middle Sidewall Corner	subsurface soil	0.029	U
B43098	Northern Floor	subsurface soil	0.027	J
B43099	Field Duplicate of B43098	subsurface soil	0.024	J
B43100	Northeastern Sidewall	subsurface soil	0.032	UJ
B43101	Northeastern Sidewall	subsurface soil	0.015	J
B43102	Floor at Original Northern Limits	subsurface soil	0.032	U
B43103	Floor Between Tie-backs and Bulkhead	subsurface soil	0.037	
B43105	Northwestern Corner of Over-Excavation by Bulkhead	subsurface soil	0.088	
B43106	Floor of Over-Excavation by Bulkhead	subsurface soil	0.12	
B43108	Northeastern Corner at Depth	subsurface soil	0.021	J
B43109	Northeastern Corner at Surface	subsurface soil	0.2	
B43110	Floor of Over-Excavation Along Southern Lmit	subsurface soil	0.032	J
B43111	Sidewall of Over-excavation Along Southern Limit	subsurface soil	0.062	
B43112	Field Duplicate of B43111	subsurface soil	0.045	
B43113	Southwestern Corner at Surface	subsurface soil	0.031	
B43114	Over-Excavation at Tree at Surface	subsurface soil	0.047	
B43115	Over-Excavation Along Concrete Wall	subsurface soil	0.032	U

Sample ID	Description	Sample Type	Result [1]	Qual
B43-DP01-SB-A02.5	B43-DP01	subsurface soil	0.049	U
B43-DP01-SB-A07.5	B43-DP01	subsurface soil	0.048	U
B43-DP02-SB-A03.0	B43-DP02	subsurface soil	0.061	U
B43-DP02-SB-A07.5	B43-DP02	subsurface soil	0.052	U
B43-DP03-SB-A07.0	B43-DP03	subsurface soil	0.057	U
B43-DP04-SB-A03.5	B43-DP04	subsurface soil	0.056	UJ
B43-DP04-SB-A07.5	B43-DP04	subsurface soil	0.048	U
B43-MW01-SB-A02.0	B43-MW01	subsurface soil	0.047	UJ
B43-MW01-SB-A06.5	B43-MW01	subsurface soil	0.05	U
B43-MW01-SB-D06.5	B43-MW01	subsurface soil	0.05	U

[1] Analytical results are in mg/kg.

Table A-2: Analytical Results for Confirmation and RI Soil Sampling, Bldg. 284

Sample ID	Description	Sample Type	Result [1]	Qual
Arsenic				
B284007	B284-MW01-02	subsurface soil	7.6	
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	5.2	
B284010	B284-MW01-03	subsurface soil	11.7	J
B284011	B284-MW01-01	subsurface soil	13.7	J
B284-01A-SS-A	B284-01A-SS-A	surface soil	8.6	
B284-01B-SS-A	B284-01B-SS-A	surface soil	4.2	
B284-02A-SS-A	B284-02A-SS-A	surface soil	4.5	
B284-02A-SS-D	B284-02A-SS-D	surface soil	5	
B284-02B-SS-A	B284-02B-SS-A	surface soil	4.3	
B284054	Excavation	subsurface soil	14.9	J
B284055	Excavation	subsurface soil	8.4	J
B284056	Excavation	subsurface soil	6.3	J
B284057	Excavation	subsurface soil	10.3	J
B284058	Excavation	subsurface soil	19.5	J
B284060	Excavation	subsurface soil	19	J
B284061	Excavation	subsurface soil	5.9	J
B284062	Field duplicate of B284061	subsurface soil	5.3	J
B284063	Excavation	subsurface soil	15.4	J
B284064	Excavation	subsurface soil	2.3	J
B284065	Excavation	subsurface soil	6.9	J
B284066	Excavation	subsurface soil	4	J
B284067	Field duplicate of B284066	subsurface soil	2.6	J
B284068	Excavation	subsurface soil	2.2	J
B284069	Excavation	subsurface soil	3.3	J
B284100	Below pipe chase (concrete removed)	subsurface soil	13	J
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	4.8	J
B284102	Floor of excavation	subsurface soil	8	
B284110	Bldg foundation (B284103)	subsurface soil	1.8	UJ
B284112	Ex floor @ sidewall (B284104)	subsurface soil	13.3	J
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	4.7	J
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	7	
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	8.7	
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	4.7	
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	3.1	
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	0.59	
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	0.89	J
Beryllium				
B284007	B284-MW01-02	subsurface soil	0.005	UJ
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	0.23	
B284010	B284-MW01-03	subsurface soil	0.005	UJ
B284011	B284-MW01-01	subsurface soil	0.004	UJ
B284-01A-SS-A	B284-01A-SS-A	surface soil	0.087	J
B284-01B-SS-A	B284-01B-SS-A	surface soil	0.025	J
B284-02A-SS-A	B284-02A-SS-A	surface soil	0.015	J
B284-02A-SS-D	B284-02A-SS-D	surface soil	0.022	J
B284-02B-SS-A	B284-02B-SS-A	surface soil	0.025	J
B284054	Excavation	subsurface soil	0.0052	UJ
B284055	Excavation	subsurface soil	0.005	UJ
B284056	Excavation	subsurface soil	0.0048	UJ
B284057	Excavation	subsurface soil	0.0046	UJ
B284058	Excavation	subsurface soil	0.0049	UJ
B284060	Excavation	subsurface soil	0.0049	UJ
B284061	Excavation	subsurface soil	0.0049	UJ
B284062	Field duplicate of B284061	subsurface soil	0.0048	UJ
B284063	Excavation	subsurface soil	0.0049	UJ
B284064	Excavation	subsurface soil	0.0041	UJ

Sample ID	Description	Sample Type	Result [1]	Qual
B284065	Excavation	subsurface soil	0.005	UJ
B284066	Excavation	subsurface soil	0.0041	UJ
B284067	Field duplicate of B284066	subsurface soil	0.0041	UJ
B284068	Excavation	subsurface soil	0.0041	UJ
B284069	Excavation	subsurface soil	0.0047	UJ
B284100	Below pipe chase (concrete removed)	subsurface soil	0.24	UJ
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	0.26	UJ
B284102	Floor of excavation	subsurface soil	0.26	U
B284110	Bldg foundation (B284103)	subsurface soil	0.26	U
B284112	Ex floor @ sidewall (B284104)	subsurface soil	0.37	U
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	0.65	U
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	0.14	J
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	0.019	J
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	0.073	J
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	0.065	J
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	0.64	UJ
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	0.63	UJ
Cadmium				
B284007	B284-MW01-02	subsurface soil	0.33	
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	0.29	
B284010	B284-MW01-03	subsurface soil	0.041	UJ
B284011	B284-MW01-01	subsurface soil	0.045	UJ
B284-01A-SS-A	B284-01A-SS-A	surface soil	1.1	
B284-01B-SS-A	B284-01B-SS-A	surface soil	1.5	
B284-02A-SS-A	B284-02A-SS-A	surface soil	1.2	
B284-02A-SS-D	B284-02A-SS-D	surface soil	1.2	
B284-02B-SS-A	B284-02B-SS-A	surface soil	2.8	
B284054	Excavation	subsurface soil	0.71	
B284055	Excavation	subsurface soil	0.014	UJ
B284056	Excavation	subsurface soil	0.36	
B284057	Excavation	subsurface soil	0.57	
B284058	Excavation	subsurface soil	0.84	
B284060	Excavation	subsurface soil	0.4	
B284061	Excavation	subsurface soil	0.15	UJ
B284062	Field duplicate of B284061	subsurface soil	0.18	
B284063	Excavation	subsurface soil	3.1	
B284064	Excavation	subsurface soil	0.19	
B284065	Excavation	subsurface soil	0.45	
B284066	Excavation	subsurface soil	0.38	
B284067	Field duplicate of B284066	subsurface soil	0.029	UJ
B284068	Excavation	subsurface soil	0.14	UJ
B284069	Excavation	subsurface soil	0.21	
B284100	Below pipe chase (concrete removed)	subsurface soil	0.24	U
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	0.26	U
B284102	Floor of excavation	subsurface soil	2.8	J
B284110	Bldg foundation (B284103)	subsurface soil	2.8	
B284112	Ex floor @ sidewall (B284104)	subsurface soil	1.3	
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	0.65	U
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	0.53	J
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	0.14	J
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	0.21	J
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	0.066	J
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	0.1	J
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	0.63	U
Lead				
B284007	B284-MW01-02	subsurface soil	106	J
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	55.9	J
B284010	B284-MW01-03	subsurface soil	2.5	J

Sample ID	Description	Sample Type	Result [1]	Qual
B284011	B284-MW01-01	subsurface soil	21.5	J
B284-01A-SS-A	B284-01A-SS-A	surface soil	58	J
B284-01B-SS-A	B284-01B-SS-A	surface soil	94	J
B284-02A-SS-A	B284-02A-SS-A	surface soil	99	J
B284-02A-SS-D	B284-02A-SS-D	surface soil	100	J
B284-02B-SS-A	B284-02B-SS-A	surface soil	130	J
B284054	Excavation	subsurface soil	61.2	J
B284055	Excavation	subsurface soil	6	J
B284056	Excavation	subsurface soil	89.6	J
B284057	Excavation	subsurface soil	34.8	J
B284058	Excavation	subsurface soil	23.1	J
B284060	Excavation	subsurface soil	29.7	J
B284061	Excavation	subsurface soil	16.2	J
B284062	Field duplicate of B284061	subsurface soil	17.2	J
B284063	Excavation	subsurface soil	104	J
B284064	Excavation	subsurface soil	2.6	UJ
B284065	Excavation	subsurface soil	45.9	J
B284066	Excavation	subsurface soil	0.67	UJ
B284067	Field duplicate of B284066	subsurface soil	0.51	U
B284068	Excavation	subsurface soil	7.5	UJ
B284069	Excavation	subsurface soil	15.5	J
B284100	Below pipe chase (concrete removed)	subsurface soil	84.4	J
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	11.6	J
B284102	Floor of excavation	subsurface soil	**266**	
B284110	Bldg foundation (B284103)	subsurface soil	**345**	
B284112	Ex floor @ sidewall (B284104)	subsurface soil	**229**	
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	4.9	J
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	16	
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	11	
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	17	
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	4.7	J
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	8.2	J
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	5.6	J
Mercury				
B284007	B284-MW01-02	subsurface soil	0.48	
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	0.74	
B284010	B284-MW01-03	subsurface soil	0.32	
B284011	B284-MW01-01	subsurface soil	0.35	
B284-01A-SS-A	B284-01A-SS-A	surface soil	0.2	J
B284-01B-SS-A	B284-01B-SS-A	surface soil	1.2	J
B284-02A-SS-A	B284-02A-SS-A	surface soil	0.22	J
B284-02A-SS-D	B284-02A-SS-D	surface soil	0.26	J
B284-02B-SS-A	B284-02B-SS-A	surface soil	3.2	J
B284054	Excavation	subsurface soil	1.5	
B284055	Excavation	subsurface soil	0.095	
B284056	Excavation	subsurface soil	0.57	
B284057	Excavation	subsurface soil	7.6	
B284058	Excavation	subsurface soil	0.16	
B284060	Excavation	subsurface soil	0.36	
B284061	Excavation	subsurface soil	0.26	
B284062	Field duplicate of B284061	subsurface soil	0.19	
B284063	Excavation	subsurface soil	8.2	
B284064	Excavation	subsurface soil	0.74	
B284065	Excavation	subsurface soil	0.18	
B284066	Excavation	subsurface soil	0.068	
B284067	Field duplicate of B284066	subsurface soil	0.079	
B284068	Excavation	subsurface soil	1.4	
B284069	Excavation	subsurface soil	0.21	

Sample ID	Description	Sample Type	Result [1]	Qual
B284100	Below pipe chase (concrete removed)	subsurface soil	0.4	
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	0.09	J
B284102	Floor of excavation	subsurface soil	2.9	
B284110	Bldg foundation (B284103)	subsurface soil	5.9	
B284112	Ex floor @ sidewall (B284104)	subsurface soil	0.56	
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	0.05	J
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	0.025	J
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	0.069	J
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	0.3	U
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	0.32	UJ
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	0.32	UJ
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	0.31	UJ
Selenium				
B284007	B284-MW01-02	subsurface soil	2.5	
B284008	B284-MW01-02 Field Duplicate of B284007	subsurface soil	1.6	U
B284010	B284-MW01-03	subsurface soil	0.091	U
B284011	B284-MW01-01	subsurface soil	0.88	UJ
B284-01A-SS-A	B284-01A-SS-A	surface soil	3.5	J
B284-01B-SS-A	B284-01B-SS-A	surface soil	8.3	
B284-02A-SS-A	B284-02A-SS-A	surface soil	3.4	J
B284-02A-SS-D	B284-02A-SS-D	surface soil	5.1	J
B284-02B-SS-A	B284-02B-SS-A	surface soil	9.6	
B284054	Excavation	subsurface soil	1.4	UJ
B284055	Excavation	subsurface soil	1.4	UJ
B284056	Excavation	subsurface soil	1.3	UJ
B284057	Excavation	subsurface soil	1.3	UJ
B284058	Excavation	subsurface soil	1.3	UJ
B284060	Excavation	subsurface soil	1.4	J
B284061	Excavation	subsurface soil	1.3	UJ
B284062	Field duplicate of B284061	subsurface soil	3	J
B284063	Excavation	subsurface soil	1.4	UJ
B284064	Excavation	subsurface soil	1.1	UJ
B284065	Excavation	subsurface soil	3	J
B284066	Excavation	subsurface soil	1.1	UJ
B284067	Field duplicate of B284066	subsurface soil	1.1	UJ
B284068	Excavation	subsurface soil	1.1	UJ
B284069	Excavation	subsurface soil	1.3	UJ
B284100	Below pipe chase (concrete removed)	subsurface soil	5.9	UJ
B284101	Ex floor @ sidewall below pipe chase	subsurface soil	3.3	J
B284102	Floor of excavation	subsurface soil	6.4	U
B284110	Bldg foundation (B284103)	subsurface soil	6.5	UJ
B284112	Ex floor @ sidewall (B284104)	subsurface soil	9.3	UJ
B284-MW01-SB-A11.5	B284-MW01-SB-A11.5	subsurface soil	6.5	U
B284-MW02-SB-A03.0	B284-MW02-SB-A03.0	subsurface soil	4.4	J
B284-MW02-SB-A04.5	B284-MW02-SB-A04.5	subsurface soil	0.98	J
B284-MW03-SB-A02.5	B284-MW03-SB-A02.5	subsurface soil	0.88	J
B284-MW04-SB-A03.0	B284-MW04-SB-A03.0	subsurface soil	1.1	J
B284-MW04-SB-A12.0	B284-MW04-SB-A12.0	subsurface soil	6.4	U
B284-MW04-SB-D12.0	B284-MW04-SB-D12.0	subsurface soil	6.3	U

[1] Analytical results are in mg/kg.

Table A-3: Analytical Results for Confirmation and RI Soil Sampling, Camel Refurbishing Area

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
Arsenic					
CRA063	CRA-DP15-01	paved	subsurface soil	10.4	J
CRA064	CRA-DP15-01 - field duplicated of CRA063	paved	subsurface soil	10.6	J
CRA065	CRA-DP15-01	paved	subsurface soil	6.3	
CRA066	CRA-DP15-02	paved	subsurface soil	17.7	
CRA067	CRA-DP15-02	paved	subsurface soil	2.3	
CRA068	CRA-DP15-03	paved	subsurface soil	4.6	
CRA069	CRA-DP15-03	paved	subsurface soil	2	U
CRA140	TRSF	unpaved	subsurface soil	8.6	J
CRA154	CRA001	unpaved	surface soil	9.1	J
CRA155	CRA002	unpaved	surface soil	6.5	J
CRA157	CRA004	unpaved	surface soil	5.9	J
CRA158	CRA004 - Field duplicate of CRA157	unpaved	surface soil	5.8	J
CRA159	CRA005	unpaved	surface soil	16.7	J
CRA160	CRA006	unpaved	surface soil	4.8	J
CRA219	CRA009	unpaved	surface soil	1.3	UJ
CRA220	CRA010	unpaved	surface soil	1.3	U
CRA221	CRA012	unpaved	surface soil	5.3	J
CRA222	CRA013	unpaved	surface soil	2.5	J
CRA223	CRA014	unpaved	surface soil	2.2	J
CRA225	CRA016	unpaved	surface soil	4.5	J
CRA226	CRA017	unpaved	surface soil	1.4	U
CRA227	CRA018	unpaved	surface soil	1.2	U
CRA228	CRA019	unpaved	surface soil	1.3	U
CRA229	CRA020	unpaved	surface soil	1.4	J
CRA230	CRA021	unpaved	surface soil	1.8	J
CRA231	CRA023	unpaved	surface soil	2.7	J
CRA232	CRA024	unpaved	surface soil	1.3	UJ
CRA233	CRA025	unpaved	surface soil	4	J
CRA234	CRA026	unpaved	surface soil	1.3	UJ
CRA235	CRA027	unpaved	surface soil	1.2	UJ
CRA236	CRA028	unpaved	surface soil	1.3	UJ
CRA238	CRA030	unpaved	surface soil	1.3	UJ
CRA239	CRA031A	unpaved	surface soil	1.7	J
CRA240	CRA031	unpaved	surface soil	1.3	UJ
CRA242	CRA032	unpaved	surface soil	1.5	J
CRA244	CRA034	unpaved	surface soil	4.2	J
CRA246	CRA035	unpaved	surface soil	2.4	J
CRA247	CRA035 - Field duplicate of CRA246	unpaved	surface soil	3.2	J
CRA248	CRA036A	unpaved	surface soil	1.2	UJ
CRA249	CRA036A - Field duplicate of CRA248	unpaved	surface soil	1.2	UJ
CRA250	CRA036	unpaved	surface soil	1.3	UJ
CRA252	CRA037	unpaved	surface soil	1.3	UJ
CRA255	CRA039	unpaved	surface soil	1.2	UJ
CRA256	CRA040	unpaved	surface soil	1.2	UJ
CRA257	CRA041	unpaved	surface soil	1.2	UJ
CRA258	CRA042	unpaved	surface soil	5.4	J
CRA259	CRA042 - Field duplicate of CRA258	unpaved	surface soil	5.8	J
CRA260	CRA043	unpaved	surface soil	1.3	J
CRA261	CRA044	unpaved	surface soil	3	J
CRA262	CRA046	unpaved	surface soil	2.2	J
CRA263	CRA047	unpaved	surface soil	1.1	UJ
CRA264	CRA049	unpaved	surface soil	1.8	J
CRA265	CRA051	unpaved	surface soil	1.2	UJ
CRA266	CRA051 - Field duplicate of CRA265	unpaved	surface soil	1.2	UJ
CRA268	CRA048	unpaved	surface soil	12	UJ
CRA269	CRA050	unpaved	surface soil	17.6	J
CRA270	CRA038	unpaved	surface soil	11.8	UJ
CRA271	CRA052	unpaved	surface soil	7.5	UJ
CRA272	CRA055	unpaved	surface soil	11.8	UJ
CRA273	CRA071	unpaved	surface soil	8.8	UJ
CRA274	CRA072	unpaved	surface soil	3.6	UJ

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA276	CRA074	unpaved	surface soil	6	UJ
CRA277	CRA075	unpaved	surface soil	9.8	UJ
CRA278	CRA075 - Field duplicate of CRA277	unpaved	surface soil	11.6	UJ
CRA279	CRA076	unpaved	surface soil	7.3	UJ
CRA280	CRA077	unpaved	surface soil	6.4	UJ
CRA281	CRA078	unpaved	surface soil	5.4	UJ
CRA282	CRA079	unpaved	surface soil	5.2	UJ
CRA283	CRA082	unpaved	surface soil	7	UJ
CRA284	CRA083	unpaved	surface soil	2.2	J
CRA285	CRA085	unpaved	surface soil	6.2	J
CRA286	CRA088	unpaved	surface soil	1.9	J
CRA287	CRA093	unpaved	surface soil	4.6	J
CRA288	CRA093 - Field duplicate of CRA287	unpaved	surface soil	3.6	
CRA289	CRA097	unpaved	surface soil	7.9	
CRA290	CRA101	unpaved	surface soil	4.7	
CRA291	CRA105	unpaved	surface soil	4.7	
CRA292	CRA086	unpaved	surface soil	3.1	
CRA293	CRA089	unpaved	surface soil	4.6	
CRA294	CRA090	unpaved	surface soil	4.7	
CRA295	CRA094	unpaved	surface soil	3.2	
CRA296	CRA095	unpaved	surface soil	1.1	UJ
CRA297	CRA098	unpaved	surface soil	1.2	J
CRA298	CRA099	unpaved	surface soil	1.7	J
CRA299	CRA099 - Field duplicate of CRA298	unpaved	surface soil	3.6	J
CRA300	CRA102	unpaved	surface soil	1.1	UJ
CRA301	CRA104	unpaved	surface soil	1.1	UJ
CRA303	CRA107	unpaved	surface soil	2.8	J
CRA304	CRA084	unpaved	surface soil	1.1	UJ
CRA305	CRA087	unpaved	surface soil	0.11	UJ
CRA306	CRA091	unpaved	surface soil	1.3	UJ
CRA307	CRA096	unpaved	surface soil	0.21	UJ
CRA308	CRA100	unpaved	surface soil	4	J
CRA309	CRA DP07	unpaved	surface soil	3.5	J
CRA310	CRA DP07 - Field duplicate of CRA309	unpaved	surface soil	1.2	UJ
CRA311	CRA053	unpaved	surface soil	5	J
CRA312	CRA070	unpaved	surface soil	1.5	J
CRA313	CRA080	unpaved	surface soil	9.3	J
CRA314	CRA080 - Field duplicate of CRA313	unpaved	surface soil	8.6	J
CRA316	CRA113	unpaved	surface soil	4.5	J
CRA317	CRA115	unpaved	subsurface soil	2.5	J
CRA318	CRA116	unpaved	surface soil	5.2	J
CRA319	CRA117	unpaved	subsurface soil	5.3	J
CRA320	CRA118	unpaved	subsurface soil	3.4	J
CRA321	CRA108	unpaved	subsurface soil	8.3	J
CRA322	CRA109	unpaved	subsurface soil	4.3	J
CRA326	CRA003-C	unpaved	subsurface soil	20.6	J
CRA327	CRA003-N	unpaved	subsurface soil	5.8	J
CRA328	CRA003-S	unpaved	subsurface soil	11.4	J
CRA329	CRA007-C	unpaved	subsurface soil	7.1	J
CRA330	CRA007-N	unpaved	subsurface soil	10.9	J
CRA331	CRA007-S	unpaved	subsurface soil	3.1	UJ
CRA332	CRA029-N	unpaved	subsurface soil	6.2	J
CRA335	CRA073-N	unpaved	subsurface soil	5.5	J
CRA336	CRA073-N Field duplicate of CRA335	unpaved	subsurface soil	3.5	UJ
CRA337	CRA073-S	unpaved	subsurface soil	4.1	UJ
CRA338	CRA106-C	unpaved	subsurface soil	8.1	J
CRA339	CRA106-N	unpaved	subsurface soil	5.4	UJ
CRA340	CRA106-W	unpaved	subsurface soil	7.1	J
CRA341	CRA106-E	unpaved	subsurface soil	6.5	UJ
CRA344	CRA111-S	unpaved	surface soil	8	J
CRA350	CRA112-W	unpaved	surface soil	3.8	J
CRA351	CRA112-W Field duplicate of CRA350	unpaved	surface soil	2.5	J
CRA352	CRA008-N	unpaved	surface soil	13.3	
CRA353	CRA008-C	unpaved	surface soil	8.5	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA354	CRA015-C	unpaved	surface soil	8.6	J
CRA355	CRA015-N	unpaved	surface soil	10.2	J
CRA356	CRA015-S	unpaved	surface soil	6.4	UJ
CRA357	CRA080A	unpaved	surface soil	3.6	UJ
CRA358	CRA104A	unpaved	surface soil	4.9	UJ
CRA359	CRA109A	unpaved	surface soil	2.5	UJ
CRA360	CRA029 - Center	unpaved	subsurface soil	10.7	J
CRA361	CRA029 - North	unpaved	subsurface soil	2.3	J
CRA362	CRA073 - Center	unpaved	subsurface soil	2.7	J
CRA363	CRA073 - North	unpaved	subsurface soil	3.2	J
CRA364	CRA073 - South	unpaved	subsurface soil	3.1	J
CRA365	CRA111 - Center	unpaved	subsurface soil	5.5	J
CRA366	CRA111 - Center - Field Duplicate of CRA365	unpaved	subsurface soil	4.7	J
CRA367	CRA111 - North	unpaved	subsurface soil	8.8	J
CRA368	CRA111 - West	unpaved	subsurface soil	9.5	J
CRA370	CRA111 - South	unpaved	subsurface soil	5	J
CRA372	CRA-112 N	unpaved	subsurface soil	9.6	
CRA373	CRA112 NW/ 111 SE	unpaved	subsurface soil	4.6	J
CRA374	CRA110	unpaved	subsurface soil	15.9	
CRA376	CRA110 W	unpaved	subsurface soil	7.6	J
CRA377	Field Duplicate of CRA376	unpaved	subsurface soil	6.7	J
CRA378	CRA111 NE	unpaved	subsurface soil	1.7	J
CRA379	CRA-HS01 (10-ft W of CRA112)	unpaved	subsurface soil	3.9	UJ
CRA384	CRA-HS06 (10-ft N of CRA112)	unpaved	subsurface soil	16.2	
CRA386	CRA-TP02 (12.5-ft S of CRA379)	unpaved	subsurface soil	5.7	UJ
CRA387	Field duplicate of CRA386	unpaved	subsurface soil	5	UJ
CRA388	CRA-TP03 (17.5-ft S of CRA112)	unpaved	subsurface soil	3.1	UJ
CRA389	CRA-TP04(17.5-ft S of CRA379)	unpaved	subsurface soil	4.8	UJ
CRA390	CRA-112	unpaved	subsurface soil	5.6	
CRA391	CRA-TP01 (12.5-ft S of CRA112)	unpaved	subsurface soil	52.1	
CRA-DP01-SB-A02.0	CRA-DP01-SB-A02.0	unpaved	subsurface soil	9.5	J
CRA-DP01-SB-A03.5	CRA-DP01-SB-A03.5	unpaved	subsurface soil	8.9	J
CRA-DP02-SB-A03.0	CRA-DP02-SB-A03.0	unpaved	subsurface soil	8.6	J
CRA-DP03-SB-A03.0	CRA-DP03-SB-A03.0	unpaved	subsurface soil	7.5	J
CRA-DP04-SB-A02.0	CRA-DP04-SB-A02.0	unpaved	subsurface soil	11	
CRA-DP04-SB-A03.5	CRA-DP04-SB-A03.5	unpaved	subsurface soil	8.8	
CRA-DP05-SB-A02.0	CRA-DP05-SB-A02.0	unpaved	subsurface soil	2.3	
CRA-DP06-SB-A02.0	CRA-DP06-SB-A02.0	unpaved	subsurface soil	3.9	
CRA-DP06-SB-A03.0	CRA-DP06-SB-A03.0	unpaved	subsurface soil	5.1	
CRA-DP07-SB-A06.5	CRA-DP07-SB-A06.5	unpaved	subsurface soil	8.3	J
CRA-DP08-SB-A04.5	CRA-DP08-SB-A04.5	unpaved	subsurface soil	6.9	J
CRA-DP09-SB-A00.5	CRA-DP09-SB-A00.5	unpaved	subsurface soil	4.7	J
CRA-DP09-SB-A03.0	CRA-DP09-SB-A03.0	unpaved	subsurface soil	6.2	J
CRA-DP10-SB-A03.0	CRA-DP10-SB-A03.0	unpaved	subsurface soil	8.6	
CRA-DP11-SB-A01.0	CRA-DP11-SB-A01.0	unpaved	subsurface soil	7.9	
CRA-DP11-SB-A02.5	CRA-DP11-SB-A02.5	unpaved	subsurface soil	3.5	
CRA-DP12-SB-A01.0	CRA-DP12-SB-A01.0	paved	subsurface soil	5.1	J
CRA-DP12-SB-A04.5	CRA-DP12-SB-A04.5	paved	subsurface soil	5.7	
CRA-DP12-SB-D01.0	CRA-DP12-SB-D01.0	paved	subsurface soil	4	J
CRA-DP13-SB-A01.5	CRA-DP13-SB-A01.5	paved	subsurface soil	1.8	J
CRA-DP13-SB-A06.5	CRA-DP13-SB-A06.5	paved	subsurface soil	11	J
CRA-DP14-SB-A01.0	CRA-DP14-SB-A01.0	paved	subsurface soil	1.3	J
CRA-DP14-SB-A07.0	CRA-DP14-SB-A07.0	paved	subsurface soil	0.89	J
CRA-DP15-SB-A03.5	CRA-DP15-SB-A03.5	paved	subsurface soil	6	
CRA-DP16-SB-A01.0	CRA-DP16-SB-A01.0	paved	subsurface soil	6.6	
CRA-DP16-SB-A08.5	CRA-DP16-SB-A08.5	paved	subsurface soil	1.5	
CRA-DP17-SB-A01.0	CRA-DP17-SB-A01.0	paved	subsurface soil	4.5	
CRA-DP17-SB-A06.0	CRA-DP17-SB-A06.0	paved	subsurface soil	8.1	
CRA-DP18-SB-A01.0	CRA-DP18-SB-A01.0	paved	subsurface soil	7.3	
CRA-DP18-SB-A06.0	CRA-DP18-SB-A06.0	paved	subsurface soil	11	
CRA-DP18-SB-D06.0	CRA-DP18-SB-D06.0	paved	subsurface soil	10	
CRA-DP19-SB-A01.0	CRA-DP19-SB-A01.0	paved	subsurface soil	4.1	
CRA-DP19-SB-A07.0	CRA-DP19-SB-A07.0	paved	subsurface soil	16	
CRA-DP20-SB-A01.0	CRA-DP20-SB-A01.0	paved	subsurface soil	3.3	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA-DP20-SB-A06.5	CRA-DP20-SB-A06.5	paved	subsurface soil	4.9	J
CRA-DP21-SB-A03.5	CRA-DP21-SB-A03.5	unpaved	subsurface soil	0.21	J
CRA-DP21-SB-A07.0	CRA-DP21-SB-A07.0	unpaved	subsurface soil	0.36	J
CRA-DP22-SB-A01.0	CRA-DP22-SB-A01.0	paved	subsurface soil	4.4	J
CRA-DP22-SB-A07.5	CRA-DP22-SB-A07.5	paved	subsurface soil	1.3	J
CRA-DP23-SB-A01.0	CRA-DP23-SB-A01.0	paved	subsurface soil	2.1	J
CRA-DP23-SB-A06.0	CRA-DP23-SB-A06.0	paved	subsurface soil	3.4	J
CRA-DP24-SB-A01.0	CRA-DP24-SB-A01.0	paved	subsurface soil	6	
CRA-DP24-SB-A06.5	CRA-DP24-SB-A06.5	paved	subsurface soil	6	
CRA-DP25-SB-A01.0	CRA-DP25-SB-A01.0	paved	subsurface soil	7	
CRA-DP25-SB-A06.0	CRA-DP25-SB-A06.0	paved	subsurface soil	7.1	
CRA-DP26-SB-A01.5	CRA-DP26-SB-A01.5	paved	subsurface soil	7.4	
CRA-DP26-SB-A06.5	CRA-DP26-SB-A06.5	paved	subsurface soil	6.7	
CRA-MW01-SB-A02.5	CRA-MW01-SB-A02.5	paved	subsurface soil	6.6	
CRA-MW01-SB-A05.5	CRA-MW01-SB-A05.5	paved	subsurface soil	5.1	
CRA-MW02-SB-A02.5	CRA-MW02-SB-A02.5	paved	subsurface soil	3.1	
CRA-MW02-SB-A05.5	CRA-MW02-SB-A05.5	paved	subsurface soil	2	
CRA-MW03-SB-A02.5	CRA-MW03-SB-A02.5	paved	subsurface soil	5.9	J
CRA-MW03-SB-A06.0	CRA-MW03-SB-A06.0	paved	subsurface soil	13	J
CRA-MW04-SB-A02.5	CRA-MW04-SB-A02.5	paved	subsurface soil	11	
CRA-MW04-SB-A05.5	CRA-MW04-SB-A05.5	paved	subsurface soil	15	
Copper					
CRA056	CRA-DP21-01	unpaved	subsurface soil	17	J
CRA057	CRA-DP21-01	unpaved	subsurface soil	4.6	
CRA059	CRA-DP21-02	unpaved	subsurface soil	102	J
CRA060	CRA-DP21-02 - field duplicate of CRA059	unpaved	subsurface soil	90.8	J
CRA061	CRA-DP21-03	unpaved	subsurface soil	106	J
CRA062	CRA-DP21-03	unpaved	subsurface soil	116	J
CRA130	CRA-DP21-04	unpaved	subsurface soil	93.6	
CRA131	CRA-DP21-04	unpaved	subsurface soil	95	
CRA140	TRSF	unpaved	subsurface soil	43	
CRA154	CRA001	unpaved	surface soil	48.4	J
CRA155	CRA002	unpaved	surface soil	89.2	J
CRA157	CRA004	unpaved	surface soil	78.6	J
CRA158	CRA004 - Field duplicate of CRA157	unpaved	surface soil	84.8	J
CRA159	CRA005	unpaved	surface soil	66.7	J
CRA160	CRA006	unpaved	surface soil	94.9	J
CRA163	Confirmation - East wall	unpaved	surface soil	88.9	J
CRA164	Confirmation - East wall	unpaved	subsurface soil	89.8	J
CRA165	Confirmation - West wall	unpaved	surface soil	28.8	J
CRA166	Confirmation - West wall	unpaved	subsurface soil	99.8	J
CRA167	Field duplicate of CRA166	unpaved	subsurface soil	117	J
CRA219	CRA009	unpaved	surface soil	80.3	
CRA220	CRA010	unpaved	surface soil	95.3	
CRA221	CRA012	unpaved	surface soil	64.9	
CRA222	CRA013	unpaved	surface soil	104	
CRA223	CRA014	unpaved	surface soil	69.4	
CRA225	CRA016	unpaved	surface soil	55.2	
CRA226	CRA017	unpaved	surface soil	66.2	
CRA227	CRA018	unpaved	surface soil	52.7	
CRA228	CRA019	unpaved	surface soil	65.9	
CRA229	CRA020	unpaved	surface soil	54.7	
CRA230	CRA021	unpaved	surface soil	81.8	
CRA231	CRA023	unpaved	surface soil	76.4	
CRA232	CRA024	unpaved	surface soil	56.8	
CRA233	CRA025	unpaved	surface soil	18	
CRA234	CRA026	unpaved	surface soil	83	
CRA235	CRA027	unpaved	surface soil	21.3	
CRA236	CRA028	unpaved	surface soil	88.1	
CRA238	CRA030	unpaved	surface soil	81.7	
CRA239	CRA031A	unpaved	surface soil	61.8	
CRA240	CRA031	unpaved	surface soil	75.4	
CRA242	CRA032	unpaved	surface soil	34.5	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA244	CRA034	unpaved	surface soil	18.1	
CRA246	CRA035	unpaved	surface soil	53.2	
CRA247	CRA035 - Field duplicate of CRA246	unpaved	surface soil	73.4	
CRA248	CRA036A	unpaved	surface soil	10.5	
CRA249	CRA036A - Field duplicate of CRA248	unpaved	surface soil	10.1	J
CRA250	CRA036	unpaved	surface soil	11.5	J
CRA252	CRA037	unpaved	surface soil	14.6	J
CRA255	CRA039	unpaved	surface soil	9.7	J
CRA256	CRA040	unpaved	surface soil	29.9	J
CRA257	CRA041	unpaved	surface soil	18.2	J
CRA258	CRA042	unpaved	surface soil	24.4	J
CRA259	CRA042 - Field duplicate of CRA258	unpaved	surface soil	22.4	J
CRA260	CRA043	unpaved	surface soil	18.6	J
CRA261	CRA044	unpaved	surface soil	150	J
CRA262	CRA046	unpaved	surface soil	25.8	J
CRA263	CRA047	unpaved	surface soil	23.1	J
CRA264	CRA049	unpaved	surface soil	15	J
CRA265	CRA051	unpaved	surface soil	29.8	J
CRA266	CRA051 - Field duplicate of CRA265	unpaved	surface soil	30.1	J
CRA268	CRA048	unpaved	surface soil	19.3	
CRA269	CRA050	unpaved	surface soil	118	
CRA270	CRA038	unpaved	surface soil	33.8	
CRA271	CRA052	unpaved	surface soil	19.8	
CRA272	CRA055	unpaved	surface soil	34.5	
CRA273	CRA071	unpaved	surface soil	42.4	
CRA274	CRA072	unpaved	surface soil	25.8	
CRA276	CRA074	unpaved	surface soil	45.9	
CRA277	CRA075	unpaved	surface soil	31.3	
CRA278	CRA075 - Field duplicate of CRA277	unpaved	surface soil	26	
CRA279	CRA076	unpaved	surface soil	13.2	
CRA280	CRA077	unpaved	surface soil	17.9	
CRA281	CRA078	unpaved	surface soil	8.8	
CRA282	CRA079	unpaved	surface soil	24.4	
CRA283	CRA082	unpaved	surface soil	15	
CRA284	CRA083	unpaved	surface soil	25.1	
CRA285	CRA085	unpaved	surface soil	15.4	
CRA286	CRA088	unpaved	surface soil	10.8	
CRA287	CRA093	unpaved	surface soil	15.2	
CRA288	CRA093 - Field duplicate of CRA287	unpaved	surface soil	15.2	
CRA289	CRA097	unpaved	surface soil	16.6	
CRA290	CRA101	unpaved	surface soil	21.8	
CRA291	CRA105	unpaved	surface soil	23.1	
CRA292	CRA086	unpaved	surface soil	14.9	
CRA293	CRA089	unpaved	surface soil	12.7	
CRA294	CRA090	unpaved	surface soil	10.8	
CRA295	CRA094	unpaved	surface soil	23.9	
CRA296	CRA095	unpaved	surface soil	9.6	
CRA297	CRA098	unpaved	surface soil	28.8	
CRA298	CRA099	unpaved	surface soil	19.1	
CRA299	CRA099 - Field duplicate of CRA298	unpaved	surface soil	12.1	
CRA300	CRA102	unpaved	surface soil	51.3	
CRA301	CRA104	unpaved	surface soil	45.6	
CRA303	CRA107	unpaved	surface soil	25.4	
CRA304	CRA084	unpaved	surface soil	9.4	
CRA305	CRA087	unpaved	surface soil	54.9	
CRA306	CRA091	unpaved	surface soil	16.9	
CRA307	CRA096	unpaved	surface soil	13.8	
CRA308	CRA100	unpaved	surface soil	68.8	
CRA309	CRA DP07	unpaved	surface soil	50.1	
CRA310	CRA DP07 - Field duplicate of CRA309	unpaved	surface soil	25	
CRA311	CRA053	unpaved	surface soil	54.9	
CRA312	CRA070	unpaved	surface soil	21.4	
CRA313	CRA080	unpaved	surface soil	30.9	
CRA314	CRA080 - Field duplicate of CRA313	unpaved	surface soil	30.4	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA316	CRA113	unpaved	surface soil	10.3	
CRA317	CRA115	unpaved	subsurface soil	14.1	
CRA318	CRA116	unpaved	surface soil	29.6	
CRA319	CRA117	unpaved	subsurface soil	14.7	
CRA320	CRA118	unpaved	subsurface soil	12.9	
CRA321	CRA108	unpaved	subsurface soil	34.4	
CRA322	CRA109	unpaved	subsurface soil	19.6	
CRA326	CRA003-C	unpaved	subsurface soil	11.2	
CRA327	CRA003-N	unpaved	subsurface soil	18.8	
CRA328	CRA003-S	unpaved	subsurface soil	58.8	
CRA329	CRA007-C	unpaved	subsurface soil	18.5	
CRA330	CRA007-N	unpaved	subsurface soil	50.9	
CRA331	CRA007-S	unpaved	subsurface soil	8	
CRA332	CRA029-N	unpaved	subsurface soil	16.1	
CRA335	CRA073-N	unpaved	subsurface soil	31.7	
CRA336	CRA073-N Field duplicate of CRA335	unpaved	subsurface soil	15.1	
CRA337	CRA073-S	unpaved	subsurface soil	10.6	
CRA338	CRA106-C	unpaved	subsurface soil	27.5	
CRA339	CRA106-N	unpaved	subsurface soil	28.6	
CRA340	CRA106-W	unpaved	subsurface soil	26.8	
CRA341	CRA106-E	unpaved	subsurface soil	37.8	
CRA344	CRA111-S	unpaved	surface soil	44.4	
CRA350	CRA112-W	unpaved	surface soil	6.5	
CRA351	CRA112-W Field duplicate of CRA350	unpaved	surface soil	6.7	
CRA352	CRA008-N	unpaved	surface soil	74.5	
CRA353	CRA008-C	unpaved	surface soil	78.5	
CRA354	CRA015-C	unpaved	surface soil	74	
CRA355	CRA015-N	unpaved	surface soil	70.7	
CRA356	CRA015-S	unpaved	surface soil	92	
CRA357	CRA080A	unpaved	surface soil	17	J
CRA358	CRA104A	unpaved	surface soil	59.7	J
CRA359	CRA109A	unpaved	surface soil	11.9	J
CRA360	CRA029 - Center	unpaved	subsurface soil	93	J
CRA361	CRA029 - North	unpaved	subsurface soil	86.2	J
CRA362	CRA073 - Center	unpaved	subsurface soil	33	J
CRA363	CRA073 - North	unpaved	subsurface soil	24	J
CRA364	CRA073 - South	unpaved	subsurface soil	15.6	J
CRA365	CRA111 - Center	unpaved	subsurface soil	14.4	J
CRA366	CRA111 - Center - Field Duplicate of CRA365	unpaved	subsurface soil	12.5	J
CRA367	CRA111 - North	unpaved	subsurface soil	15.1	J
CRA368	CRA111 - West	unpaved	subsurface soil	44.7	J
CRA370	CRA111 - South	unpaved	subsurface soil	8	J
CRA372	CRA-112 N	unpaved	subsurface soil	22.7	
CRA373	CRA112 NW/ 111 SE	unpaved	subsurface soil	6.6	
CRA374	CRA110	unpaved	subsurface soil	26	
CRA376	CRA110 W	unpaved	subsurface soil	10.4	
CRA377	Field Duplicate of CRA376	unpaved	subsurface soil	12.6	
CRA378	CRA111 NE	unpaved	subsurface soil	3	
CRA-DP01-SB-A02.0	CRA-DP01-SB-A02.0	unpaved	subsurface soil	89	
CRA-DP01-SB-A03.5	CRA-DP01-SB-A03.5	unpaved	subsurface soil	70	
CRA-DP02-SB-A03.0	CRA-DP02-SB-A03.0	unpaved	subsurface soil	130	
CRA-DP03-SB-A03.0	CRA-DP03-SB-A03.0	unpaved	subsurface soil	72	
CRA-DP04-SB-A02.0	CRA-DP04-SB-A02.0	unpaved	subsurface soil	65	
CRA-DP04-SB-A03.5	CRA-DP04-SB-A03.5	unpaved	subsurface soil	82	
CRA-DP05-SB-A02.0	CRA-DP05-SB-A02.0	unpaved	subsurface soil	8.3	
CRA-DP06-SB-A02.0	CRA-DP06-SB-A02.0	unpaved	subsurface soil	25	
CRA-DP06-SB-A03.0	CRA-DP06-SB-A03.0	unpaved	subsurface soil	13	
CRA-DP07-SB-A06.5	CRA-DP07-SB-A06.5	unpaved	subsurface soil	57	J
CRA-DP08-SB-A04.5	CRA-DP08-SB-A04.5	unpaved	subsurface soil	12	J
CRA-DP09-SB-A00.5	CRA-DP09-SB-A00.5	unpaved	subsurface soil	47	J
CRA-DP09-SB-A03.0	CRA-DP09-SB-A03.0	unpaved	subsurface soil	12	J
CRA-DP10-SB-A03.0	CRA-DP10-SB-A03.0	unpaved	subsurface soil	11	
CRA-DP11-SB-A01.0	CRA-DP11-SB-A01.0	unpaved	subsurface soil	49	
CRA-DP11-SB-A02.5	CRA-DP11-SB-A02.5	unpaved	subsurface soil	7.4	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA-DP12-SB-A01.0	CRA-DP12-SB-A01.0	paved	subsurface soil	30	
CRA-DP12-SB-A04.5	CRA-DP12-SB-A04.5	paved	subsurface soil	22	
CRA-DP12-SB-D01.0	CRA-DP12-SB-D01.0	paved	subsurface soil	57	
CRA-DP13-SB-A01.5	CRA-DP13-SB-A01.5	paved	subsurface soil	17	
CRA-DP13-SB-A06.5	CRA-DP13-SB-A06.5	paved	subsurface soil	40	
CRA-DP14-SB-A01.0	CRA-DP14-SB-A01.0	paved	subsurface soil	5.5	
CRA-DP14-SB-A07.0	CRA-DP14-SB-A07.0	paved	subsurface soil	4.9	
CRA-DP15-SB-A03.5	CRA-DP15-SB-A03.5	paved	subsurface soil	12	
CRA-DP16-SB-A01.0	CRA-DP16-SB-A01.0	paved	subsurface soil	44	
CRA-DP16-SB-A08.5	CRA-DP16-SB-A08.5	paved	subsurface soil	6.2	
CRA-DP17-SB-A01.0	CRA-DP17-SB-A01.0	paved	subsurface soil	24	
CRA-DP17-SB-A06.0	CRA-DP17-SB-A06.0	paved	subsurface soil	23	
CRA-DP18-SB-A01.0	CRA-DP18-SB-A01.0	paved	subsurface soil	32	
CRA-DP18-SB-A06.0	CRA-DP18-SB-A06.0	paved	subsurface soil	66	
CRA-DP18-SB-D06.0	CRA-DP18-SB-D06.0	paved	subsurface soil	57	
CRA-DP19-SB-A01.0	CRA-DP19-SB-A01.0	paved	subsurface soil	22	
CRA-DP19-SB-A07.0	CRA-DP19-SB-A07.0	paved	subsurface soil	30	
CRA-DP20-SB-A01.0	CRA-DP20-SB-A01.0	paved	subsurface soil	18	J
CRA-DP20-SB-A06.5	CRA-DP20-SB-A06.5	paved	subsurface soil	16	J
CRA-DP21-SB-A03.5	CRA-DP21-SB-A03.5	unpaved	subsurface soil	75	J
CRA-DP21-SB-A07.0	CRA-DP21-SB-A07.0	unpaved	subsurface soil	75	J
CRA-DP22-SB-A01.0	CRA-DP22-SB-A01.0	paved	subsurface soil	23	J
CRA-DP22-SB-A07.5	CRA-DP22-SB-A07.5	paved	subsurface soil	3	J
CRA-DP23-SB-A01.0	CRA-DP23-SB-A01.0	paved	subsurface soil	9.9	J
CRA-DP23-SB-A06.0	CRA-DP23-SB-A06.0	paved	subsurface soil	8	J
CRA-DP24-SB-A01.0	CRA-DP24-SB-A01.0	paved	subsurface soil	9.7	
CRA-DP24-SB-A06.5	CRA-DP24-SB-A06.5	paved	subsurface soil	8.4	
CRA-DP25-SB-A01.0	CRA-DP25-SB-A01.0	paved	subsurface soil	23	
CRA-DP25-SB-A06.0	CRA-DP25-SB-A06.0	paved	subsurface soil	13	
CRA-DP26-SB-A01.5	CRA-DP26-SB-A01.5	paved	subsurface soil	35	
CRA-DP26-SB-A06.5	CRA-DP26-SB-A06.5	paved	subsurface soil	18	
CRA-MW01-SB-A02.5	CRA-MW01-SB-A02.5	paved	subsurface soil	13	
CRA-MW01-SB-A05.5	CRA-MW01-SB-A05.5	paved	subsurface soil	16	
CRA-MW02-SB-A02.5	CRA-MW02-SB-A02.5	paved	subsurface soil	8.7	
CRA-MW02-SB-A05.5	CRA-MW02-SB-A05.5	paved	subsurface soil	7.7	
CRA-MW03-SB-A02.5	CRA-MW03-SB-A02.5	paved	subsurface soil	21	J
CRA-MW03-SB-A06.0	CRA-MW03-SB-A06.0	paved	subsurface soil	51	J
CRA-MW04-SB-A02.5	CRA-MW04-SB-A02.5	paved	subsurface soil	26	
CRA-MW04-SB-A05.5	CRA-MW04-SB-A05.5	paved	subsurface soil	45	
Lead					
CRA140	TRSF	unpaved	subsurface soil	12.9	J
CRA154	CRA001	unpaved	surface soil	15.7	J
CRA155	CRA002	unpaved	surface soil	67.6	J
CRA157	CRA004	unpaved	surface soil	33.5	J
CRA158	CRA004 - Field duplicate of CRA157	unpaved	surface soil	29.9	J
CRA159	CRA005	unpaved	surface soil	5.5	J
CRA160	CRA006	unpaved	surface soil	31.7	J
CRA219	CRA009	unpaved	surface soil	13.5	J
CRA220	CRA010	unpaved	surface soil	15.2	J
CRA221	CRA012	unpaved	surface soil	18.4	J
CRA222	CRA013	unpaved	surface soil	48	J
CRA223	CRA014	unpaved	surface soil	7.9	J
CRA225	CRA016	unpaved	surface soil	5.6	J
CRA226	CRA017	unpaved	surface soil	26.5	J
CRA227	CRA018	unpaved	surface soil	6.9	J
CRA228	CRA019	unpaved	surface soil	27.1	J
CRA229	CRA020	unpaved	surface soil	11	J
CRA230	CRA021	unpaved	surface soil	26.8	J
CRA231	CRA023	unpaved	surface soil	11.5	J
CRA232	CRA024	unpaved	surface soil	34.8	J
CRA233	CRA025	unpaved	surface soil	0.61	UJ
CRA234	CRA026	unpaved	surface soil	170	J
CRA235	CRA027	unpaved	surface soil	6.9	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA236	CRA028	unpaved	surface soil	10.9	J
CRA238	CRA030	unpaved	surface soil	36.9	J
CRA239	CRA031A	unpaved	surface soil	50.8	J
CRA240	CRA031	unpaved	surface soil	32.3	J
CRA242	CRA032	unpaved	surface soil	0.77	J
CRA244	CRA034	unpaved	surface soil	83.5	J
CRA246	CRA035	unpaved	surface soil	2	J
CRA247	CRA035 - Field duplicate of CRA246	unpaved	surface soil	3.9	J
CRA248	CRA036A	unpaved	surface soil	2.6	J
CRA249	CRA036A - Field duplicate of CRA248	unpaved	surface soil	6.6	J
CRA250	CRA036	unpaved	surface soil	7.2	J
CRA252	CRA037	unpaved	surface soil	10	J
CRA255	CRA039	unpaved	surface soil	8	J
CRA256	CRA040	unpaved	surface soil	6.6	J
CRA257	CRA041	unpaved	surface soil	2	J
CRA258	CRA042	unpaved	surface soil	61.8	
CRA259	CRA042 - Field duplicate of CRA258	unpaved	surface soil	41.4	
CRA260	CRA043	unpaved	surface soil	19.7	J
CRA261	CRA044	unpaved	surface soil	49.5	
CRA262	CRA046	unpaved	surface soil	40.1	J
CRA263	CRA047	unpaved	surface soil	12	J
CRA264	CRA049	unpaved	surface soil	16.4	J
CRA265	CRA051	unpaved	surface soil	60.6	
CRA266	CRA051 - Field duplicate of CRA265	unpaved	surface soil	140	
CRA268	CRA048	unpaved	surface soil	13.5	J
CRA269	CRA050	unpaved	surface soil	63.5	J
CRA270	CRA038	unpaved	surface soil	14.7	J
CRA271	CRA052	unpaved	surface soil	91.2	J
CRA272	CRA055	unpaved	surface soil	94	J
CRA273	CRA071	unpaved	surface soil	36.2	J
CRA274	CRA072	unpaved	surface soil	20.2	J
CRA276	CRA074	unpaved	surface soil	41.1	J
CRA277	CRA075	unpaved	surface soil	28.4	J
CRA278	CRA075 - Field duplicate of CRA277	unpaved	surface soil	28.4	J
CRA279	CRA076	unpaved	surface soil	2.7	UJ
CRA280	CRA077	unpaved	surface soil	32.7	J
CRA281	CRA078	unpaved	surface soil	7.8	J
CRA282	CRA079	unpaved	surface soil	38.7	J
CRA283	CRA082	unpaved	surface soil	15.1	J
CRA284	CRA083	unpaved	surface soil	25.4	J
CRA285	CRA085	unpaved	surface soil	2.8	UJ
CRA286	CRA088	unpaved	surface soil	8.7	J
CRA287	CRA093	unpaved	surface soil	32.8	J
CRA288	CRA093 - Field duplicate of CRA287	unpaved	surface soil	33.8	J
CRA289	CRA097	unpaved	surface soil	55.1	J
CRA290	CRA101	unpaved	surface soil	32.4	J
CRA291	CRA105	unpaved	surface soil	35.9	J
CRA292	CRA086	unpaved	surface soil	34.7	J
CRA293	CRA089	unpaved	surface soil	12.1	J
CRA294	CRA090	unpaved	surface soil	43.5	J
CRA295	CRA094	unpaved	surface soil	4.4	J
CRA296	CRA095	unpaved	surface soil	2.8	
CRA297	CRA098	unpaved	surface soil	27.8	
CRA298	CRA099	unpaved	surface soil	98.7	
CRA299	CRA099 - Field duplicate of CRA298	unpaved	surface soil	57.6	
CRA300	CRA102	unpaved	surface soil	17.7	
CRA301	CRA104	unpaved	surface soil	72.3	
CRA303	CRA107	unpaved	surface soil	87	
CRA304	CRA084	unpaved	surface soil	18.5	
CRA305	CRA087	unpaved	surface soil	0.42	
CRA306	CRA091	unpaved	surface soil	26	
CRA307	CRA096	unpaved	surface soil	0.49	
CRA308	CRA100	unpaved	surface soil	153	
CRA309	CRA DP07	unpaved	surface soil	76.6	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA310	CRA DP07 - Field duplicate of CRA309	unpaved	surface soil	59.3	
CRA311	CRA053	unpaved	surface soil	73.8	
CRA312	CRA070	unpaved	surface soil	46.7	
CRA313	CRA080	unpaved	surface soil	84.4	J
CRA314	CRA080 - Field duplicate of CRA313	unpaved	surface soil	86.3	J
CRA316	CRA113	unpaved	surface soil	8.2	J
CRA317	CRA115	unpaved	subsurface soil	8.2	J
CRA318	CRA116	unpaved	surface soil	107	J
CRA319	CRA117	unpaved	subsurface soil	18.9	J
CRA320	CRA118	unpaved	subsurface soil	6.9	J
CRA321	CRA108	unpaved	subsurface soil	84.8	J
CRA322	CRA109	unpaved	subsurface soil	25.1	J
CRA326	CRA003-C	unpaved	subsurface soil	5.8	J
CRA327	CRA003-N	unpaved	subsurface soil	24.9	J
CRA328	CRA003-S	unpaved	subsurface soil	4.9	J
CRA329	CRA007-C	unpaved	subsurface soil	40.8	J
CRA330	CRA007-N	unpaved	subsurface soil	10.2	J
CRA331	CRA007-S	unpaved	subsurface soil	2.1	J
CRA332	CRA029-N	unpaved	subsurface soil	4.2	J
CRA335	CRA073-N	unpaved	subsurface soil	142	J
CRA336	CRA073-N Field duplicate of CRA335	unpaved	subsurface soil	62.3	J
CRA337	CRA073-S	unpaved	subsurface soil	25	J
CRA338	CRA106-C	unpaved	subsurface soil	74.4	J
CRA339	CRA106-N	unpaved	subsurface soil	21.8	J
CRA340	CRA106-W	unpaved	subsurface soil	73.8	J
CRA341	CRA106-E	unpaved	subsurface soil	57.3	J
CRA344	CRA111-S	unpaved	surface soil	148	J
CRA350	CRA112-W	unpaved	surface soil	5.9	J
CRA351	CRA112-W Field duplicate of CRA350	unpaved	surface soil	8.1	J
CRA352	CRA008-N	unpaved	surface soil	31.8	J
CRA353	CRA008-C	unpaved	surface soil	27.6	J
CRA354	CRA015-C	unpaved	surface soil	112	J
CRA355	CRA015-N	unpaved	surface soil	25.7	J
CRA356	CRA015-S	unpaved	surface soil	134	J
CRA357	CRA080A	unpaved	surface soil	48.3	J
CRA358	CRA104A	unpaved	surface soil	64.9	J
CRA359	CRA109A	unpaved	surface soil	31.7	J
CRA360	CRA029 - Center	unpaved	subsurface soil	36.9	J
CRA361	CRA029 - North	unpaved	subsurface soil	14.6	J
CRA362	CRA073 - Center	unpaved	subsurface soil	207	
CRA363	CRA073 - North	unpaved	subsurface soil	135	
CRA364	CRA073 - South	unpaved	subsurface soil	88.7	
CRA365	CRA111 - Center	unpaved	subsurface soil	14.8	J
CRA366	CRA111 - Center - Field Duplicate of CRA365	unpaved	subsurface soil	15.2	J
CRA367	CRA111 - North	unpaved	subsurface soil	18.2	J
CRA368	CRA111 - West	unpaved	subsurface soil	134	
CRA370	CRA111 - South	unpaved	subsurface soil	11.9	J
CRA372	CRA-112 N	unpaved	subsurface soil	35.2	
CRA373	CRA112 NW/ 111 SE	unpaved	subsurface soil	4	UJ
CRA374	CRA110	unpaved	subsurface soil	28.8	
CRA376	CRA110 W	unpaved	subsurface soil	12.5	
CRA377	Field Duplicate of CRA376	unpaved	subsurface soil	16.8	
CRA378	CRA111 NE	unpaved	subsurface soil	2.3	UJ
CRA-DP01-SB-A02.0	CRA-DP01-SB-A02.0	unpaved	subsurface soil	31	J
CRA-DP01-SB-A03.5	CRA-DP01-SB-A03.5	unpaved	subsurface soil	52	J
CRA-DP02-SB-A03.0	CRA-DP02-SB-A03.0	unpaved	subsurface soil	92	J
CRA-DP03-SB-A03.0	CRA-DP03-SB-A03.0	unpaved	subsurface soil	31	J
CRA-DP04-SB-A02.0	CRA-DP04-SB-A02.0	unpaved	subsurface soil	40	J
CRA-DP04-SB-A03.5	CRA-DP04-SB-A03.5	unpaved	subsurface soil	61	J
CRA-DP05-SB-A02.0	CRA-DP05-SB-A02.0	unpaved	subsurface soil	13	J
CRA-DP06-SB-A02.0	CRA-DP06-SB-A02.0	unpaved	subsurface soil	14	J
CRA-DP06-SB-A03.0	CRA-DP06-SB-A03.0	unpaved	subsurface soil	20	J
CRA-DP07-SB-A06.5	CRA-DP07-SB-A06.5	unpaved	subsurface soil	170	J
CRA-DP08-SB-A04.5	CRA-DP08-SB-A04.5	unpaved	subsurface soil	7.6	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA-DP09-SB-A00.5	CRA-DP09-SB-A00.5	unpaved	subsurface soil	48	J
CRA-DP09-SB-A03.0	CRA-DP09-SB-A03.0	unpaved	subsurface soil	5.5	J
CRA-DP10-SB-A03.0	CRA-DP10-SB-A03.0	unpaved	subsurface soil	10	J
CRA-DP11-SB-A01.0	CRA-DP11-SB-A01.0	unpaved	subsurface soil	60	J
CRA-DP11-SB-A02.5	CRA-DP11-SB-A02.5	unpaved	subsurface soil	12	J
CRA-DP12-SB-A01.0	CRA-DP12-SB-A01.0	paved	subsurface soil	5.3	J
CRA-DP12-SB-A04.5	CRA-DP12-SB-A04.5	paved	subsurface soil	6.1	J
CRA-DP12-SB-D01.0	CRA-DP12-SB-D01.0	paved	subsurface soil	8	J
CRA-DP13-SB-A01.5	CRA-DP13-SB-A01.5	paved	subsurface soil	4.7	J
CRA-DP13-SB-A06.5	CRA-DP13-SB-A06.5	paved	subsurface soil	8.7	J
CRA-DP14-SB-A01.0	CRA-DP14-SB-A01.0	paved	subsurface soil	3.4	J
CRA-DP14-SB-A07.0	CRA-DP14-SB-A07.0	paved	subsurface soil	4.6	J
CRA-DP15-SB-A03.5	CRA-DP15-SB-A03.5	paved	subsurface soil	21	J
CRA-DP16-SB-A01.0	CRA-DP16-SB-A01.0	paved	subsurface soil	9.8	J
CRA-DP16-SB-A08.5	CRA-DP16-SB-A08.5	paved	subsurface soil	5	J
CRA-DP17-SB-A01.0	CRA-DP17-SB-A01.0	paved	subsurface soil	7.2	J
CRA-DP17-SB-A06.0	CRA-DP17-SB-A06.0	paved	subsurface soil	5.6	J
CRA-DP18-SB-A01.0	CRA-DP18-SB-A01.0	paved	subsurface soil	8	J
CRA-DP18-SB-A06.0	CRA-DP18-SB-A06.0	paved	subsurface soil	11	J
CRA-DP18-SB-D06.0	CRA-DP18-SB-D06.0	paved	subsurface soil	9.9	J
CRA-DP19-SB-A01.0	CRA-DP19-SB-A01.0	paved	subsurface soil	16	J
CRA-DP19-SB-A07.0	CRA-DP19-SB-A07.0	paved	subsurface soil	4.9	J
CRA-DP20-SB-A01.0	CRA-DP20-SB-A01.0	paved	subsurface soil	6.2	J
CRA-DP20-SB-A06.5	CRA-DP20-SB-A06.5	paved	subsurface soil	8.4	J
CRA-DP21-SB-A03.5	CRA-DP21-SB-A03.5	paved	subsurface soil	1.3	J
CRA-DP21-SB-A07.0	CRA-DP21-SB-A07.0	paved	subsurface soil	1.3	J
CRA-DP22-SB-A01.0	CRA-DP22-SB-A01.0	paved	subsurface soil	4.7	J
CRA-DP22-SB-A07.5	CRA-DP22-SB-A07.5	paved	subsurface soil	4.6	J
CRA-DP23-SB-A01.0	CRA-DP23-SB-A01.0	paved	subsurface soil	4.5	J
CRA-DP23-SB-A06.0	CRA-DP23-SB-A06.0	paved	subsurface soil	4.6	J
CRA-DP24-SB-A01.0	CRA-DP24-SB-A01.0	paved	subsurface soil	6	J
CRA-DP24-SB-A06.5	CRA-DP24-SB-A06.5	paved	subsurface soil	6	J
CRA-DP25-SB-A01.0	CRA-DP25-SB-A01.0	paved	subsurface soil	10	J
CRA-DP25-SB-A06.0	CRA-DP25-SB-A06.0	paved	subsurface soil	7.5	J
CRA-DP26-SB-A01.5	CRA-DP26-SB-A01.5	paved	subsurface soil	29	J
CRA-DP26-SB-A06.5	CRA-DP26-SB-A06.5	paved	subsurface soil	14	J
CRA-MW01-SB-A02.5	CRA-MW01-SB-A02.5	paved	subsurface soil	8.2	J
CRA-MW01-SB-A05.5	CRA-MW01-SB-A05.5	paved	subsurface soil	34	J
CRA-MW02-SB-A02.5	CRA-MW02-SB-A02.5	paved	subsurface soil	4.8	J
CRA-MW02-SB-A05.5	CRA-MW02-SB-A05.5	paved	subsurface soil	4.6	J
CRA-MW03-SB-A02.5	CRA-MW03-SB-A02.5	paved	subsurface soil	39	J
CRA-MW03-SB-A06.0	CRA-MW03-SB-A06.0	paved	subsurface soil	150	J
CRA-MW04-SB-A02.5	CRA-MW04-SB-A02.5	paved	subsurface soil	16	J
CRA-MW04-SB-A05.5	CRA-MW04-SB-A05.5	paved	subsurface soil	41	J
Selenium					
CRA140	TRSF	unpaved	subsurface soil	0.81	UJ
CRA154	CRA001	unpaved	surface soil	1.4	UJ
CRA155	CRA002	unpaved	surface soil	1.5	UJ
CRA157	CRA004	unpaved	surface soil	1.5	UJ
CRA158	CRA004 - Field duplicate of CRA157	unpaved	surface soil	1.5	UJ
CRA159	CRA005	unpaved	surface soil	1.4	UJ
CRA160	CRA006	unpaved	surface soil	1.5	UJ
CRA219	CRA009	unpaved	surface soil	1.4	U
CRA220	CRA010	unpaved	surface soil	2.6	
CRA221	CRA012	unpaved	surface soil	1.4	U
CRA222	CRA013	unpaved	surface soil	2	
CRA223	CRA014	unpaved	surface soil	1.4	U
CRA225	CRA016	unpaved	surface soil	1.3	U
CRA226	CRA017	unpaved	surface soil	1.5	U
CRA227	CRA018	unpaved	surface soil	1.4	U
CRA228	CRA019	unpaved	surface soil	1.4	U
CRA229	CRA020	unpaved	surface soil	1.4	U
CRA230	CRA021	unpaved	surface soil	1.9	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA231	CRA023	unpaved	surface soil	1.4	UJ
CRA232	CRA024	unpaved	surface soil	1.4	UJ
CRA233	CRA025	unpaved	surface soil	1.3	UJ
CRA234	CRA026	unpaved	surface soil	1.5	UJ
CRA235	CRA027	unpaved	surface soil	1.3	UJ
CRA236	CRA028	unpaved	surface soil	1.4	UJ
CRA238	CRA030	unpaved	surface soil	1.4	UJ
CRA239	CRA031A	unpaved	surface soil	1.4	UJ
CRA240	CRA031	unpaved	surface soil	1.4	UJ
CRA242	CRA032	unpaved	surface soil	1.3	UJ
CRA244	CRA034	unpaved	surface soil	1.3	UJ
CRA246	CRA035	unpaved	surface soil	1.4	UJ
CRA247	CRA035 - Field duplicate of CRA246	unpaved	surface soil	1.5	UJ
CRA248	CRA036A	unpaved	surface soil	1.3	UJ
CRA249	CRA036A - Field duplicate of CRA248	unpaved	surface soil	1.6	UJ
CRA250	CRA036	unpaved	surface soil	0.88	U
CRA252	CRA037	unpaved	surface soil	4.7	UJ
CRA255	CRA039	unpaved	surface soil	0.83	U
CRA256	CRA040	unpaved	surface soil	10.4	J
CRA257	CRA041	unpaved	surface soil	5.5	UJ
CRA258	CRA042	unpaved	surface soil	5.7	UJ
CRA259	CRA042 - Field duplicate of CRA258	unpaved	surface soil	4.7	UJ
CRA260	CRA043	unpaved	surface soil	8.3	J
CRA261	CRA044	unpaved	surface soil	4.3	UJ
CRA262	CRA046	unpaved	surface soil	6.5	UJ
CRA263	CRA047	unpaved	surface soil	0.8	U
CRA264	CRA049	unpaved	surface soil	2.6	UJ
CRA265	CRA051	unpaved	surface soil	1.4	J
CRA266	CRA051 - Field duplicate of CRA265	unpaved	surface soil	2	J
CRA268	CRA048	unpaved	surface soil	0.8	U
CRA269	CRA050	unpaved	surface soil	0.82	U
CRA270	CRA038	unpaved	surface soil	1.1	UJ
CRA271	CRA052	unpaved	surface soil	0.83	UJ
CRA272	CRA055	unpaved	surface soil	0.86	U
CRA273	CRA071	unpaved	surface soil	0.79	U
CRA274	CRA072	unpaved	surface soil	0.82	U
CRA276	CRA074	unpaved	surface soil	0.77	U
CRA277	CRA075	unpaved	surface soil	0.8	U
CRA278	CRA075 - Field duplicate of CRA277	unpaved	surface soil	0.79	U
CRA279	CRA076	unpaved	surface soil	0.79	U
CRA280	CRA077	unpaved	surface soil	0.77	U
CRA281	CRA078	unpaved	surface soil	0.77	U
CRA282	CRA079	unpaved	surface soil	0.78	U
CRA283	CRA082	unpaved	surface soil	0.76	U
CRA284	CRA083	unpaved	surface soil	0.78	U
CRA285	CRA085	unpaved	surface soil	0.78	U
CRA286	CRA088	unpaved	surface soil	0.87	U
CRA287	CRA093	unpaved	surface soil	0.77	U
CRA288	CRA093 - Field duplicate of CRA287	unpaved	surface soil	0.29	UJ
CRA289	CRA097	unpaved	surface soil	0.12	U
CRA290	CRA101	unpaved	surface soil	0.14	U
CRA291	CRA105	unpaved	surface soil	0.13	U
CRA292	CRA086	unpaved	surface soil	0.12	U
CRA293	CRA089	unpaved	surface soil	0.14	UJ
CRA294	CRA090	unpaved	surface soil	0.38	UJ
CRA295	CRA094	unpaved	surface soil	0.29	UJ
CRA296	CRA095	unpaved	surface soil	0.08	U
CRA297	CRA098	unpaved	surface soil	0.076	U
CRA298	CRA099	unpaved	surface soil	0.074	U
CRA299	CRA099 - Field duplicate of CRA298	unpaved	surface soil	0.074	U
CRA300	CRA102	unpaved	surface soil	0.075	U
CRA301	CRA104	unpaved	surface soil	0.076	U
CRA303	CRA107	unpaved	surface soil	0.086	U
CRA304	CRA084	unpaved	surface soil	0.08	U

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA305	CRA087	unpaved	surface soil	0.27	UJ
CRA306	CRA091	unpaved	surface soil	0.088	U
CRA307	CRA096	unpaved	surface soil	0.12	U
CRA308	CRA100	unpaved	surface soil	0.087	U
CRA309	CRA DP07	unpaved	surface soil	0.085	U
CRA310	CRA DP07 - Field duplicate of CRA309	unpaved	surface soil	0.085	U
CRA311	CRA053	unpaved	surface soil	0.097	U
CRA312	CRA070	unpaved	surface soil	0.088	U
CRA313	CRA080	unpaved	surface soil	0.13	UJ
CRA314	CRA080 - Field duplicate of CRA313	unpaved	surface soil	0.12	U
CRA316	CRA113	unpaved	surface soil	0.29	
CRA317	CRA115	unpaved	subsurface soil	0.13	U
CRA318	CRA116	unpaved	surface soil	0.4	
CRA319	CRA117	unpaved	subsurface soil	0.12	UJ
CRA320	CRA118	unpaved	subsurface soil	0.13	UJ
CRA321	CRA108	unpaved	subsurface soil	0.22	J
CRA322	CRA109	unpaved	subsurface soil	0.45	J
CRA326	CRA003-C	unpaved	subsurface soil	0.14	U
CRA327	CRA003-N	unpaved	subsurface soil	0.13	U
CRA328	CRA003-S	unpaved	subsurface soil	1.5	U
CRA329	CRA007-C	unpaved	subsurface soil	0.14	U
CRA330	CRA007-N	unpaved	subsurface soil	10.7	J
CRA331	CRA007-S	unpaved	subsurface soil	0.69	J
CRA332	CRA029-N	unpaved	subsurface soil	0.14	UJ
CRA335	CRA073-N	unpaved	subsurface soil	0.13	UJ
CRA336	CRA073-N Field duplicate of CRA335	unpaved	subsurface soil	0.12	UJ
CRA337	CRA073-S	unpaved	subsurface soil	0.12	UJ
CRA338	CRA106-C	unpaved	subsurface soil	0.55	J
CRA339	CRA106-N	unpaved	subsurface soil	0.12	UJ
CRA340	CRA106-W	unpaved	subsurface soil	0.39	J
CRA341	CRA106-E	unpaved	subsurface soil	0.13	UJ
CRA344	CRA111-S	unpaved	surface soil	0.12	UJ
CRA350	CRA112-W	unpaved	surface soil	0.12	UJ
CRA351	CRA112-W Field duplicate of CRA350	unpaved	surface soil	0.12	UJ
CRA352	CRA008-N	unpaved	surface soil	6.6	UJ
CRA353	CRA008-C	unpaved	surface soil	12.5	
CRA354	CRA015-C	unpaved	surface soil	2.2	UJ
CRA355	CRA015-N	unpaved	surface soil	1.5	UJ
CRA356	CRA015-S	unpaved	surface soil	2.2	UJ
CRA357	CRA080A	unpaved	surface soil	0.13	UJ
CRA358	CRA104A	unpaved	surface soil	0.12	UJ
CRA359	CRA109A	unpaved	surface soil	0.27	J
CRA360	CRA029 - Center	unpaved	subsurface soil	0.82	J
CRA361	CRA029 - North	unpaved	subsurface soil	2.5	J
CRA362	CRA073 - Center	unpaved	subsurface soil	0.66	UJ
CRA363	CRA073 - North	unpaved	subsurface soil	0.63	UJ
CRA364	CRA073 - South	unpaved	subsurface soil	1.2	J
CRA365	CRA111 - Center	unpaved	subsurface soil	0.7	UJ
CRA366	CRA111 - Center - Field Duplicate of CRA365	unpaved	subsurface soil	0.45	J
CRA367	CRA111 - North	unpaved	subsurface soil	0.99	J
CRA368	CRA111 - West	unpaved	subsurface soil	2.2	J
CRA370	CRA111 - South	unpaved	subsurface soil	0.6	UJ
CRA372	CRA-112 N	unpaved	subsurface soil	7.3	U
CRA373	CRA112 NW/ 111 SE	unpaved	subsurface soil	6.5	UJ
CRA374	CRA110	unpaved	subsurface soil	6.9	U
CRA376	CRA110 W	unpaved	subsurface soil	6.7	UJ
CRA377	Field Duplicate of CRA376	unpaved	subsurface soil	6.6	UJ
CRA378	CRA111 NE	unpaved	subsurface soil	6.8	UJ
CRA-DP01-SB-A02.0	CRA-DP01-SB-A02.0	unpaved	subsurface soil	9.1	
CRA-DP01-SB-A03.5	CRA-DP01-SB-A03.5	unpaved	subsurface soil	6.9	
CRA-DP02-SB-A03.0	CRA-DP02-SB-A03.0	unpaved	subsurface soil	5.8	J
CRA-DP03-SB-A03.0	CRA-DP03-SB-A03.0	unpaved	subsurface soil	6.9	
CRA-DP04-SB-A02.0	CRA-DP04-SB-A02.0	unpaved	subsurface soil	3.1	J
CRA-DP04-SB-A03.5	CRA-DP04-SB-A03.5	unpaved	subsurface soil	4.6	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA-DP05-SB-A02.0	CRA-DP05-SB-A02.0	unpaved	subsurface soil	5.7	U
CRA-DP06-SB-A02.0	CRA-DP06-SB-A02.0	unpaved	subsurface soil	5.7	U
CRA-DP06-SB-A03.0	CRA-DP06-SB-A03.0	unpaved	subsurface soil	6.4	U
CRA-DP07-SB-A06.5	CRA-DP07-SB-A06.5	unpaved	subsurface soil	6.4	
CRA-DP08-SB-A04.5	CRA-DP08-SB-A04.5	unpaved	subsurface soil	5.8	U
CRA-DP09-SB-A00.5	CRA-DP09-SB-A00.5	unpaved	subsurface soil	5.2	U
CRA-DP09-SB-A03.0	CRA-DP09-SB-A03.0	unpaved	subsurface soil	6.3	U
CRA-DP10-SB-A03.0	CRA-DP10-SB-A03.0	unpaved	subsurface soil	0.96	J
CRA-DP11-SB-A01.0	CRA-DP11-SB-A01.0	unpaved	subsurface soil	5.1	J
CRA-DP11-SB-A02.5	CRA-DP11-SB-A02.5	unpaved	subsurface soil	0.5	J
CRA-DP12-SB-A01.0	CRA-DP12-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP12-SB-A04.5	CRA-DP12-SB-A04.5	paved	subsurface soil	1.4	J
CRA-DP12-SB-D01.0	CRA-DP12-SB-D01.0	paved	subsurface soil	2.9	J
CRA-DP13-SB-A01.5	CRA-DP13-SB-A01.5	paved	subsurface soil	5.5	U
CRA-DP13-SB-A06.5	CRA-DP13-SB-A06.5	paved	subsurface soil	5.3	J
CRA-DP14-SB-A01.0	CRA-DP14-SB-A01.0	paved	subsurface soil	5.9	U
CRA-DP14-SB-A07.0	CRA-DP14-SB-A07.0	paved	subsurface soil	5.7	U
CRA-DP15-SB-A03.5	CRA-DP15-SB-A03.5	paved	subsurface soil	1.6	J
CRA-DP16-SB-A01.0	CRA-DP16-SB-A01.0	paved	subsurface soil	2.4	J
CRA-DP16-SB-A08.5	CRA-DP16-SB-A08.5	paved	subsurface soil	5.8	U
CRA-DP17-SB-A01.0	CRA-DP17-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP17-SB-A06.0	CRA-DP17-SB-A06.0	paved	subsurface soil	6.4	U
CRA-DP18-SB-A01.0	CRA-DP18-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP18-SB-A06.0	CRA-DP18-SB-A06.0	paved	subsurface soil	5.3	J
CRA-DP18-SB-D06.0	CRA-DP18-SB-D06.0	paved	subsurface soil	4	J
CRA-DP19-SB-A01.0	CRA-DP19-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP19-SB-A07.0	CRA-DP19-SB-A07.0	paved	subsurface soil	5.7	U
CRA-DP20-SB-A01.0	CRA-DP20-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP20-SB-A06.5	CRA-DP20-SB-A06.5	paved	subsurface soil	5.9	U
CRA-DP21-SB-A03.5	CRA-DP21-SB-A03.5	paved	subsurface soil	1.1	J
CRA-DP21-SB-A07.0	CRA-DP21-SB-A07.0	paved	subsurface soil	0.93	J
CRA-DP22-SB-A01.0	CRA-DP22-SB-A01.0	paved	subsurface soil	0.6	J
CRA-DP22-SB-A07.5	CRA-DP22-SB-A07.5	paved	subsurface soil	5.4	U
CRA-DP23-SB-A01.0	CRA-DP23-SB-A01.0	paved	subsurface soil	5.6	U
CRA-DP23-SB-A06.0	CRA-DP23-SB-A06.0	paved	subsurface soil	5.9	U
CRA-DP24-SB-A01.0	CRA-DP24-SB-A01.0	paved	subsurface soil	1.9	J
CRA-DP24-SB-A06.5	CRA-DP24-SB-A06.5	paved	subsurface soil	1.7	J
CRA-DP25-SB-A01.0	CRA-DP25-SB-A01.0	paved	subsurface soil	2.1	J
CRA-DP25-SB-A06.0	CRA-DP25-SB-A06.0	paved	subsurface soil	1.6	J
CRA-DP26-SB-A01.5	CRA-DP26-SB-A01.5	paved	subsurface soil	4.7	J
CRA-DP26-SB-A06.5	CRA-DP26-SB-A06.5	paved	subsurface soil	1.9	J
CRA-MW01-SB-A02.5	CRA-MW01-SB-A02.5	paved	subsurface soil	0.52	J
CRA-MW01-SB-A05.5	CRA-MW01-SB-A05.5	paved	subsurface soil	6.6	U
CRA-MW02-SB-A02.5	CRA-MW02-SB-A02.5	paved	subsurface soil	5.5	U
CRA-MW02-SB-A05.5	CRA-MW02-SB-A05.5	paved	subsurface soil	6.2	U
CRA-MW03-SB-A02.5	CRA-MW03-SB-A02.5	paved	subsurface soil	2.5	J
CRA-MW03-SB-A06.0	CRA-MW03-SB-A06.0	paved	subsurface soil	5.5	J
CRA-MW04-SB-A02.5	CRA-MW04-SB-A02.5	paved	subsurface soil	5.5	J
CRA-MW04-SB-A05.5	CRA-MW04-SB-A05.5	paved	subsurface soil	7	
Zinc					
CRA140	TRSF	unpaved	subsurface soil	76.5	
CRA154	CRA001	unpaved	surface soil	110	J
CRA155	CRA002	unpaved	surface soil	199	J
CRA157	CRA004	unpaved	surface soil	170	J
CRA158	CRA004 - Field duplicate of CRA157	unpaved	surface soil	189	J
CRA159	CRA005	unpaved	surface soil	105	J
CRA160	CRA006	unpaved	surface soil	184	J
CRA219	CRA009	unpaved	surface soil	166	
CRA220	CRA010	unpaved	surface soil	198	
CRA221	CRA012	unpaved	surface soil	109	
CRA222	CRA013	unpaved	surface soil	211	
CRA223	CRA014	unpaved	surface soil	124	
CRA225	CRA016	unpaved	surface soil	43.6	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA226	CRA017	unpaved	surface soil	162	
CRA227	CRA018	unpaved	surface soil	96.7	
CRA228	CRA019	unpaved	surface soil	161	
CRA229	CRA020	unpaved	surface soil	101	J
CRA230	CRA021	unpaved	surface soil	169	J
CRA231	CRA023	unpaved	surface soil	157	J
CRA232	CRA024	unpaved	surface soil	71	J
CRA233	CRA025	unpaved	surface soil	22.9	J
CRA234	CRA026	unpaved	surface soil	158	J
CRA235	CRA027	unpaved	surface soil	40.9	J
CRA236	CRA028	unpaved	surface soil	75.7	J
CRA238	CRA030	unpaved	surface soil	178	J
CRA239	CRA031A	unpaved	surface soil	146	J
CRA240	CRA031	unpaved	surface soil	181	J
CRA242	CRA032	unpaved	surface soil	36	J
CRA244	CRA034	unpaved	surface soil	63.6	J
CRA246	CRA035	unpaved	surface soil	55.1	J
CRA247	CRA035 - Field duplicate of CRA246	unpaved	surface soil	79	J
CRA248	CRA036A	unpaved	surface soil	16.6	J
CRA249	CRA036A - Field duplicate of CRA248	unpaved	surface soil	15.7	J
CRA250	CRA036	unpaved	surface soil	16.8	J
CRA252	CRA037	unpaved	surface soil	29.1	J
CRA255	CRA039	unpaved	surface soil	20.6	J
CRA256	CRA040	unpaved	surface soil	48.9	J
CRA257	CRA041	unpaved	surface soil	29.9	J
CRA258	CRA042	unpaved	surface soil	77.2	J
CRA259	CRA042 - Field duplicate of CRA258	unpaved	surface soil	61.3	J
CRA260	CRA043	unpaved	surface soil	45.2	J
CRA261	CRA044	unpaved	surface soil	107	J
CRA262	CRA046	unpaved	surface soil	56.8	J
CRA263	CRA047	unpaved	surface soil	47.7	J
CRA264	CRA049	unpaved	surface soil	44.4	J
CRA265	CRA051	unpaved	surface soil	53.1	J
CRA266	CRA051 - Field duplicate of CRA265	unpaved	surface soil	46.1	J
CRA268	CRA048	unpaved	surface soil	64.3	J
CRA269	CRA050	unpaved	surface soil	161	J
CRA270	CRA038	unpaved	surface soil	109	J
CRA271	CRA052	unpaved	surface soil	65.3	J
CRA272	CRA055	unpaved	surface soil	132	J
CRA273	CRA071	unpaved	surface soil	131	J
CRA274	CRA072	unpaved	surface soil	44.2	J
CRA276	CRA074	unpaved	surface soil	83.7	J
CRA277	CRA075	unpaved	surface soil	125	J
CRA278	CRA075 - Field duplicate of CRA277	unpaved	surface soil	83.7	J
CRA279	CRA076	unpaved	surface soil	12.2	J
CRA280	CRA077	unpaved	surface soil	45.7	J
CRA281	CRA078	unpaved	surface soil	20.7	J
CRA282	CRA079	unpaved	surface soil	215	J
CRA283	CRA082	unpaved	surface soil	29.4	J
CRA284	CRA083	unpaved	surface soil	37.6	J
CRA285	CRA085	unpaved	surface soil	34.9	J
CRA286	CRA088	unpaved	surface soil	17.6	J
CRA287	CRA093	unpaved	surface soil	40	J
CRA288	CRA093 - Field duplicate of CRA287	unpaved	surface soil	35.9	
CRA289	CRA097	unpaved	surface soil	48.5	
CRA290	CRA101	unpaved	surface soil	42.2	
CRA291	CRA105	unpaved	surface soil	72.1	
CRA292	CRA086	unpaved	surface soil	29.4	
CRA293	CRA089	unpaved	surface soil	17.7	
CRA294	CRA090	unpaved	surface soil	12.7	
CRA295	CRA094	unpaved	surface soil	14.1	
CRA296	CRA095	unpaved	surface soil	13.4	J
CRA297	CRA098	unpaved	surface soil	32.1	J
CRA298	CRA099	unpaved	surface soil	67.4	J

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA299	CRA099 - Field duplicate of CRA298	unpaved	surface soil	41.1	J
CRA300	CRA102	unpaved	surface soil	21.8	J
CRA301	CRA104	unpaved	surface soil	86.5	J
CRA303	CRA107	unpaved	surface soil	58.5	J
CRA304	CRA084	unpaved	surface soil	26.6	J
CRA305	CRA087	unpaved	surface soil	29.9	J
CRA306	CRA091	unpaved	surface soil	36	J
CRA307	CRA096	unpaved	surface soil	12.5	J
CRA308	CRA100	unpaved	surface soil	190	J
CRA309	CRA DP07	unpaved	surface soil	89.8	J
CRA310	CRA DP07 - Field duplicate of CRA309	unpaved	surface soil	63	J
CRA311	CRA053	unpaved	surface soil	93.8	J
CRA312	CRA070	unpaved	surface soil	32.4	J
CRA313	CRA080	unpaved	surface soil	178	
CRA314	CRA080 - Field duplicate of CRA313	unpaved	surface soil	208	
CRA316	CRA113	unpaved	surface soil	15.6	
CRA317	CRA115	unpaved	subsurface soil	11.9	
CRA318	CRA116	unpaved	surface soil	136	
CRA319	CRA117	unpaved	subsurface soil	73.8	
CRA320	CRA118	unpaved	subsurface soil	11.9	
CRA321	CRA108	unpaved	subsurface soil	100	
CRA322	CRA109	unpaved	subsurface soil	85.6	
CRA326	CRA003-C	unpaved	subsurface soil	30	
CRA327	CRA003-N	unpaved	subsurface soil	48.9	
CRA328	CRA003-S	unpaved	subsurface soil	77.4	
CRA329	CRA007-C	unpaved	subsurface soil	67.5	
CRA330	CRA007-N	unpaved	subsurface soil	103	
CRA331	CRA007-S	unpaved	subsurface soil	13.1	
CRA332	CRA029-N	unpaved	subsurface soil	31.4	
CRA335	CRA073-N	unpaved	subsurface soil	353	
CRA336	CRA073-N Field duplicate of CRA335	unpaved	subsurface soil	136	
CRA337	CRA073-S	unpaved	subsurface soil	29.1	
CRA338	CRA106-C	unpaved	subsurface soil	73.9	
CRA339	CRA106-N	unpaved	surface soil	32.4	
CRA340	CRA106-W	unpaved	surface soil	92.5	
CRA341	CRA106-E	unpaved	surface soil	162	
CRA344	CRA111-S	unpaved	surface soil	93.3	
CRA350	CRA112-W	unpaved	surface soil	14	
CRA351	CRA112-W Field duplicate of CRA350	unpaved	surface soil	14.4	
CRA352	CRA008-N	unpaved	surface soil	150	
CRA353	CRA008-C	unpaved	surface soil	156	
CRA354	CRA015-C	unpaved	surface soil	194	
CRA355	CRA015-N	unpaved	surface soil	155	
CRA356	CRA015-S	unpaved	surface soil	220	
CRA357	CRA080A	unpaved	subsurface soil	44.6	
CRA358	CRA104A	unpaved	subsurface soil	97.5	
CRA359	CRA109A	unpaved	subsurface soil	38.3	
CRA360	CRA029 - Center	unpaved	subsurface soil	237	
CRA361	CRA029 - North	unpaved	subsurface soil	174	
CRA362	CRA073 - Center	unpaved	subsurface soil	171	
CRA363	CRA073 - North	unpaved	subsurface soil	125	
CRA364	CRA073 - South	unpaved	subsurface soil	48.4	
CRA365	CRA111 - Center	unpaved	subsurface soil	32.2	
CRA366	CRA111 - Center - Field Duplicate of CRA365	unpaved	subsurface soil	28	
CRA367	CRA111 - North	unpaved	subsurface soil	52.7	
CRA368	CRA111 - West	unpaved	subsurface soil	159	
CRA370	CRA111 - South	unpaved	subsurface soil	22.4	
CRA372	CRA-112 N	unpaved	subsurface soil	70.8	
CRA373	CRA112 NW/ 111 SE	unpaved	subsurface soil	16.4	
CRA374	CRA110	unpaved	subsurface soil	88.1	
CRA376	CRA110 W	unpaved	subsurface soil	35.5	
CRA377	Field Duplicate of CRA376	unpaved	subsurface soil	40.1	
CRA378	CRA111 NE	unpaved	subsurface soil	15	
CRA-DP01-SB-A02.0	CRA-DP01-SB-A02.0	unpaved	subsurface soil	180	

Sample ID	Description	Pavement	Sample Type	Result [1]	Qual
CRA-DP01-SB-A03.5	CRA-DP01-SB-A03.5	unpaved	subsurface soil	120	
CRA-DP02-SB-A03.0	CRA-DP02-SB-A03.0	unpaved	subsurface soil	150	
CRA-DP03-SB-A03.0	CRA-DP03-SB-A03.0	unpaved	subsurface soil	150	
CRA-DP04-SB-A02.0	CRA-DP04-SB-A02.0	unpaved	subsurface soil	110	J
CRA-DP04-SB-A03.5	CRA-DP04-SB-A03.5	unpaved	subsurface soil	170	J
CRA-DP05-SB-A02.0	CRA-DP05-SB-A02.0	unpaved	subsurface soil	19	J
CRA-DP06-SB-A02.0	CRA-DP06-SB-A02.0	unpaved	subsurface soil	24	J
CRA-DP06-SB-A03.0	CRA-DP06-SB-A03.0	unpaved	subsurface soil	34	J
CRA-DP07-SB-A06.5	CRA-DP07-SB-A06.5	unpaved	subsurface soil	210	J
CRA-DP08-SB-A04.5	CRA-DP08-SB-A04.5	unpaved	subsurface soil	8.9	J
CRA-DP09-SB-A00.5	CRA-DP09-SB-A00.5	unpaved	subsurface soil	53	J
CRA-DP09-SB-A03.0	CRA-DP09-SB-A03.0	unpaved	subsurface soil	27	J
CRA-DP10-SB-A03.0	CRA-DP10-SB-A03.0	unpaved	subsurface soil	19	
CRA-DP11-SB-A01.0	CRA-DP11-SB-A01.0	unpaved	subsurface soil	110	
CRA-DP11-SB-A02.5	CRA-DP11-SB-A02.5	unpaved	subsurface soil	31	
CRA-DP12-SB-A01.0	CRA-DP12-SB-A01.0	paved	subsurface soil	28	
CRA-DP12-SB-A04.5	CRA-DP12-SB-A04.5	paved	subsurface soil	26	
CRA-DP12-SB-D01.0	CRA-DP12-SB-D01.0	paved	subsurface soil	65	
CRA-DP13-SB-A01.5	CRA-DP13-SB-A01.5	paved	subsurface soil	20	
CRA-DP13-SB-A06.5	CRA-DP13-SB-A06.5	paved	subsurface soil	81	
CRA-DP14-SB-A01.0	CRA-DP14-SB-A01.0	paved	subsurface soil	5.6	
CRA-DP14-SB-A07.0	CRA-DP14-SB-A07.0	paved	subsurface soil	5	
CRA-DP15-SB-A03.5	CRA-DP15-SB-A03.5	paved	subsurface soil	72	J
CRA-DP16-SB-A01.0	CRA-DP16-SB-A01.0	paved	subsurface soil	63	J
CRA-DP16-SB-A08.5	CRA-DP16-SB-A08.5	paved	subsurface soil	8.3	J
CRA-DP17-SB-A01.0	CRA-DP17-SB-A01.0	paved	subsurface soil	21	J
CRA-DP17-SB-A06.0	CRA-DP17-SB-A06.0	paved	subsurface soil	21	J
CRA-DP18-SB-A01.0	CRA-DP18-SB-A01.0	paved	subsurface soil	32	J
CRA-DP18-SB-A06.0	CRA-DP18-SB-A06.0	paved	subsurface soil	130	J
CRA-DP18-SB-D06.0	CRA-DP18-SB-D06.0	paved	subsurface soil	100	J
CRA-DP19-SB-A01.0	CRA-DP19-SB-A01.0	paved	subsurface soil	37	J
CRA-DP19-SB-A07.0	CRA-DP19-SB-A07.0	paved	subsurface soil	23	J
CRA-DP20-SB-A01.0	CRA-DP20-SB-A01.0	paved	subsurface soil	20	J
CRA-DP20-SB-A06.5	CRA-DP20-SB-A06.5	paved	subsurface soil	26	J
CRA-DP21-SB-A03.5	CRA-DP21-SB-A03.5	paved	subsurface soil	36	J
CRA-DP21-SB-A07.0	CRA-DP21-SB-A07.0	paved	subsurface soil	33	J
CRA-DP22-SB-A01.0	CRA-DP22-SB-A01.0	paved	subsurface soil	23	J
CRA-DP22-SB-A07.5	CRA-DP22-SB-A07.5	paved	subsurface soil	4.8	J
CRA-DP23-SB-A01.0	CRA-DP23-SB-A01.0	paved	subsurface soil	8.9	J
CRA-DP23-SB-A06.0	CRA-DP23-SB-A06.0	paved	subsurface soil	5.8	J
CRA-DP24-SB-A01.0	CRA-DP24-SB-A01.0	paved	subsurface soil	28	
CRA-DP24-SB-A06.5	CRA-DP24-SB-A06.5	paved	subsurface soil	25	
CRA-DP25-SB-A01.0	CRA-DP25-SB-A01.0	paved	subsurface soil	41	
CRA-DP25-SB-A06.0	CRA-DP25-SB-A06.0	paved	subsurface soil	27	
CRA-DP26-SB-A01.5	CRA-DP26-SB-A01.5	paved	subsurface soil	65	
CRA-DP26-SB-A06.5	CRA-DP26-SB-A06.5	paved	subsurface soil	30	
CRA-MW01-SB-A02.5	CRA-MW01-SB-A02.5	paved	subsurface soil	48	J
CRA-MW01-SB-A05.5	CRA-MW01-SB-A05.5	paved	subsurface soil	31	J
CRA-MW02-SB-A02.5	CRA-MW02-SB-A02.5	paved	subsurface soil	7.8	
CRA-MW02-SB-A05.5	CRA-MW02-SB-A05.5	paved	subsurface soil	6	
CRA-MW03-SB-A02.5	CRA-MW03-SB-A02.5	paved	subsurface soil	77	J
CRA-MW03-SB-A06.0	CRA-MW03-SB-A06.0	paved	subsurface soil	170	J
CRA-MW04-SB-A02.5	CRA-MW04-SB-A02.5	paved	subsurface soil	68	
CRA-MW04-SB-A05.5	CRA-MW04-SB-A05.5	paved	subsurface soil	61	

[1] Analytical results are in mg/kg.

Table A-4: Analytical Results for Confirmation and RI Soil Sampling, Hazardous Substances Storage Area

Sample ID	Description	Sample Type	Result [1]	Qual
4,4'-DDE				
HSSA001	HSS-DP03-01	surface soil	0.001	NJ
HSSA002	HSS-DP03-01	subsurface soil	0.0005	NJ
HSSA003	HSS-DP03-01	subsurface soil	0.003	J
HSSA006	HSS-DP03-02	subsurface soil	0.0037	U
HSSA007	HSS-DP03-03	surface soil	0.005	
HSSA008	HSS-DP03-03	subsurface soil	0.0004	NJ
HSSA009	HSS-DP03-03	subsurface soil	0.0049	U
HSSA010	HSS-DP03-04	surface soil	0.001	NJ
HSSA011	HSS-DP03-04	subsurface soil	0.0036	U
HSSA012	HSS-DP03-04	subsurface soil	0.0003	NJ
HSSA022	HSS-DP03-03 - field duplicate of HSSA009	subsurface soil	0.0089	
HSSA024	HSS-DP03-05	surface soil	0.0091	
HSSA025	HSS-DP03-05	subsurface soil	0.002	NJ
HSSA027	HSS-DP03-06	subsurface soil	0.004	
HSSA028	HSS-DP03-06 - field duplicate of HSSA027	subsurface soil	0.0045	U
HSSA029	HSS-DP03-07	subsurface soil	0.002	J
HSSA058	HSS-DP03 NE corner (floor)	subsurface soil	0.0091	
HSSA059	HSS-DP03 NW corner (surface)	subsurface soil	0.0005	NJ
HSSA060	HSS-DP03 NW corner (floor)	subsurface soil	0.001	NJ
HSSA061	HSS-DP03 SW corner (surface)	subsurface soil	0.001	NJ
HSSA062	HSS-DP03 SW corner (floor)	subsurface soil	0.003	J
HSSA063	Field duplicate of HSSA062	subsurface soil	0.002	J
HSSA064	HSS-DP03 Below concrete pad, N ex limit	subsurface soil	0.0034	U
HSS-DP01-SB-A03.5	HSS-DP01-SB-A03.5	subsurface soil	0.0046	U
HSS-DP02-SB-A03.0	HSS-DP02-SB-A03.0	subsurface soil	0.0023	J
HSS-DP02-SB-A05.5	HSS-DP02-SB-A05.5	subsurface soil	0.0041	U
HSS-DP03-SB-A06.0	HSS-DP03-SB-A06.0	subsurface soil	0.0042	U
HSS-DP04-SB-A02.0	HSS-DP04-SB-A02.0	subsurface soil	0.0029	J
HSS-DP04-SB-A05.5	HSS-DP04-SB-A05.5	subsurface soil	0.0042	U
HSS-DP05-SB-A02.5	HSS-DP05-SB-A02.5	subsurface soil	0.002	J
HSS-DP05-SB-A07.5	HSS-DP05-SB-A07.5	subsurface soil	0.0045	U
HSS-DP05-SS-A	HSS-DP05-SS-A	surface soil	0.021	U
HSS-DP06-SB-A02.5	HSS-DP06-SB-A02.5	subsurface soil	0.0029	J
HSS-DP06-SB-A07.0	HSS-DP06-SB-A07.0	subsurface soil	0.0041	U
HSS-DP06-SB-D02.5	HSS-DP06-SB-D02.5	subsurface soil	0.0036	U
HSS-DP06-SS-A	HSS-DP06-SS-A	surface soil	0.028	U
HSS-DP07-SB-A06.0	HSS-DP07-SB-A06.0	subsurface soil	0.0038	U
HSS-DP08-SB-A02.5	HSS-DP08-SB-A02.5	subsurface soil	0.0006	J
HSS-DP08-SB-A05.5	HSS-DP08-SB-A05.5	subsurface soil	0.0015	J
HSS-MW01-SB-A03.0	HSS-MW01-SB-A03.0	subsurface soil	0.0037	U
HSS-MW01-SB-A07.5	HSS-MW01-SB-A07.5	subsurface soil	0.004	U
HSS-MW01-SB-D07.5	HSS-MW01-SB-D07.5	subsurface soil	0.0043	U
HSS-MW01-SS-A	HSS-MW01-SS-A	surface soil	0.03	U
HSS-MW02-SB-A02.0	HSS-MW02-SB-A02.0	subsurface soil	0.0054	J
HSS-MW02-SB-A05.0	HSS-MW02-SB-A05.0	subsurface soil	0.0047	U
Antimony				
HSSA003	HSS-DP03-01	subsurface soil	2.6	UJ
HSSA006	HSS-DP03-02	subsurface soil	1.4	U
HSSA012	HSS-DP03-04	subsurface soil	1.3	U
HSSA071	HSS-DP03	subsurface soil	1.8	UJ
HSSA072	HSS-DP03 Below concrete pad	subsurface soil	1.6	UJ
HSSA073	HSS-DP03 Below concrete pad - field duplicate of HSSA072	subsurface soil	1.5	UJ
HSS-DP01-SB-A03.5	HSS-DP01-SB-A03.5	subsurface soil	3.7	J
HSS-DP02-SB-A03.0	HSS-DP02-SB-A03.0	subsurface soil	5.1	J
HSS-DP02-SB-A05.5	HSS-DP02-SB-A05.5	subsurface soil	2.3	J

Sample ID	Description	Sample Type	Result [1]	Qual
HSS-DP03-SB-A06.0	HSS-DP03-SB-A06.0	subsurface soil	2.2	J
HSS-DP04-SB-A02.0	HSS-DP04-SB-A02.0	subsurface soil	8.4	J
HSS-DP04-SB-A05.5	HSS-DP04-SB-A05.5	subsurface soil	3.5	J
HSS-DP05-SB-A02.5	HSS-DP05-SB-A02.5	subsurface soil	3.3	J
HSS-DP05-SB-A07.5	HSS-DP05-SB-A07.5	subsurface soil	1.4	J
HSS-DP05-SS-A	HSS-DP05-SS-A	surface soil	5.5	J
HSS-DP06-SB-A02.5	HSS-DP06-SB-A02.5	subsurface soil	5.3	J
HSS-DP06-SB-A07.0	HSS-DP06-SB-A07.0	subsurface soil	1.1	J
HSS-DP06-SB-D02.5	HSS-DP06-SB-D02.5	subsurface soil	1.3	J
HSS-DP06-SS-A	HSS-DP06-SS-A	surface soil	5	J
HSS-DP07-SB-A06.0	HSS-DP07-SB-A06.0	subsurface soil	0.78	J
HSS-DP08-SB-A02.5	HSS-DP08-SB-A02.5	subsurface soil	2.3	J
HSS-DP08-SB-A05.5	HSS-DP08-SB-A05.5	subsurface soil	1.7	J
HSS-MW01-SB-A03.0	HSS-MW01-SB-A03.0	subsurface soil	0.71	J
HSS-MW01-SB-A07.5	HSS-MW01-SB-A07.5	subsurface soil	1.1	J
HSS-MW01-SB-D07.5	HSS-MW01-SB-D07.5	subsurface soil	13	UJ
HSS-MW01-SS-A	HSS-MW01-SS-A	surface soil	5.8	J
HSS-MW02-SB-A02.0	HSS-MW02-SB-A02.0	subsurface soil	5.2	J
HSS-MW02-SB-A05.0	HSS-MW02-SB-A05.0	subsurface soil	4	J
Arsenic				
HSSA017	Direct-Push Boring	subsurface soil	4.2	J
HSSA018	Direct-Push Boring	subsurface soil	8.9	J
HSSA019	Direct-Push Boring	surface soil	8.7	J
HSSA020	Direct-Push Boring	subsurface soil	0.14	UJ
HSSA021	Direct-Push Boring	subsurface soil	7.4	J
HSSA023	Field Duplicate of HSSA018	subsurface soil	9	J
HSSA031	Direct-Push Boring	subsurface soil	7	J
HSSA032	Direct-Push Boring	subsurface soil	3	J
HSSA035	Direct-Push Boring	subsurface soil	7	J
HSSA036	Direct-Push Boring	subsurface soil	3.7	J
HSSA037	Direct-Push Boring	surface soil	6.4	J
HSSA038	Direct-Push Boring	subsurface soil	5	J
HSSA039	Direct-Push Boring	subsurface soil	4.7	J
HSSA040	Direct-Push Boring	subsurface soil	6.5	J
HSSA041	Direct-Push Boring	surface soil	2.3	UJ
HSSA042	Direct-Push Boring	subsurface soil	5.4	J
HSSA043	Direct-Push Boring	subsurface soil	2.4	UJ
HSSA044	Field Duplicate of HSSA043	subsurface soil	4.4	J
HSSA045	Surface Soil	surface soil	5.5	
HSSA054	Surface Soil	surface soil	5.5	J
HSSA065	HSS-DP07	subsurface soil	15.8	J
HSSA066	Excavation	subsurface soil	6.7	J
HSSA069	Excavation	subsurface soil	6.6	J
HSSA070	Field Duplicate of HSSA069	subsurface soil	5.7	J
HSSA074	Excavation	surface soil	6.5	J
HSSA075	Excavation	subsurface soil	9	J
HSSA078	Excavation	surface soil	6.9	J
HSSA079	Excavation	subsurface soil	6.4	J
HSSA081	Excavation	subsurface soil	7.9	J
HSSA085	Excavation	surface soil	3.4	
HSSA086	Excavation	subsurface soil	5.2	J
HSSA089	Inside AST fence	surface soil	11.7	J
HSSA090	Inside AST fence	surface soil	7.7	J
HSSA091	Inside AST fence	surface soil	13.3	
HSSA092	HSSA089	subsurface soil	11.4	
HSSA093	HSSA089	subsurface soil	6.5	J
HSSA094	Inside AST fence	surface soil	11.1	
HSSA095	Excavation	subsurface soil	7	UJ

Sample ID	Description	Sample Type	Result [1]	Qual
HSSA096	Excavation	subsurface soil	8.2	UJ
HSSA097	Excavation	subsurface soil	8.1	UJ
HSSA098	Excavation	subsurface soil	8	UJ
HSSA099	Excavation	subsurface soil	7.1	UJ
HSSA100	Excavation	subsurface soil	9.4	UJ
HSSA101	Excavation	subsurface soil	8.3	UJ
HSSA102	Field Duplicate of HSSA101	subsurface soil	8.2	UJ
HSSA105	Excavation	subsurface soil	3	J
HSSA106	Excavation	subsurface soil	3.4	J
HSSA107	Excavation	subsurface soil	5.4	J
HSSA108	Field Duplicate of HSSA107	subsurface soil	3.7	J
HSSA109	Excavation	subsurface soil	5.3	J
HSS-DP01-SB-A03.5		subsurface soil	9	J
HSS-DP02-SB-A03.0		subsurface soil	8.7	J
HSS-DP02-SB-A05.5		subsurface soil	5.9	J
HSS-DP03-SB-A06.0		subsurface soil	9.9	J
HSS-DP04-SB-A02.0		subsurface soil	6.8	J
HSS-DP04-SB-A05.5		subsurface soil	6.7	J
HSS-DP05-SB-A02.5		subsurface soil	5.2	J
HSS-DP05-SB-A07.5		subsurface soil	8.6	J
HSS-DP05-SS-A		surface soil	6.6	J
HSS-DP06-SB-A02.5		subsurface soil	1.1	J
HSS-DP06-SB-A07.0		subsurface soil	6.4	J
HSS-DP06-SB-D02.5	Duplicate of HSS-DP06-SB-A02.5	subsurface soil	9.4	J
HSS-DP06-SS-A		surface soil	6.1	J
HSS-DP07-SB-A06.0		subsurface soil	4.7	J
HSS-DP08-SB-A02.5		subsurface soil	4.4	J
HSS-DP08-SB-A05.5		subsurface soil	6.6	J
HSS-MW01-SB-A03.0		subsurface soil	12	J
HSS-MW01-SB-A07.5		subsurface soil	5.8	J
HSS-MW01-SB-D07.5	Duplicate of HSS-MW01-SB-A07.5	subsurface soil	7	J
HSS-MW01-SS-A		surface soil	6.2	J
HSS-MW02-SB-A02.0		subsurface soil	4.4	J
HSS-MW02-SB-A05.0		subsurface soil	7.4	J
Lead				
HSSA017	Direct-Push Boring	subsurface soil	4.2	J
HSSA018	Direct-Push Boring	subsurface soil	78	J
HSSA019	Direct-Push Boring	surface soil	36	J
HSSA020	Direct-Push Boring	subsurface soil	2.6	J
HSSA021	Direct-Push Boring	subsurface soil	128	J
HSSA023	Field Duplicate of HSSA018	subsurface soil	0.36	UJ
HSSA031	Direct-Push Boring	subsurface soil	9.7	J
HSSA032	Direct-Push Boring	subsurface soil	28.3	J
HSSA035	Direct-Push Boring	subsurface soil	7.2	J
HSSA036	Direct-Push Boring	subsurface soil	15.7	J
HSSA037	Direct-Push Boring	surface soil	121	J
HSSA038	Direct-Push Boring	subsurface soil	73	J
HSSA039	Direct-Push Boring	subsurface soil	60.7	J
HSSA040	Direct-Push Boring	subsurface soil	139	J
HSSA041	Direct-Push Boring	surface soil	111	J
HSSA042	Direct-Push Boring	subsurface soil	96.6	J
HSSA043	Direct-Push Boring	subsurface soil	3.2	J
HSSA044	Field Duplicate of HSSA043	subsurface soil	2.8	J
HSSA045	Surface Soil	surface soil	35.4	
HSSA054	Surface Soil	surface soil	122	J
HSSA065	HSS-DP07	subsurface soil	104	
HSSA066	Excavation	subsurface soil	3.1	J
HSSA069	Excavation	subsurface soil	1.2	J

Sample ID	Description	Sample Type	Result [1]	Qual
HSSA070	Field Duplicate of HSSA069	subsurface soil	1.5	J
HSSA074	Excavation	surface soil	26.2	J
HSSA075	Excavation	subsurface soil	0.52	UJ
HSSA078	Excavation	surface soil	148	J
HSSA079	Excavation	subsurface soil	14.5	J
HSSA081	Excavation	subsurface soil	34.2	J
HSSA085	Excavation	surface soil	4.2	UJ
HSSA086	Excavation	subsurface soil	0.54	U
HSSA089	Inside AST fence	surface soil	189	J
HSSA090	Inside AST fence	surface soil	161	J
HSSA091	Inside AST fence	surface soil	127	J
HSSA092	HSSA089	subsurface soil	89.9	
HSSA093	HSSA089	subsurface soil	2.8	
HSSA094	Inside AST fence	surface soil	137	
HSSA095	Excavation	subsurface soil	12.9	UJ
HSSA096	Excavation	subsurface soil	62.9	J
HSSA097	Excavation	subsurface soil	17.2	J
HSSA098	Excavation	subsurface soil	1.9	UJ
HSSA099	Excavation	subsurface soil	7.4	UJ
HSSA100	Excavation	subsurface soil	68	J
HSSA101	Excavation	subsurface soil	33.4	J
HSSA102	Field Duplicate of HSSA101	subsurface soil	47.5	J
HSSA105	Excavation	subsurface soil	116	J
HSSA106	Excavation	subsurface soil	2.1	UJ
HSSA107	Excavation	subsurface soil	1.5	UJ
HSSA108	Field Duplicate of HSSA107	subsurface soil	1.2	UJ
HSSA109	Excavation	subsurface soil	4.5	UJ
HSS-DP01-SB-A03.5		subsurface soil	11	J
HSS-DP02-SB-A03.0		subsurface soil	13	J
HSS-DP02-SB-A05.5		subsurface soil	6.1	J
HSS-DP03-SB-A06.0		subsurface soil	5.6	J
HSS-DP04-SB-A02.0		subsurface soil	19	J
HSS-DP04-SB-A05.5		subsurface soil	6.3	J
HSS-DP05-SB-A02.5		subsurface soil	20	J
HSS-DP05-SB-A07.5		subsurface soil	6.5	J
HSS-DP05-SS-A		surface soil	18	J
HSS-DP06-SB-A02.5		subsurface soil	160	J
HSS-DP06-SB-A07.0		subsurface soil	7.3	J
HSS-DP06-SB-D02.5		subsurface soil	5.8	J
HSS-DP06-SS-A		surface soil	24	J
HSS-DP07-SB-A06.0		subsurface soil	4.8	J
HSS-DP08-SB-A02.5		subsurface soil	20	J
HSS-DP08-SB-A05.5		subsurface soil	10	J
HSS-MW01-SB-A03.0		subsurface soil	5.2	J
HSS-MW01-SB-A07.5		subsurface soil	7.2	J
HSS-MW01-SB-D07.5		subsurface soil	5.1	J
HSS-MW01-SS-A		surface soil	19	J
HSS-MW02-SB-A02.0		subsurface soil	63	J
HSS-MW02-SB-A05.0		subsurface soil	6.1	J
Selenium				
HSSA017	Direct-Push Boring	subsurface soil	0.13	UJ
HSSA018	Direct-Push Boring	subsurface soil	0.18	UJ
HSSA019	Direct-Push Boring	surface soil	0.14	UJ
HSSA020	Direct-Push Boring	subsurface soil	0.12	UJ
HSSA021	Direct-Push Boring	subsurface soil	0.12	UJ
HSSA023	Field Duplicate of HSSA018	subsurface soil	0.19	UJ
HSSA031	Direct-Push Boring	subsurface soil	1.9	
HSSA032	Direct-Push Boring	subsurface soil	1.7	U

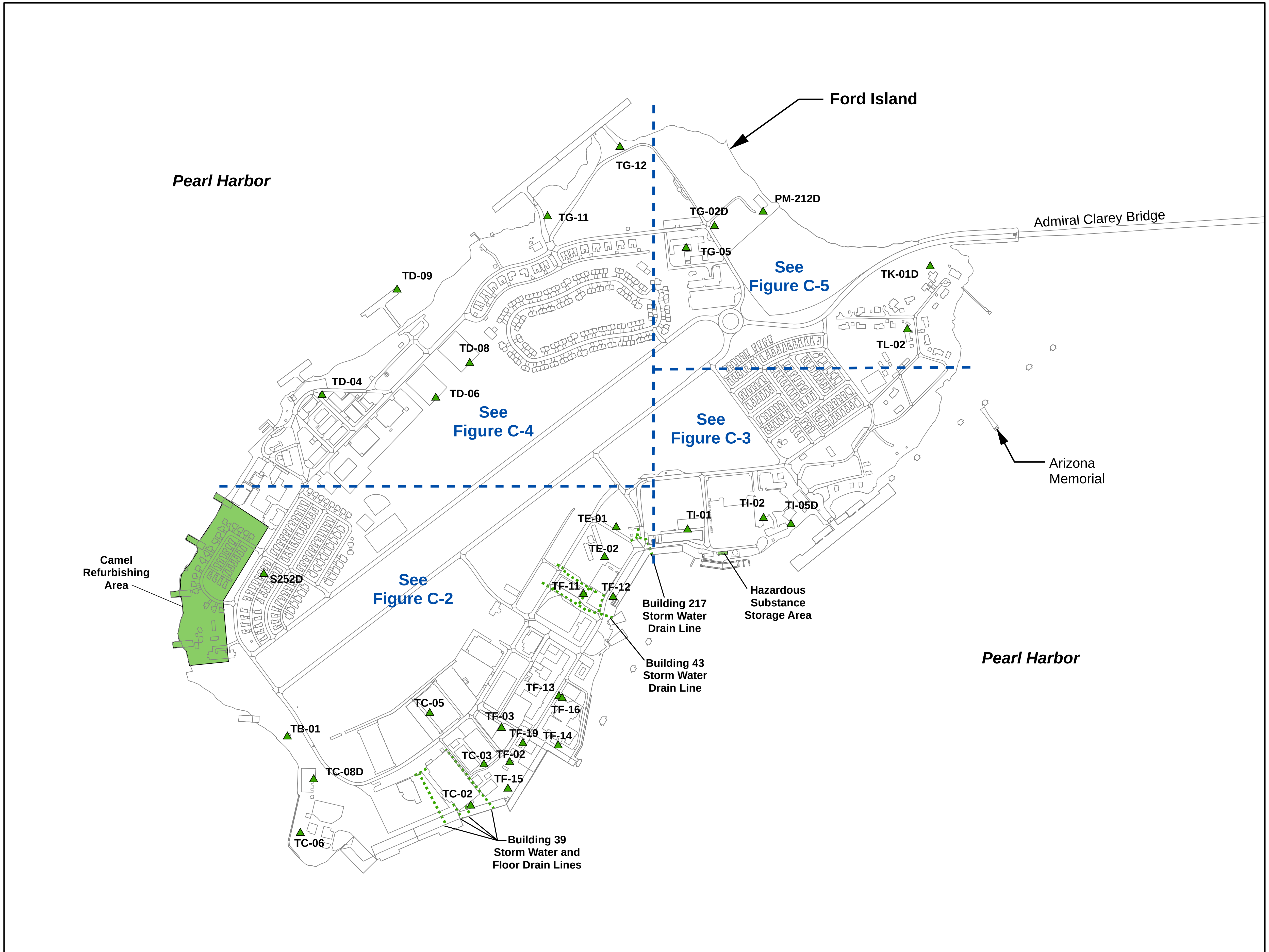
Sample ID	Description	Sample Type	Result [1]	Qual
HSSA035	Direct-Push Boring	subsurface soil	1.5	U
HSSA036	Direct-Push Boring	subsurface soil	1.9	U
HSSA037	Direct-Push Boring	surface soil	1.8	U
HSSA038	Direct-Push Boring	subsurface soil	1.6	U
HSSA039	Direct-Push Boring	subsurface soil	1.5	U
HSSA040	Direct-Push Boring	subsurface soil	1.6	U
HSSA041	Direct-Push Boring	surface soil	2.5	
HSSA042	Direct-Push Boring	subsurface soil	1.5	U
HSSA043	Direct-Push Boring	subsurface soil	1.7	U
HSSA044	Field Duplicate of HSSA043	subsurface soil	2.4	U
HSSA045	Surface Soil	surface soil	4.8	
HSSA054	Surface Soil	surface soil	6.9	
HSSA065	HSS-DP07	subsurface soil	0.79	UJ
HSSA066	Excavation	subsurface soil	0.82	UJ
HSSA069	Excavation	subsurface soil	0.76	UJ
HSSA070	Field Duplicate of HSSA069	subsurface soil	0.75	UJ
HSSA074	Excavation	surface soil	0.79	UJ
HSSA075	Excavation	subsurface soil	0.72	UJ
HSSA078	Excavation	surface soil	0.77	U
HSSA079	Excavation	subsurface soil	0.85	U
HSSA081	Excavation	subsurface soil	0.88	U
HSSA085	Excavation	surface soil	0.81	U
HSSA086	Excavation	subsurface soil	0.74	UJ
HSSA089	Inside AST fence	surface soil	0.74	U
HSSA090	Inside AST fence	surface soil	0.76	U
HSSA091	Inside AST fence	surface soil	0.74	U
HSSA092	HSSA089	subsurface soil	1.3	U
HSSA093	HSSA089	subsurface soil	0.12	UJ
HSSA094	Inside AST fence	surface soil	1.3	U
HSSA095	Excavation	subsurface soil	1.3	UJ
HSSA096	Excavation	subsurface soil	1.6	J
HSSA097	Excavation	subsurface soil	1.3	UJ
HSSA098	Excavation	subsurface soil	0.12	UJ
HSSA099	Excavation	subsurface soil	0.13	UJ
HSSA100	Excavation	subsurface soil	1.3	UJ
HSSA101	Excavation	subsurface soil	0.13	UJ
HSSA102	Field Duplicate of HSSA101	subsurface soil	0.8	J
HSSA105	Excavation	subsurface soil	5.7	UJ
HSSA106	Excavation	subsurface soil	0.53	UJ
HSSA107	Excavation	subsurface soil	0.54	UJ
HSSA108	Field Duplicate of HSSA107	subsurface soil	0.54	UJ
HSSA109	Excavation	subsurface soil	0.56	UJ
HSS-DP01-SB-A03.5		subsurface soil	7	U
HSS-DP02-SB-A03.0		subsurface soil	0.82	J
HSS-DP02-SB-A05.5		subsurface soil	6.3	U
HSS-DP03-SB-A06.0		subsurface soil	6.4	U
HSS-DP04-SB-A02.0		subsurface soil	1.9	J
HSS-DP04-SB-A05.5		subsurface soil	6.3	U
HSS-DP05-SB-A02.5		subsurface soil	5.8	U
HSS-DP05-SB-A07.5		subsurface soil	6.8	U
HSS-DP05-SS-A		surface soil	7.2	
HSS-DP06-SB-A02.5		subsurface soil	7.3	
HSS-DP06-SB-A07.0		subsurface soil	6.2	U
HSS-DP06-SB-D02.5		subsurface soil	5.5	U
HSS-DP06-SS-A		surface soil	6	
HSS-DP07-SB-A06.0		subsurface soil	5.8	U
HSS-DP08-SB-A02.5		subsurface soil	5.9	U
HSS-DP08-SB-A05.5		subsurface soil	6	U

Sample ID	Description	Sample Type	Result [1]	Qual
HSS-MW01-SB-A03.0		subsurface soil	5.6	U
HSS-MW01-SB-A07.5		subsurface soil	6.1	U
HSS-MW01-SB-D07.5		subsurface soil	6.5	U
HSS-MW01-SS-A		surface soil	6.1	J
HSS-MW02-SB-A02.0		subsurface soil	4.7	J
HSS-MW02-SB-A05.0		subsurface soil	7.1	U
Zinc				
HSSA017	Direct-Push Boring	subsurface soil	17.3	
HSSA018	Direct-Push Boring	subsurface soil	134	J
HSSA019	HSS-DP07-03	surface soil	97.5	J
HSSA020	Direct-Push Boring	subsurface soil	10.6	
HSSA021	Direct-Push Boring	subsurface soil	260	J
HSSA023	Field Duplicate of HSSA018	subsurface soil	91.4	J
HSSA031	Direct-Push Boring	subsurface soil	59.4	J
HSSA032	Direct-Push Boring	subsurface soil	94.7	J
HSSA035	Direct-Push Boring	subsurface soil	51.3	J
HSSA036	Direct-Push Boring	subsurface soil	49.6	J
HSSA037	HSS-DP07-06	surface soil	229	J
HSSA038	Direct-Push Boring	subsurface soil	140	J
HSSA039	Direct-Push Boring	subsurface soil	78.1	J
HSSA040	Direct-Push Boring	subsurface soil	284	J
HSSA041	HSS-DP07-08	surface soil	280	J
HSSA042	Direct-Push Boring	subsurface soil	240	J
HSSA043	Direct-Push Boring	subsurface soil	20.4	J
HSSA044	Field Duplicate of HSSA043	subsurface soil	28.8	J
HSSA045	Surface Soil	surface soil	173	
HSSA054	Surface Soil	surface soil	334	J
HSSA065	HSS-DP07	subsurface soil	418	
HSSA066	Excavation	subsurface soil	25.5	
HSSA069	Excavation	subsurface soil	14.1	
HSSA070	Field Duplicate of HSSA069	subsurface soil	14.8	
HSSA074	Excavation	surface soil	149	
HSSA075	Excavation	subsurface soil	13.5	
HSSA078	Excavation	surface soil	303	
HSSA079	Excavation	subsurface soil	91.1	
HSSA081	Excavation	subsurface soil	148	
HSSA085	Excavation	surface soil	74.3	
HSSA086	Excavation	subsurface soil	15.2	
HSSA089	Inside AST fence	surface soil	461	
HSSA090	Inside AST fence	surface soil	384	
HSSA091	Inside AST fence	surface soil	332	
HSSA092	HSSA089	subsurface soil	240	J
HSSA093	HSSA089	subsurface soil	21	J
HSSA094	East of Excavation	surface soil	314	J
HSSA095	Excavation	subsurface soil	89.1	
HSSA096	Excavation	subsurface soil	244	
HSSA097	Excavation	subsurface soil	85.5	
HSSA098	Excavation	subsurface soil	13.4	
HSSA099	Excavation	subsurface soil	55.3	
HSSA100	Excavation	subsurface soil	160	
HSSA101	Excavation	subsurface soil	65.4	
HSSA102	Field Duplicate of HSSA101	subsurface soil	80.7	
HSSA105	Excavation	subsurface soil	269	
HSSA106	Excavation	subsurface soil	12.8	
HSSA107	Excavation	subsurface soil	6.7	
HSSA108	Field Duplicate of HSSA107	subsurface soil	6	
HSSA109	Excavation	subsurface soil	18.2	
HSS-DP01-SB-A03.5		subsurface soil	59	J

Sample ID	Description	Sample Type	Result [1]	Qual
HSS-DP02-SB-A03.0		subsurface soil	76	J
HSS-DP02-SB-A05.5		subsurface soil	26	J
HSS-DP03-SB-A06.0		subsurface soil	22	J
HSS-DP04-SB-A02.0		subsurface soil	140	J
HSS-DP04-SB-A05.5		subsurface soil	45	J
HSS-DP05-SB-A02.5		subsurface soil	87	J
HSS-DP05-SB-A07.5		subsurface soil	21	J
HSS-DP05-SS-A		surface soil	89	J
HSS-DP06-SB-A02.5		subsurface soil	260	J
HSS-DP06-SB-A07.0		subsurface soil	15	J
HSS-DP06-SB-D02.5		subsurface soil	17	J
HSS-DP06-SS-A		surface soil	90	J
HSS-DP07-SB-A06.0		subsurface soil	9.4	J
HSS-DP08-SB-A02.5		subsurface soil	50	J
HSS-DP08-SB-A05.5		subsurface soil	30	J
HSS-MW01-SB-A03.0		subsurface soil	15	J
HSS-MW01-SB-A07.5		subsurface soil	17	J
HSS-MW01-SB-D07.5		subsurface soil	8.3	J
HSS-MW01-SS-A		surface soil	95	J
HSS-MW02-SB-A02.0		subsurface soil	160	J
HSS-MW02-SB-A05.0		subsurface soil	48	J

[1] Analytical results are in mg/kg.

Attachment C
Site Figures



LEGEND

(green box)	Hazardous Sustance Sites
TL-02 (triangle)	Transformer Location
(green dotted line)	Storm Water Drain Line
(blue dashed line)	Denotes Figures C-2 through C-5 Map Boundaries

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

ABBREVIATIONS

PRL	Potential Release Location
RI	Remedial Investigation

N

No Scale

Figure C-1
Figures C-2 through C-5 Map Boundaries
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

Map Document: (Q:\CLEAN III\GIS\HC04\MXD\Fig2_PRLs_lmn.mxd)
9/22/2008 -- 11:08 AM

LEGEND

(green fill)	Hazardous Substance Sites
37	Facility Location and Number
142	Location of Building Demolished after RI
TL-02	Transformer Location
(green dashed line)	Storm Water Drain Line

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

ABBREVIATIONS

BLDG	Building
PRL	Potential Release Location
RI	Remedial Investigation

N

300 150 0 300 Feet

Figure C-2
Southwest Quadrant
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

Map Document: (Q:\CLEAN III\GIS\HC04\MXD\PRLs_3.mxd)
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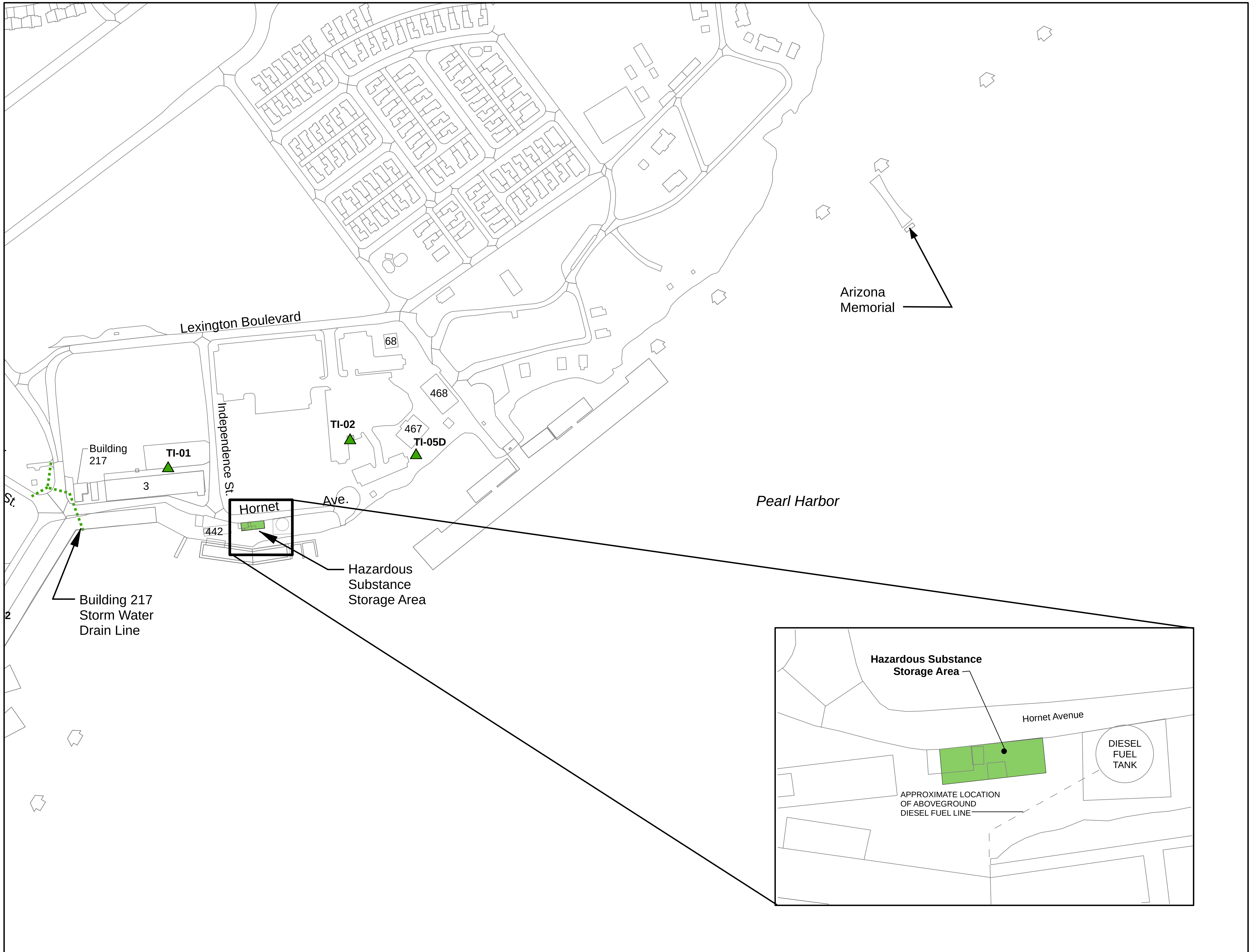

LEGEND

Hazardous Substance Sites

468 Facility Location and Number

TL-02 Transformer Location

Storm Water Drain Line

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

ABBREVIATIONS

PRL Potential Release Location

RI Remedial Investigation

N

300 150 0 300 Feet

Figure C-3
Southeast Quadrant
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

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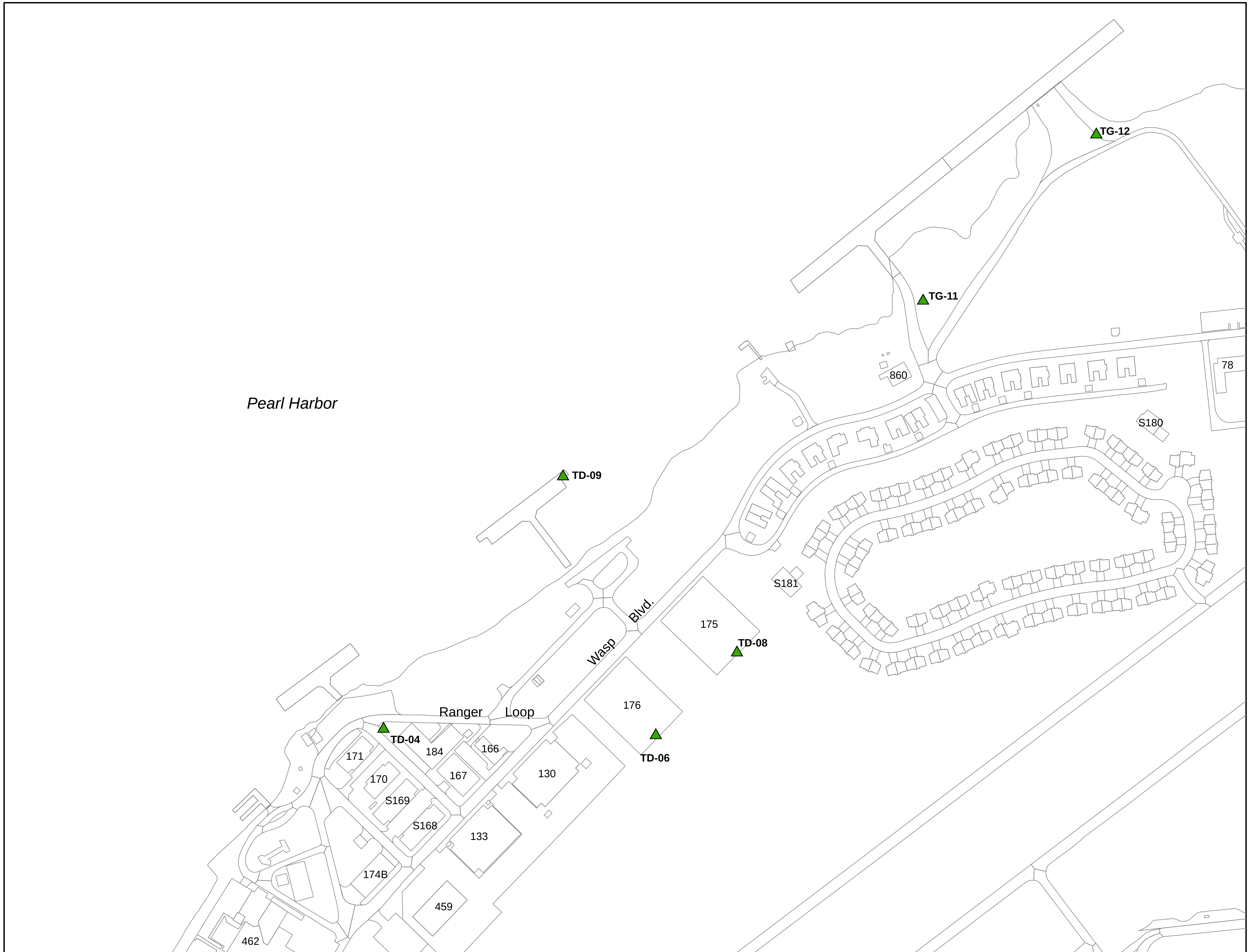

LEGEND

175 Facility Location and Number

TL-02 Transformer Location

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

N

300 150 0 300 Feet

Figure C-4
Northwest Quadrant
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

Map Document: (Q:\CLEAN III\GIS\HC04\MXD\PRLs_2.mxd)
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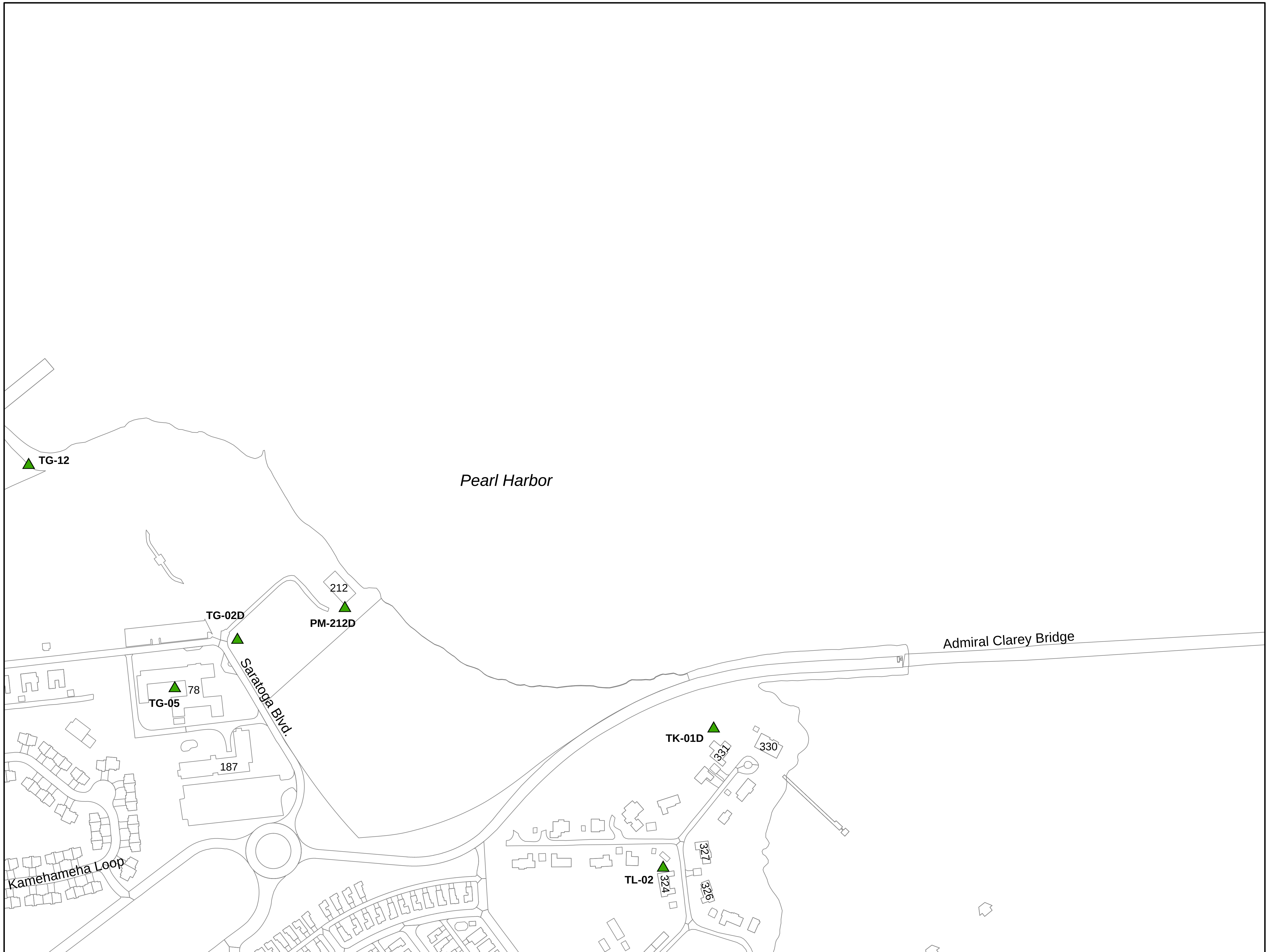

LEGEND

330 Facility Location and Number

TL-02 Transformer Location

SOURCES

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

N

340 170 0 340 Feet

Figure C-5
Northeast Quadrant
Ford Island Hazardous Substance and
32 Transformer Sites
Pearl Harbor Naval Complex
Oahu, Hawaii

Map Document: (Q:\CLEAN III\GIS\HC04\MXD\PRLs_1.mxd)
06/09/2009 -- 12:00 PM

Attachment D
Responsiveness Summary

Table D-1: Responses to Public Comments

<table>
<tr><th>Comment No.</th><th>Question/Comment</th></tr>
<tr><td colspan="2">Questions and Comments Received During the Proposed Plan Meeting (5 March 2008) for Ford Island Hazardous Substance and 32 Transformer Sites</td></tr>
<tr><td>1</td><td>Steve Mow, a representative from the Hawaii Dept. of Health (HDOH) asked why a feasibility study was not performed, as it would be the next logical step after a remedial investigation (RI).</td></tr>
<tr><td colspan="2">The Navy replied that they knew that the island is going to undergo substantial development, and that there were some outstanding soil issues, so by conducting an engineering evaluation/cost analysis (EE/CA) which recommended removal action, this would save time and money by simply removing the problem from the site altogether.</td></tr>
<tr><td>2</td><td>The HDOH representative then inquired that if that was the case, why do a proposed plan and record of decision (ROD) and not an EE/CA followed by a removal verification report (RVR).</td></tr>
<tr><td colspan="2">The Navy responded that it was their understanding that in the CERCLA process, once a RI has been performed, the only way to close out the site is through a ROD. If the EE/CA and removal action had been performed following a site inspection rather than a RI, then a RVR could have closed out the site.</td></tr>
<tr><td>3</td><td>The HDOH representative asked whether The Navy requires peer review for a FS or an EE/CA.</td></tr>
<tr><td colspan="2">The Navy replied that yes, they do seek peer review for both a FS and an EE/CA.</td></tr>
<tr><td>4</td><td>The HDOH representative asked if the removal action failed to get all of the contaminated material, then what happens?</td></tr>
<tr><td colspan="2">The Navy replied that they would then have to return to the traditional CERCLA path of an RI/FS, which is exactly what happens in the next presentation [Land Use Controls at Building 284 and Former Buildings 80 and 302], so in that instance, they were not saved a step by conducting an EE/CA and removal action.</td></tr>
</table>

Attachment E
Detailed Reference Table

Table E-1: Detailed Reference Table

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
1	engineering evaluation/cost analysis	Section 2.1.2.2 Page 11	Engineering Evaluation/Cost Analysis, Ford Island Hazardous Substance Sites. Pearl Harbor, HI; Executive Summary, pages iii through ix, Pacific Division, Naval Facilities Engineering Command. February 2003a.
2	No further action	Section 2.1.2.2 Page 11	Final Remediation Verification Report, Non-Time-Critical Removal Action, Ford Island Hazardous Substance Sites, Pearl Harbor Naval Complex, Hawaii; Section 6 Conclusions, page 6-1, Shaw Environmental, February 2005.
3	Proposed Plan	Section 2.1.2.2 Page 11	Proposed Plan, Ford Island Hazardous Substance & Transformer Sites, Pearl Harbor Naval Complex, Oahu, Hawaii; Pages 4-4 and 4-5, Earth Tech, February 2008.
4	biological resources	Section 2.1.4.2 Page 13	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 2.4, pages 2-3 through 2-6, Earth Tech, February 2003c.
5	Groundwater classification	Section 2.1.4.5 Page 15	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 2.8.4, pages 2-22 through 2-24, Earth Tech, February 2003c.
6	Bldg. 39 site	Section 2.2.1 Page 15	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 5-2, Earth Tech, February 2003c.
7	Bldg. 39	Section 2.2.2.1 Page 15	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.5, pages 5-27 through 5-29, Earth Tech, February 2003c.
8	Investigation activities	Section 2.2.2.3 Page 16	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.5.2, pages 5-29 through 5-33 plus Figure 5-2, Earth Tech, February 2003c.
9	Investigation results	Section 2.2.2.3 Page 16	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.5.2, pages 5-33 through 5-60, Earth Tech, February 2003c.
10	based on the RI results	Section 2.2.2.4 Page 17	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.5.4, page 5-60, Earth Tech, February 2003c.
11	Action Memorandum	Section 2.2.2.4 Page 17	Action Memorandum for Removal Actions at Five Hazardous Substance Sites, Ford Island, Pearl Harbor Naval Complex, Hawaii; Section III.E.1, page 14, Earth Tech, May 2003a.
12	Bldg. 43	Section 2.3.1 Page 19	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.6.1, pages 5-60 through 5-61, Earth Tech, February 2003c.
13	Bldg. 43 site	Section 2.3.1 Page 19	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 5-9, Earth Tech, February 2003c.
14	During the RI	Section 2.3.2.2 Page 19	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.6.2, pages 5-61 through 5-62, Earth Tech, February 2003c.
15	RI results	Section 2.3.2.3 Page 20	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.6.4, pages 5-88 through 5-89, Earth Tech, February 2003c.
16	Action Memorandum	Section 2.3.2.3 Page 20	Action Memorandum for Removal Actions at Five Hazardous Substance Sites, Ford Island, Pearl Harbor Naval Complex, Hawaii; Section IV.E.1, pages 18 and 19, Earth Tech, May 2003a.
17	Addendum No. 1	Section 2.3.2.3 Page 20	Action Memorandum Addendum No. 1 for Removal Actions at Five Hazardous Substance Sites, Ford Island, Pearl Harbor Naval Complex, Hawaii; Section III.E.1, pages 5 and 6, Earth Tech, September 2003b.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
18	Bldg. 217 location	Section 2.4.1 Page 23	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.7.1, page 5-89, Earth Tech, February 2003c.
19	Bldg. 217 site	Section 2.4.1 Page 23	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 5-16, Earth Tech, February 2003c.
20	RI	Section 2.4.2.2 Page 23	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.7.2, pages 5-89 and 5-90, Earth Tech, February 2003c.
21	results of the RI	Section 2.4.2 Page 24	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.7.4, page 5-101, Earth Tech, February 2003c.
22	Camel Refurbishing Area is located	Section 2.5.1 Page 25	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 5-27, Earth Tech, February 2003c.
23	Camel Refurbishing Area site	Section 2.5.1 Page 25	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.10.1, page 5-141, Earth Tech, February 2003c.
24	During the RI	Section 2.5.2.2 Page 25	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.10.2, pages 5-142 through 5-144; Figure 5-27, Earth Tech, February 2003c.
25	human health PRE	Section 2.5.2.2 Page 25	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.6.4, pages 5-88 and 5-89, Earth Tech, February 2003c.
26	based on the RI results	Section 2.5.2.3 Page 25	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.10.4, pages 5-162 and 5-163, Earth Tech, February 2003c.
27	Action Memorandum	Section 2.5.2.3 Page 25	Action Memorandum for Removal Actions at Five Hazardous Substance Sites, Ford Island, Pearl Harbor Naval Complex, Hawaii; Section IV.E.1, pages 27 and 28, Earth Tech, May 2003a.
28	excavation limits	Section 2.5.2.3, Page 26	Final Remediation Verification Report, Non-Time Critical Removal Action, Ford Island Hazardous Substance Sites; Figure 6, Shaw Environmental, February 2005.
29	arsenic cleanup levels	Section 2.5.5.1 Page 27 & 28	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Attachment U.2, Earth Tech, February 2003c.
30	HSSA location	Section 2.6.1 Page 29	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.11.1, pages 163 and 164, Earth Tech, February 2003c.
31	HSSA site	Section 2.6.1 Page 29	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 5-32, Earth Tech, February 2003c.
32	RI activities	Section 2.6.2.2 Page 30	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.11.2, pages 164 and 165, Earth Tech, February 2003c.
33	human health PRE	Section 2.6.2.2 Page 30	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.11.3.2, pages 5-181 through 5-184, Earth Tech, February 2003c.
34	further action	Section 2.6.2.2 Page 30	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.11.4, page 5-188, Earth Tech, February 2003c.
35	further action	Section 2.6.2.2 Page 30	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 5.11.3.3, pages 5-184 through 5-188, Earth Tech, February 2003c.
36	Action Memorandum	Section 2.6.2.4 Page 31	Action Memorandum for Removal Actions at Five Hazardous Substance Sites, Ford Island, Pearl Harbor Naval Complex, Hawaii; Section VII.E.1, pages 31 and 32, Earth Tech, May 2003a.
37	transformer sites	Section 2.7.1 Page 34	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 3.2, page 3-1 , Earth Tech, February 2003c.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record[1]
38	55 transformers	Section 2.7.1 Page 34	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Figure 3-1, Earth Tech, February 2003c.
39	32 transformer sites	Section 2.7.1 Page 34	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 3.9, pages 3-23 through 3-27, Earth Tech, February 2003c.
40	RI	Section 2.7.2.2. Page 34	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 3.3, pages 3-1 through 3-4, Earth Tech, February 2003c.
41	human health PRE	Section 2.7.5 Page 35	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 3.7, pages 3-21 and 3-22, Earth Tech, February 2003c.
42	ecological SRA	Section 2.7.5 Page 35	Remedial Investigation Report, Ford Island, Pearl Harbor, Hawaii; Section 3.8, pages 3-22 and 3-23, Earth Tech, February 2003c.