Record of Decision
Service Station Gulch
JOINT BASE PEARL HARBOR-HICKAM WAHIAWA ANNEX, OAHU, HAWAII

NCTAMS PAC National Priorities List Site

April 2013

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

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-03-D-1837, CTO 0008

CONTENTS

ACRONYMS AND ABBREVIATIONS

ATSDR	Agency for Toxic Substances and Disease Registry
BERA	baseline ecological risk assessment
bgs	below ground surface
Bldg.	building
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	CERCLA Information System
COPC	chemical of potential concern
CSM	conceptual site model
CTE	central tendency exposure
DoD	Department of Defense
DOH	Department of Health, State of Hawaii
EASTPAC	Eastern Pacific Areas
EPA	Environmental Protection Agency, United States
EPC	exposure point concentration
FFA	Federal Facility Agreement
HI	hazard index
HQ	hazard quotient
IAS	initial assessment study
JBPHH	Joint Base Pearl Harbor-Hickam
L-HQ	LOAEL-based HQ
NAVCAMS	Naval Communication Area Master Station
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCTAMS PAC	Naval Computer and Telecommunications Area Master Station Pacific
NEX	Navy Exchange
no.	number
NPL	National Priorities List
NRTF	Naval Radio Transmitter Facility
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricants
PP	proposed plan
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RBS	risk-based screening
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act
SRA	screening risk assessment
SSRBE	site-specific risk-based evaluation
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbons
U.S.	United States
UCL	upper confidence limit
VOC	volatile organic compound

1. Declaration

1.1 SITE NAME AND LOCATION

This record of decision (ROD) has been prepared by the United States (U.S.) Navy for the Service Station Gulch located within the Joint Base Pearl Harbor-Hickam (JBPHH) Wahiawa Annex (formerly Naval Computer and Telecommunications Area Master Station Pacific [NCTAMS PAC]) on the island of Oahu, Hawaii (Figure 1). The Service Station Gulch at JBPHH Wahiawa Annex is north of Center Street, behind the former Building (Bldg.) 329 Navy Exchange (NEX) Service Station; the former Bldg. 295 (where Bldg. 198 now exists); and former Bldg. 88, the Chief Petty Officers' Club (Figure 2).

JBPHH Wahiawa Annex is one of two major land areas located within the NCTAMS PAC National Priorities List (NPL) site (Figure 1). The Naval Radio Transmitter Facility (NRTF) is the second land area within the JBPHH facility. JBPHH Wahiawa Annex was placed on the U.S. Environmental Protection Agency (EPA) NPL in May 1994 as EPA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (CERCLIS) Number (no.) HI0170090054. The Service Station Gulch was identified in the Federal Facility Agreement[1] (FFA), signed 29 January 2009, as one of 24 CERCLA sites at the facility requiring additional remedial investigation (RI) (EPA, State of Hawaii, and DON 2009).

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD presents the final remedy for the Service Station Gulch located at JBPHH Wahiawa Annex, Oahu, Hawaii. The final remedy was chosen in accordance with 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 United States Executive Order 12580 (EO 1987). Information supporting the decisions leading to the selected remedy is contained in the Administrative Record file for the site.

The U.S. Department of the Navy, the EPA, and the State of Hawaii Department of Health (DOH) concur with the final selected remedy.

1.3 DESCRIPTION OF SELECTED REMEDY

The Navy and EPA, with concurrence from DOH, have determined that the Service Station Gulch requires No Action to be protective of human health and the environment. This decision is based on the following:

- Results of the human health risk assessment and the baseline ecological risk assessment (BERA)
- Current site conditions and intended future use
- Absence of critical aquatic or terrestrial wildlife receptors

[1] Text in blue font identifies where detailed cross-reference site information is available (Attachment B). In the event of any inconsistency between the text in this ROD and the text in any of the cross-reference documents, the text in this ROD will take precedence.

1.4 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate, is cost effective, and utilizes permanent solutions to the extent practicable.

The selected remedy for the site does not satisfy the statutory preference for treatment as a principal element of the final remedy because no response action 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 five-year review per NCP (40 Code of Federal Regulations 300.430(f)(4)(ii)) will be not be required for this final remedy.

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LEGEND

- JBPHH Wahiawa Annex
- NRTF Lualualei
- Freeway
- Highway
- Road
- Hospital
- Surrounding Area
- Ocean

JBPHH Joint Base Pearl Harbor-Hickam

SOURCE

- Base Mapping From State of Hawaii Statewide GIS Data and Other Mapping Developed By and For The U.S. Navy

N

4,200 2,100 0 4,200 8,400 12,600 Feet

Figure 1
NCTAMS PAC NPL Installations
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

Legend

- JBPHH Wahiawa Annex Boundary
- Service Station Gulch Site Boundary

N

0 95 190 380 Feet

Figure 2
Site Location Map
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

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1.5 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF FINAL REMEDY

The Navy and EPA, with the concurrence of DOH, have selected No Action as the final remedy for the Service Station Gulch. This remedy is protective of human health and the environment at the Service Station Gulch within NCTAMS PAC NPL at JBPHH Wahiawa Annex, Oahu, Hawaii.

4/11/13

J. W. James
Captain, U.S. Navy
Commander
Joint Base Pearl Harbor-Hickam

Date

5/27/13

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

Date

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

7-11-13

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

Date

2. Decision Summary

This section summarizes site characteristics, potential human health risks, potential ecological risks, and the rationale for the decisions that led to selection of the final remedy for the Service Station Gulch.

2.1 SITE NAME, LOCATION, AND DESCRIPTION

JBPHH Wahiawa Annex (EPA CERCLIS no. HI0170090054) is an active military installation situated on approximately 700 acres of land in central Oahu, Hawaii. The Service Station Gulch site is located adjacent to Bldg. 329, the former NEX Service Station; the former Bldg. 295 (where Bldg. 198 now exists); and former Bldg. 88, the former Chief Petty Officers' Club (Figure 2).

The Service Station Gulch is a steep, flood-prone gulch that is unsuitable for development. The gulch has a dense vegetative cover that has been in place for 40 years. The dense vegetation protects against soil erosion and provides an additional barrier to deter contact with subsurface soil for both human and ecological receptors. The dense vegetation and established root network protects soil from erosion and, along with the steep terrain, provides a natural barrier to keep people out of the gulch. During heavy rainfall, an intermittent stream runs through the bottom of the gulch.

Executive Order 12580 authorizes the Navy to act as the lead agency for environmental response actions at Navy sites, including the Service Station Gulch. The EPA and DOH have provided oversight during the environmental investigation activities at the site. Funding for the site work at the Service Station Gulch is provided by the Navy Environmental Restoration Program.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Site History

The mission of JBPHH Wahiawa Annex is to provide operational direction and management to all Naval Telecommunications System assets in the Commander, Naval and Telecommunications Command Pacific area of responsibility; manage, operate, and maintain Defense Communication System and Telecommunication System assets; manage cryptologic resources for Commander, Naval Security Group; provide operational direction and management of the Department of Defense (DoD) worldwide High Frequency Direction Finding System; and provide a full range of automated data processing and information resources services to the Navy and other DoD activities in the Pacific. The two major land areas are JBPHH Wahiawa Annex, the main station and receiver site; and NRTF Lualualei, the transmitter site (Figure 1).

Construction of the transmitter station at Lualualei began in 1933; the transmitter station was intended to support a receiver station installed at Wailupe in 1920. The main antennae were completed in 1935, and the facility was activated in 1936. JBPHH Wahiawa Annex was originally established in 1940 as a temporary Naval Radio Station and Naval Radio Direction Finder Station, but the need to expand receiving facilities and to separate transmitting and receiving facilities forced expansion at JBPHH Wahiawa Annex. The expansion schedule was accelerated after the attack on Pearl Harbor, and receiver functions at Wailupe and Lualualei were consolidated at Wahiawa by the end of 1941. Military activities at JBPHH Wahiawa Annex decreased after the end of World War II, but were increased in the early 1950s during the Korean War and again in the early 1960s during the Vietnam War (ATSDR 1998).

From 1967 to 1980, a reportedly small amount of inert wastes; auto parts; and petroleum, oil, and lubricants (POLs) were disposed of in the Service Station Gulch (NEESA 1986). The Chief Petty Officers' Club reportedly disposed of glass bottles and other galley wastes in the gulch. Some

construction debris was also observed in the gulch behind the former Bldg. 88 location. The service station reportedly disposed of all its waste POLs and other debris in the gulch.

2.2.2 Site Investigations

The Service Station Gulch addressed in this ROD was the subject of the following environmental investigations.

Initial Assessment Study (IAS) of Naval Communication Area Master Station (NAVCAMS) Eastern Pacific Areas (EASTPAC) (NEESA 1986). A total of 14 sites were initially identified by the IAS as potentially contaminated: 6 sites at NAVCAMS Wahiawa (including the Service Station Gulch site); 7 sites at NRTF Lualualei; and a site that consisted of areas around transformers at both NAVCAMS Wahiawa and NRTF Lualualei. The IAS concluded that none of the sites posed an immediate threat to human health or the environment. No action was recommended for the Service Station Gulch site because of the small quantity of waste disposed of, the inert quality of most of the waste, and the degradability of the small amount of waste POLs. Further investigation was recommended under the Navy Assessment and Control of Installation Pollutants program to assess potential long-term impacts. A confirmation study involving sampling and monitoring of nearby sites, including the Old Wahiawa Landfill, Bldg. 6 Disposal Area, and various transformer locations, was recommended to determine whether suspected contamination was present and to quantify the extent of any problems.

Site Inspection of NAVCAMS EASTPAC (HLA 1989). The site inspection addressed the four sites recommended for further investigation by the IAS (NEESA 1986). Soil samples collected from the Old Wahiawa Landfill, which is upgradient of the Service Station Gulch site, contained detectable concentrations of lead and mercury. Arsenic, lead, mercury, di-n-butylphthalate, and xylenes were reported in soil samples collected from the Bldg. 6 Disposal Area, which is downgradient of the Service Station Gulch site. Further investigation was recommended for the Service Station Gulch.

Public Health Assessment of NCTAMS EASTPAC (ATSDR 1998). The Agency for Toxic Substances and Disease Registry (ATSDR) conducted a site visit at NCTAMS EASTPAC in January 1995, after it was placed on the EPA NPL in 1994. ATSDR identified contamination in gulches at JBPHH Wahiawa Annex and ingestion of fish as a potential exposure pathway. Although gulches at JBPHH Wahiawa Annex were contaminated with polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), pesticides, and metals in localized areas, ATSDR concluded that contaminants in the gulches were not likely to migrate via intermittent surface water runoff due to the low levels detected and the distance to the nearest perennial stream. According to ATSDR, the aquatic ecosystem and the fish in the nearest perennial stream were unlikely to be impacted by contamination in the gulches at JBPHH Wahiawa Annex; therefore, no complete exposure pathway exists and no public health hazards exist.

RI of the Service Station Gulch at JBPHH Wahiawa Annex (AECOM 2011). In 2003-2004, a RI was conducted to fully delineate and characterize the nature and extent of previously identified contamination resulting from past disposal practices performed at the Service Station Gulch. The RI activities conducted were based on the historical site use and the chemicals of potential concern (COPCs) associated with the site, and included a biological survey as well as soil and surface water sampling. The majority of the site was found to be relatively inaccessible due to the steepness of the gulch slope. Various debris materials were found throughout the area, including on the steep slope. Observed materials included small amounts of rubbish (e.g., cans and bottles), construction debris,

and inert wastes. Auto parts and POLs were reportedly disposed of in the gulch from the Chief Petty Officers' Club and from the service station.

A biological reconnaissance survey of JBPHH Wahiawa Annex was conducted to collect and identify plant specimens, catalog their habitat types, survey migration pathways for hazardous constituents, and identify possible human and ecological receptors and possible threatened or endangered species.

Surface and shallow subsurface soil sampling was conducted at the site in accordance with the work plan/sampling and analysis plan (Earth Tech 2003). Samples were collected from the top, sides, and bottom of the gulch. Each soil sample along the gulch slope was collected from a roughly 50-foot by 50-foot grid to provide adequate sample coverage. Within each grid, a judgmental sample was collected from the location most likely to be contaminated based on the presence of debris, soil discoloration, stressed vegetation, and/or odor observed by the field crew. At the bottom of the gulch, samples were collected from depositional zones (e.g., inside bends) in the intermittent stream channel where contaminants adsorbed to suspended solids were expected to settle.

Four surface water samples were collected from the intermittent stream at the bottom of the gulch during the remobilization effort in 2004.

A human health screening risk assessment (SRA) and BERA were conducted to evaluate whether exposure to the impacted soils and surface water (when present) is safe for people and the environment. The site was determined to be protective of human health and the environment based on the results of the human health and ecological risk assessments, the absence of critical aquatic or terrestrial wildlife receptors, the current site conditions, and the planned future use.

Proposed Plan (DON 2012). In 2012, a Proposed Plan (PP) was prepared to present the proposed final site remedy for the Service Station Gulch and to facilitate public involvement in the remedy selection process. The PP identified No Action as the recommended alternative and requested public comment (DON 2012).

2.2.3 Enforcement Activities

There have been no CERCLA enforcement activities at the Service Station Gulch.

2.3 COMMUNITY PARTICIPATION

Public participation in the decision process for environmental activities at the JBPHH Wahiawa Annex 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, EPA, 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 at Naval Facilities Engineering Command (NAVFAC) Hawaii.

A PP was prepared to formally present the selected remedy to the public and to solicit public comment. A public meeting for the PP was held on 24 May 2012, at the Oahu Veterans Center. Responses to verbal comments received during the comment period and public meeting are presented as a responsiveness

summary in Attachment A of this ROD. No written comments were received during the public comment period. The complete transcript of the public meeting is available in the Administrative Record file.

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

Wahiawa Public Library
820 California Ave.
Wahiawa, HI 96786
808-622-6345

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 NAVFAC Pacific. The address for the Administrative Record file is provided below:

Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Attn: NAVFAC PAC EV3
JBPHH Hawaii 96860-3134

2.4 SCOPE AND ROLE OF RESPONSE ACTION

The Service Station Gulch addressed in this ROD is located within the JBPHH Wahiawa Annex. The JBPHH Wahiawa Annex is 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, EPA, and DOH through a FFA (EPA, State of Hawaii, and DON 2009), effective July 2009, 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 guidance and policy, and applicable State of Hawaii law.
- Facilitate cooperation, exchange of information, and participation of the Navy, EPA, and DOH.
- 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 the human health and ecological risk assessments conducted, the No Action decision for the Service Station Gulch is designed to fulfill the objectives of the FFA for JBPHH Wahiawa Annex. The Navy, EPA Region 9, and DOH concluded that, based on the human health and ecological risk assessments, current site conditions, intended future use, and lack of use by special status species as presented in the final RI (AECOM 2011) and the PP (DON 2012), no action is required for this site.

2.5 SITE CHARACTERISTICS

2.5.1 Site Overview

This section provides an overview of the site.

2.5.1.1 TOPOGRAPHY

JBPHH Wahiawa Annex is located on the eastern side of the highest part of the Schofield Plateau. The plateau is approximately 14 miles long and 5 miles wide. It rises from near sea level on the north and south ends to an elevation of approximately 1,000 feet near JBPHH Wahiawa Annex. Elevations at JBPHH Wahiawa Annex range from 1,050 feet to 1,300 feet above mean sea level. The facility is bisected by the North Fork of the Kaukoanahua Stream that begins several miles east of the site in the Koolau Range and flows to the west, toward the town of Wahiawa, and then to the North Shore. The area in the immediate vicinity of the site is generally flat to rolling terrain, with the Service Station Gulch being the largest vertical feature; in places, it is more than 80 feet deep. The Service Station Gulch site is approximately 4.15 acres per the site boundary depicted on Figure 2.

2.5.1.2 GEOLOGY

The island of Oahu is the eroded remnant of two large coalesced shield volcanoes, the Waianae and Koolau volcanoes. Shield-building lavas emanated primarily from the rift zones of both of these volcanoes, and the island of Oahu consists predominantly of basalt flows. These volcanic rocks have been severely weathered by fluvial processes. Eroded and weathered remnants of these two volcanoes form two of Oahu's four geomorphic provinces: the Waianae Range on the west and the younger Koolau Range on the east. The other two provinces are the Schofield Plateau and the Coastal Plain (NEESA 1986).

Most of the station's land slopes gently westward. The soils of Wahiawa are part of the Helemano-Wahiawa association. These soils are derived from weathered Koolau volcanics and are mostly silty clay or silty clay loam. The Helemano Silty Clay is a well-drained and moderately fine- to fine-textured upland soil on alluvial fans and colluvial slopes on the sides of gulches. The soil consists of a dark reddish-brown silty clay surface layer approximately 10 inches thick. The subsoil consists of dark reddish-brown and dark red silty clay and is approximately 50 inches in thickness. The substratum consists of soft and highly weathered basic igneous rock. The residual soils are red, silty clay or clayey silt laterites. Permeability is moderately rapid, and runoff is medium to very rapid; the erosion hazard on the 30 to 90 percent slopes is very severe (NEESA 1986, USDA SCS 1972).

Surface and shallow subsurface soils collected at the site from depths to 24 inches below ground surface (bgs) and visually identified were, without exception, clays and silty clays with low to medium plasticity, with an estimated 85- to 95-percent fine-grained content, and were moist and soft. The majority of the samples contained no gravel. In most locations, a surficial, thin (up to 2 inches), decomposed organic layer was present, which was scraped away prior to sampling. Selected locations on the southern slope of the Service Station Gulch site appear to be outcroppings of the dark gray, soft, weathered basic igneous rock discussed above. However, the exposed slope primarily

consists of dark-reddish brown to dark red residual and alluvial weathered remnants of this igneous rock. The bottom of the Service Station Gulch drainage is composed of alluvial sediment of the Helemano Silty Clay. No other soil types were encountered in this area of the Service Station Gulch.

2.5.1.3 HYDROGEOLOGY

Surface Water Hydrology. JBPHH Wahiawa Annex is drained westward by Poamoho Stream on the north and by the North Fork of the Kaukonahua Stream on the south. The North Fork of the Kaukonahua Stream enters the Wahiawa Reservoir about 3 miles downstream from the JBPHH Wahiawa Annex facility. Approximately 7 miles west of JBPHH Wahiawa Annex, the North Fork of the Kaukonahua Stream and the Poamoho Stream join for approximately 1 mile before emptying into Kaiaka Bay and the Pacific Ocean. Other than intermittent streams, no other surface water bodies are present at JBPHH Wahiawa Annex (NEESA 1986).

The surface drainage at JBPHH Wahiawa Annex consists of narrow ravines that divide the station into a northern area used for receiver facilities and a southern area containing communications and support facilities. The station is surrounded on three sides by deep, narrow, steep-sided ravines of streams draining the Koolau Range. Rainfall is generally characterized by intense tropical cloudbursts, most of which tends to run off rather than infiltrate into the soil (NEESA 1983). The storm drainage system at the facility consists of a series of east-west-trending gulches that join the Poamoho Stream west of the facility (NEESA 1986).

Groundwater Hydrology. The Schofield Aquifer occurs within the fractured basalts of the Koolau Volcanic Series and possibly the Waianae Volcanics at greater depths. Water infiltrating from rainwater and streams recharges the aquifer, which yields large quantities of water without significant drawdown. The unconfined top of the Schofield Aquifer in the JBPHH Wahiawa Annex area occurs at a depth of approximately 800 to 900 feet bgs. Relatively impermeable basalt dikes form barriers within the more permeable volcanics. Groundwater from higher elevations flows to successively lower levels by subsurface leakage through, over, and around the dikes. The dikes thus create step-like breaks in the water table as it flows from one barrier to the next. Groundwater generally flows toward the north. Perched aquifers created by less permeable rock layers are known to occur locally (PRC 1992).

Potable water is supplied by three deep wells located at the east end of Schofield Barracks just south of Wahiawa. The wells are owned and operated by the Navy (Earth Tech 1998). There are no other known wells located within a 0.5-mile radius of Service Station Gulch. The DOH monitors the water supplied from all three of these well sites.

2.5.1.4 CULTURAL RESOURCES

A National Historic Preservation Act Section 106 Review was requested on 21 June 2002. The review determined that no historic properties would be affected by the RI of the Service Station Gulch site at JBPHH Wahiawa Annex.

Wildlife and Sensitive Ecosystems Biological surveys were conducted to identify and characterize ecological populations and sensitive habitats that may be affected by investigation activities or exposed to contamination originating from the site. A biological survey for the site was conducted in June 2003 (see Appendix A.4 of the RI). The Service Station Gulch site survey area was approximately 500 lineal feet of forested, steep-sided gulch at JBPHH Wahiawa Annex. Flora and fauna identified during the surveys are discussed in the following sections.

2.5.1.5 WILDLIFE

Two introduced mammalian species were encountered in the gulch during the survey: domestic dog (*Canis f. familiaris*) and feral pig (*Sus s. scrofa*). Although no rodents were detected, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources present with the area. All of these mammalian species are deleterious to native habitats and the native and indigenous fauna they support. A total of 259 individual birds representing 14 species from 11 separate families were recorded during transect counts. All of the birds recorded are alien species. Avian diversity was relatively low. Two species accounted for 51 percent of the total number of birds: red-vented bulbul (*Pycnonotus cafer*) and Japanese white-eye (*Zosterops japonicus*). No mammalian or avian species currently listed by either the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended, or by the State of Hawaii under its endangered species program were detected during the survey (Aecos 2003).

2.5.1.6 VEGETATION

The site consists of steep, heavily forested terrain. An intermittent stream threading around trees at the bottom of the gulch contained minimal water at the time of the survey: only a couple of pools less than 2 inches deep, which were used by wild pigs. The gulch and adjacent ruderal environment harbor 53 plant species, of which only 9 are considered native: 4 are Polynesian introductions (arrived with the early Polynesians who first populated the islands), 4 are indigenous (native, but found elsewhere in the world), and 1 is endemic (unique to the Hawaiian Islands). The more significant native species, *ʻuluhe* (*Dicranopteris linearis*), *ʻieʻie* (*Freycinetia arborea*), and *koa* (*Acacia koa*), were once common in the mountains on Oahu, but have not been seen in the lowlands or near the coast. The total number of species is small considering the size of the area surveyed, which is attributed to the dense shade within the entire gulch caused by numerous small and large trees. The forest within the gulch is dominated by introduced species. The largest trees in the gulch are Moluccan albizia (*Falcataria moluccana*), a relatively fast-growing species introduced to Hawaii early in the 1900s and widely planted around Oahu by foresters. No threatened or endangered species of plant was found at this site during the survey (Aecos 2003).

2.5.2 Conceptual Site Model

The conceptual site model (CSM) developed for the Service Station Gulch site describes potential impacted media, transport mechanisms, and exposure routes for potential human and ecological receptors. The CSM was developed from previous investigations, historical research, aerial photographs, interviews, and research findings from the RI report (AECOM 2011).

The primary purpose of the CSM is to structure the human health and ecological SRA to determine whether exposure pathways are potentially complete or incomplete (requiring no further evaluation). Only potentially complete exposure pathways are evaluated quantitatively in the risk assessment, which is consistent with EPA guidance (EPA 1989). A potentially complete exposure pathway must include all of the following elements before a quantitative assessment is performed:

- Source and type of chemicals present
- Affected media
- Chemical release and transport mechanisms (e.g., spillage and advection, vaporization)
- Known and potential routes of exposure (e.g., ingestion, dermal contact, inhalation)
- Known or potential human and environmental receptors (e.g., residents, workers, wildlife)

The absence of any one of these elements results in an incomplete exposure pathway. Thus, for an incomplete pathway (i.e., with no potential human or ecological exposure), the potential for adverse health effects would be deemed negligible and would not warrant further evaluation.

Figure 4 summarizes possible exposure pathways for potential current and future receptors at the site. Although the site is restricted and is not considered for property transfer at this time, potential human receptors for the Service Station Gulch include trespassers (adult/child) and hunters under current land use setting, and trespassers (adult/child), hunters, onsite workers, and residents (adult/child) under the future land use setting. The most important potential routes of exposure are direct contact with and incidental ingestion of contaminated soil and surface water (if present, located in the intermittent stream). The CSM for the BERA is presented as Figure 5.

2.5.3 Sampling Strategy

In 2003-2004, a RI was conducted to fully delineate and characterize the nature and extent of previously identified contamination resulting from past disposal practices performed at the Service Station Gulch. Samples were collected from the top, sides, and bottom of the gulch, as shown in Figure 3.

Each soil sample along the gulch slope was collected using a roughly 50-foot grid to provide adequate coverage. Within each grid, a judgmental approach was used to select the locations most likely to be contaminated based on the presence of debris, soil discoloration, stressed vegetation, and/or odor observed by the field crew. At the bottom of the gulch, samples were collected from depositional zones (e.g., inside bends) in the intermittent stream where contaminants adsorbed to suspended solids were expected to settle.

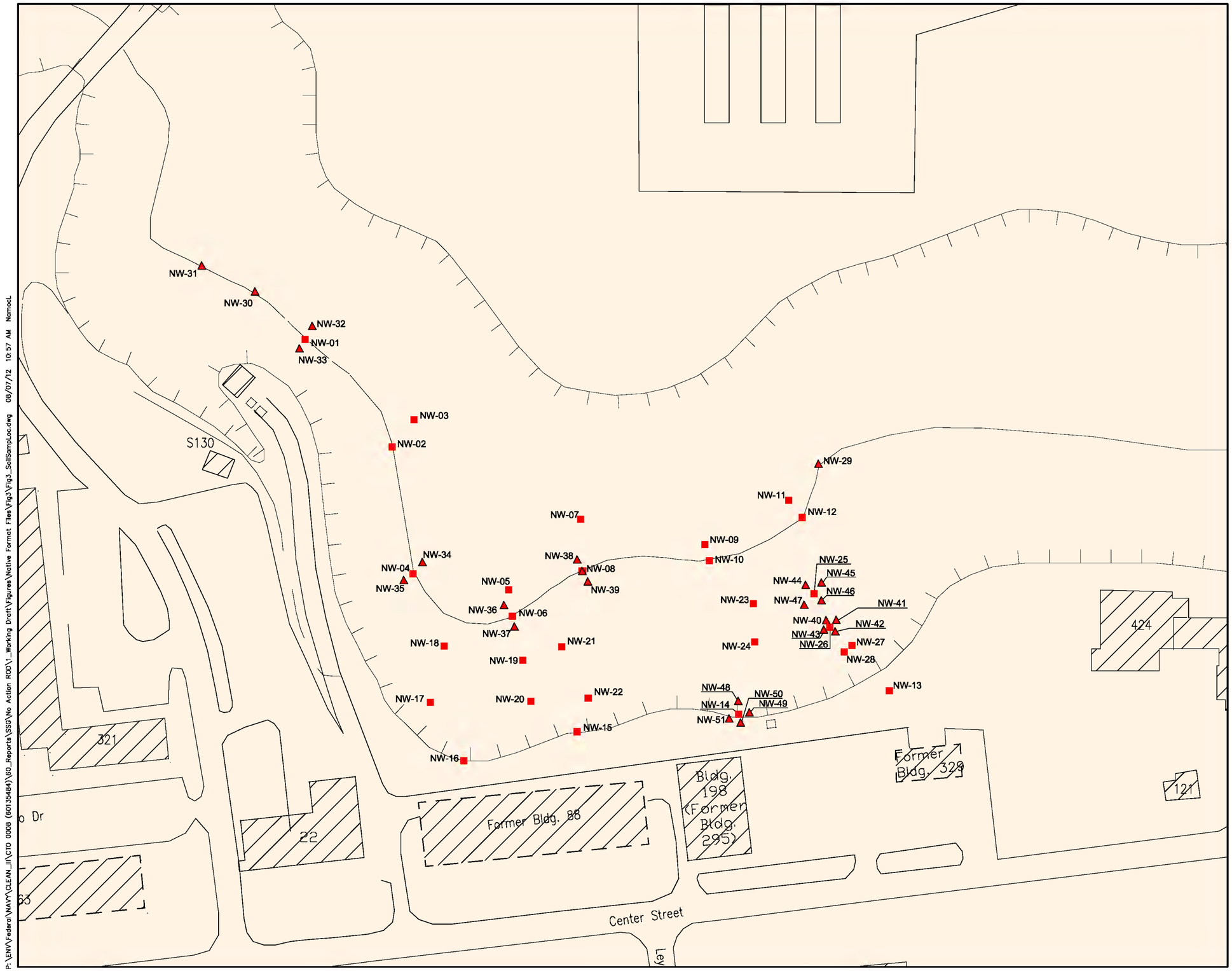
Soil samples were analyzed for volatile organic compounds (VOCs) (in subsurface soil only), semivolatile organic compounds (SVOCs), PAHs, metals, and total petroleum hydrocarbons (TPH). Surface soil samples collected from the intermittent stream at the bottom of the gulch were also analyzed for PCB Aroclors. Step-out surface soil sampling and additional horizontal and vertical delineation subsurface soil sampling was conducted to delineate contamination for PCBs, PAHs, VOCs, and metals. Four surface water samples were collected from the intermittent stream at the bottom of the gulch during the remobilization effort in 2004 and analyzed for VOCs, SVOCs, PAHs, TPH, and metals (filtered and unfiltered).

2.5.4 Nature and Extent of Contamination

The RI sampling was conducted between June 2003 and March 2004 and included soil sampling and surface water sampling.

2.5.4.1 Soil Sampling

A total of 75 soil samples were collected from locations in the intermediate stream channel at the bottom of the site, opposite bank of the stream channel, at the top of the gulch, and on the steep sides of the gulch at evenly spaced intervals, and from areas most likely to be contaminated, based on observed debris. Surface (0 to 0.5 foot bgs) and subsurface soil (1.5 to 3.0 feet bgs) samples were collected to delineate the horizontal and vertical extent of contamination. Concentrations of PCBs (Aroclors 1254 and Aroclors 1260), PAHs (benzo(a)pyrene and dibenz(a,h)anthracene), and acetone were detected above the EPA's residential regional screening levels (RSLs) (EPA 2009a). Several metals (aluminum, arsenic, chromium, cobalt, and iron) were also found to exceed both the RSLs and the 95th percentile background concentration values. Analyte concentrations and distributions are shown in Attachment C, Figures C-1 through C-5.



LEGEND

NW-02 ■ Soil Sample and Sample ID (June 2003)

▲ Soil Sample and Sample ID (August 2003 follow-on)

Building/Structures

Former Buildings

NOTES

"August 2003 follow-on" includes step-out and additional vertical delineation samples on this figure.

SOURCES

Base Map: U.S. Navy 2001

City and County of Honolulu GIS Website

Remedial Investigation, Service Station Gulch (AECOM 2011)

N

0 80 Feet

Figure 3
Soil Sampling Locations
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

P:\ENV\Federal\WAVY\CLEAN_III\CTO 0008 (60135484)\60_Reports\SSG\No Action ROD\1_Working Draft\Figures\Native Format Files\Fig3\Fig3_SoilSampLoc.dwg 08/07/12 10:57 AM NamocL

Contributing Sources	Transport Mechanisms	Exposure Route	Receptors: Current Land Use: Trespassers and Hunters (Adult/Child)	Receptors: Current Land Use: Ecological Receptors	Receptors: Future Land Use: Residents (Adult/Child) [a]	Receptors: Future Land Use: Industrial Workers	Receptors: Future Land Use: Trespassers and Hunters (Adult/Child)	Receptors: Future Land Use: Construction Workers [a]	Receptors: Future Land Use: Ecological Receptors [b]	Rationale
Surface Soil/ Sediment	Direct Contact	Dermal Absorption	Potentially Complete	Insignificant	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Insignificant	Dermal absorption and incidental ingestion of surface soil are potentially complete pathways for current trespassers and hunters. Exposure for onsite terrestrial ecological receptors will not be assessed because of a lack of exposure parameters for this pathway. Dermal absorption and incidental ingestion pathways are potentially complete for residential users and construction workers. Conditions for ecological receptors are assumed to remain the same in the future.
		Incidental Ingestion	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Same as above for human receptors. Terrestrial ecological receptors may incidentally ingest surface soil during foraging and/or grooming activities.
	Air Transport	Inhalation of VOCs	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	The inhalation pathway for VOCs is considered incomplete for both human and ecological receptors because VOCs in surface soil volatilize to the atmosphere quickly, especially in a warm climate. No significant levels of VOCs are expected to persist.
		Inhalation of Particulates	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Potentially Complete	Insignificant	Inhalation of contaminated dust is considered insignificant for human and ecological receptors because the heavy vegetation and damp conditions limit airborne dust emissions. Future construction workers could be exposed to contaminated dust during excavation work.
	Bio-uptake	Ingestion of Plants/Animals	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Incomplete	Potentially Complete	There are no agricultural activities on site. Hunters may ingest animals that forage on site. Ecological receptors may eat the natural vegetation growing on site and feed on prey living on site.
	Surface Water Runoff	Dermal Absorption	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Exposure to dissolved contaminants in surface water is a potentially complete pathway for all receptors except the construction worker, because major construction would be discouraged in a wildlife management area.
		Incidental Ingestion	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Exposure to dissolved contaminants in surface water is a potentially complete pathway for all receptors except the construction worker, because major construction would be discouraged in a wildlife management area.
		Inhalation of VOCs	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	The inhalation pathway for VOCs is considered incomplete for both human and ecological receptors because VOCs in surface soil volatilize to the atmosphere quickly, especially in a warm climate. No significant levels of VOCs are expected to persist.
		Bioaccumulation/ Consumption of Food	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Exposure to dissolved contaminants in surface water is a potentially complete pathway for all receptors except the construction worker, because major construction would be discouraged in a wildlife management area.
Subsurface Soil	Unsaturated/ Saturated Zone Transport to Groundwater	Dermal Absorption	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Although groundwater beneath the site is potable and supplied to NCTAMS Wahiawa by a nearby drinking water well (3100-02), PWC analytical data for that downgradient drinking water well confirm contaminants are not present in groundwater (DON 1995, 2000). In addition, groundwater contamination is unlikely due to the depth (approximately 900 feet bgs), clayey soils, and tendency for contaminants to be transported via surface water runoff rather than infiltrate. As a result, residents do not have a complete exposure pathway. Trespassers and hunters are not expected to come into contact with groundwater under current land uses because groundwater does not discharge to the surface on site. The depth to groundwater is too great to allow exposure of workers during future construction activities. Ecological receptors are not expected to come into contact with groundwater on site.
		Incidental Ingestion								
		Inhalation of VOCs								
	Direct Contact	Dermal Absorption	Incomplete	Incomplete	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Incomplete	Direct contact with subsurface soil is incomplete for all current human receptors. Exposure to subsurface soil may occur when future residents or onsite workers engage in gardening or construction activities. Ecological receptors are not expected to be exposed to subsurface soil contaminants through these routes.
		Incidental Ingestion								
		Inhalations of VOCs								
		Inhalation of Particulates								

[a] Although this parcel is not considered for property transfer at this time, future residential and/or industrial land use is possible.

[b] Future conditions are assumed to be the same as current conditions for ecological receptors. No future scenarios are run.

Figure 4
Conceptual Site Model
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

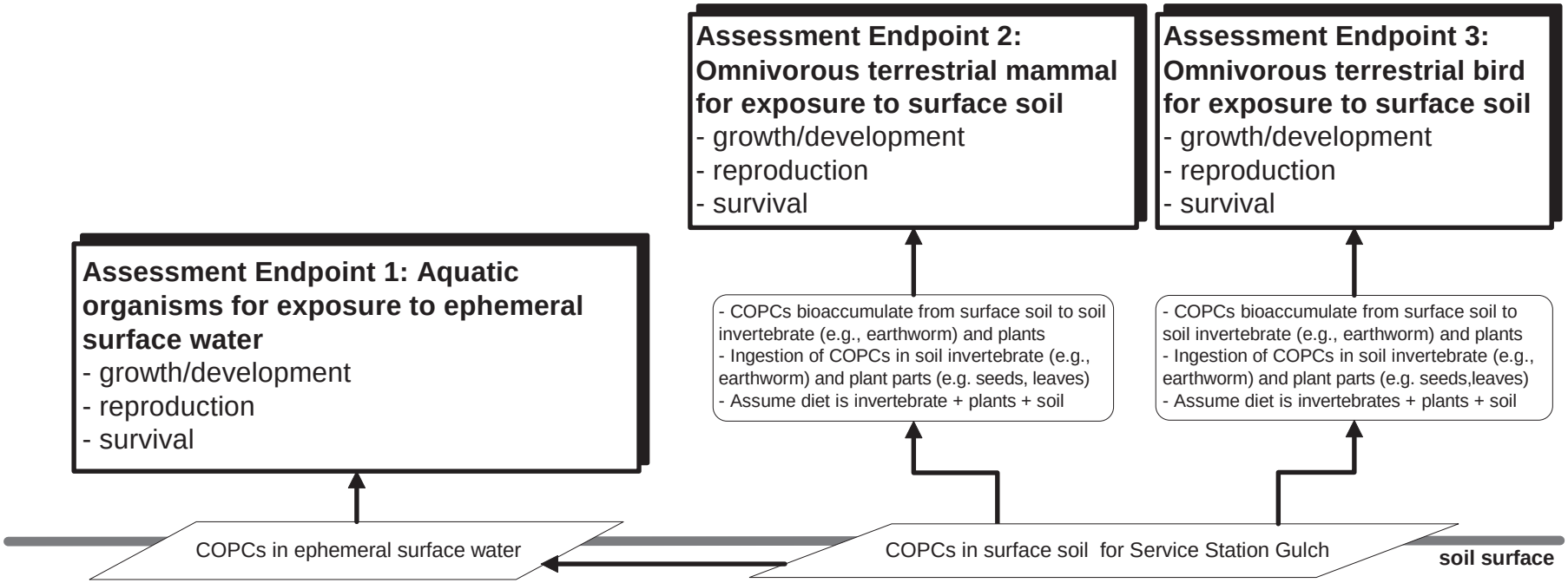


Figure 5
Conceptual Site Model Summary for Step 3a BERA
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

2.5.4.2 SURFACE WATER SAMPLING

Surface water samples collected from the intermittent stream at the bottom of the gulch during the wet season showed that none of the four surface water samples had results that exceeded screening criteria.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

2.6.1 Current Site Use

The JBPHH Wahiawa Annex operates and maintains communications facilities for the Navy in the Eastern Pacific, which is considered an industrial/commercial use facility. It is part of the Defense Communications System and of the military satellite communications system. The Service Station Gulch lies within a steep, densely vegetated ravine that is currently unused. The area in and around the site is heavily vegetated and forms a natural barrier to keep people out of the gulch. The site boundaries are shown on Figure 2.

2.6.2 Future Site Use

JBPHH Wahiawa Annex will continue to be maintained by the Navy for use as a communications facility, which is considered an industrial/commercial use facility; however, the potential for unrestricted (residential) use was also considered along with trespassers (adult/child), hunters, and onsite construction/utility workers. There are no current plans to develop the site and no land use changes are anticipated in the near future due to the following:

- Hazards from an intermittent stream that runs through the site
- Soil erosion from runoff
- Location of the site within a steep-sided, densely vegetated gulch

2.6.2.1 GROUNDWATER CLASSIFICATION AND USE

The State of Hawaii does not currently have an EPA-approved comprehensive state groundwater protection plan in place. As a result, federal, other state guidance, and site-specific factors were considered in determining the status of groundwater at the Service Station Gulch. Groundwater at the Service Station Gulch was classified in accordance with the *Classification of Shallow Caprock Groundwater at Navy Oahu Facilities, Oahu, Hawaii* (Earth Tech 2007). This classification was developed through a partnership with the EPA Region 9 and DOH to develop and agree upon a framework for groundwater classification at Navy facilities in Hawaii, and both agencies have approved the findings of the document. This framework allows site-specific factors to be considered in determining whether groundwater meets the criteria for beneficial use as a public or private drinking water source in the future as defined in the EPA Groundwater Protection Strategy (EPA 1988).

According to the *Guidelines for Ground-Water Classification Under the EPA Ground-Water Protection Strategy* (EPA 1988), groundwater is classified as Class I, II, or III as follows:

- Class I groundwater is highly vulnerable to contamination and is an irreplaceable source of drinking water for a substantial population, or is ecologically vital.
- Class II groundwater is a current or potential source of drinking water.
- Class III groundwater is not a potential source of drinking water and is of limited beneficial use.

The deep Schofield System aquifer meets the criteria for Class I groundwater. However, contamination of the deep groundwater is highly unlikely because of the 660- to 900-foot depth to groundwater, underlying clays, and steep ravines edging the property, which intercept perched groundwater (NEESA 1986). The perched groundwater is not likely to meet the criteria for classification as either Class I or Class II groundwater because of its limited extent. Under the federal guidelines, a potential source of drinking water (Class I or II) is defined as a groundwater source "capable of yielding a quantity of drinking water to a well or spring sufficient for the needs of an average family." This yield is established at 150 gallons per day or 0.104 gallon per minute sustainable throughout the year (EPA 1988). It is unlikely that the perched groundwater at the Service Station Gulch would meet these yield requirements.

2.7 SUMMARY OF SITE RISKS

In accordance with both Navy and EPA guidance (DON 1999, 2008, 2009, and EPA 1989, 1991, 1997, 2004, 2009b), a human health and ecological risk assessment was conducted to evaluate the risk associated with exposure to chemicals disposed of at the Service Station Gulch.

2.7.1 Human Health Screening Risk Assessment

This section describes the Tier I human health SRA that was performed and the associated results.

2.7.1.1 HUMAN HEALTH SCREENING RISK ASSESSMENT SUMMARY

The human health Tier I risk evaluation is presented in two parts. The first part (Tier 1A) identifies the COPCs that may pose unacceptable risk to human health and the second part (Tier 1B) quantifies those risks. The Tier IA risk-based screening (RBS) uses maximum detected concentrations to compare against relevant screening values to identify COPCs. The Tier IB site-specific risk-based evaluation (SSRBE) of the COPCs identified in the RBS are then used to quantify risks and hazards from current and anticipated future exposure at the site.

The human health RBS for the Service Station Gulch included the following steps:

- *Development of a CSM*. The CSM identified potentially complete exposure pathways for both current and future land uses (see Figure 4).
- *Identification of Relevant Data Sets.* For this risk assessment, surface and subsurface soil and surface water data were evaluated quantitatively. Analytical data for TPH were not included in the quantitative evaluation because there are no toxicity data availability for TPH.
- *Identification of COPCs.* Any detected chemical was considered a preliminary COPC. Maximum concentrations were screened against residential criteria (EPA RSLs and DOH environmental action levels) to identify COPCs for further evaluation of the site.
- *Selection of exposure point concentrations (EPCs).* Both the maximum detected concentration and the 95 percent upper confidence limit (UCL) concentration were compared to determine the EPC for each site. If the 95 percent UCL concentration exceeded the maximum detected concentration for a specific chemical data set, the maximum detected concentration was used as the EPC; otherwise, the 95 percent UCL was used as the EPC. The EPC was used in the RBS to evaluate both the central tendency exposure (CTE) and reasonable maximum exposure (RME) risks. COPC concentrations noted as "non-detect" were represented by one-half the reporting limit.
- *Comparison of COPC EPCs to Screening Criteria.* Although residents were not identified as receptors for this preliminary risk evaluation, the EPCs were compared to CTE preliminary

remediation goals (PRGs) and EPA (2009a) residential RSLs in addition to industrial RSLs for onsite workers to provide options for land use considerations. If risks and noncancer hazards for residential or industrial exposures exceeded the points of departure (i.e., 1E–06 for carcinogenic risks and cumulative hazard index [HI] of 1 for noncarcinogenic effects), the EPCs were then compared to site-specific RSLs.

For the SSRBE, COPCs were identified as those chemicals with EPCs that exceeded soil or tap water RSLs in the RBS. The site-specific COPCs identified for the Service Station Gulch site were aluminum, Aroclor 1254, Aroclor 1260, arsenic, benzo(a)pyrene, dibenz(a,h)anthracene, chromium, cobalt, and iron.

In addition to the resident and industrial worker addressed in the RBS, the SSRBE evaluates these additional potential current or future receptors: trespassers (adult/child), hunters, and onsite construction/utility workers. No definite future land uses have been planned for the Service Station Gulch site; however, it is likely that it will remain the same. Since reuse has not been defined, several receptors are also evaluated to provide risk managers with risk estimates for alternate receptor scenarios. For the trespasser scenario, RSLs were developed based on the child trespasser because this receptor is considered more protective of health than the adult trespasser.

2.7.1.2 HUMAN HEALTH SCREENING RISK ASSESSMENT RESULTS

Surface Soil. The cumulative cancer risks for exposure to EPCs in surface soil at the Service Station Gulch site associated with both RME and CTE RSLs for residential and industrial use scenarios and site-specific receptors are within or less than the target cancer risk range of 1E–06 to 1E-04 regardless of whether risks exclude the contribution of naturally occurring background metals. The HIs for the RME and CTE scenarios are less than the target non-cancer hazard of 1, with the exception of the residential receptor. However, when HIs are calculated to exclude background metals, all HIs are all less than the target non-cancer hazard of 1.

Subsurface Soil. The cumulative cancer risks for exposure to EPCs in surface soil at the Service Station Gulch site associated with both RME and CTE RSLs for residential and industrial use scenarios and site specific receptors are within or less than the target cancer risk range of 1E–06 to 1E–04, regardless of whether risks exclude the contribution of naturally occurring background metals.

HIs for the RME and CTE scenarios are less than the target non-cancer hazard of 1, with the exception of the residential receptor. However, when HIs are calculated to exclude background metals, all HIs are all less than the target non-cancer hazard of 1.

Surface Water. The cumulative cancer risks for residents, child trespassers, and hunters potentially exposed to total and dissolved chemicals in surface water exceed the 1E–06 point of departure for the RME and CTE RSL exposure scenarios, but are still within the target cancer risk range of 1E–06 to 1E–04. Cumulative cancer risks for all other receptors are less than the 1E–06 point of departure, assuming both the RME and CTE RSL exposure scenarios. HIs associated with exposure to the EPCs did not exceed 1 assuming both the RME and CTE RSL exposure scenarios.

In summary, the results of the human health risk assessment indicate cancer risk is within the risk management range of 1E–06 to 1E–04 for all receptors (Table 1). When excluding metal data within the background range, the non-cancer hazard is below a HI of 1.

Table 1: Summary of Human Health Cumulative Cancer Risks and Effects

Human Health Receptor	EPC Comparison to RME RSLs - Including Background [a]		EPC Comparison to CTE PRGs - Including Background [a]		EPC Comparison to RME RSLs - Excluding Background [a]		EPC Comparison to CTE PRGs - Excluding Background [a]	
	Cumulative Cancer Risk	HI	Cumulative Cancer Risk	HI	Cumulative Cancer Risk	HI	Cumulative Cancer Risk	HI
Surface Soil								
Resident	4.E–05	8	2.E–05	6	1.E–05	0.7	3.E–06	0.4
Industrial Worker	1.E–05	0.6	1.E–06	0.3	2.E–06	0.07	3.E–07	0.02
Child Trespasser	1.E–05	2	5.E–06	1	2.E–06	0.2	9.E–07	0.1
Hunter	9.E–07	0.04	9.E–08	0.01	2.E–07	0.005	2.E–08	0.001
Construction Worker	6.E–06	2	4.E–07	1	1.E–06	0.3	7.E–08	0.1
Subsurface Soil								
Resident	5.E–05	8	2.E–05	6	5.E–06	0.3	2.E–06	0.2
Industrial Worker	1.E–05	0.6	1.E–06	0.3	6.E–07	0.02	1.E–07	0.01
Construction Worker	6.E–06	3	4.E–07	1	1.E–07	0.0 [a]	1.E–08	0.0 [b]
Surface Water								
Resident (total metals)	2.E–05	0.1	5.E–06	0.1	N/A	N/A	N/A	N/A
Resident (dissolved metals)	5.E–06	0.05	2.E–06	0.05	N/A	N/A	N/A	N/A
Child Trespasser (total metals)	4.E–09	1.E–04	8.E–10	2.E–05	N/A	N/A	N/A	N/A
Child Trespasser (dissolved metals)	1.E–09	3.E–05	3.E–10	7.E–06	N/A	N/A	N/A	N/A
Hunter (total metals)	2.E–09	1.E–05	2.E–10	3.E–06	N/A	N/A	N/A	N/A
Hunter (dissolved metals)	6.E–10	4.E–06	5.E–11	8.E–07	N/A	N/A	N/A	N/A

N/A not applicable

[a] Background levels from *Environmental Background Analysis of Metals in Soil at Navy Oahu Facilities, Oahu, Hawaii* (Earth Tech 2006).

[b] Only inorganic chemicals contribute to the non-carcinogenic hazard (or HI) in the subsurface soil for a construction worker. All inorganic chemicals were below background concentrations.

2.7.2 Baseline Ecological Risk Assessment

This section describes the BERA that was performed and the associated results.

A hazard quotient (HQ) methodology is used to estimate ecological SRA risk. An HQ is a ratio of a modeled or measured EPC for a COPC to an effect threshold for the COPC that is an acceptable environmental concentration. An ecological SRA HQ ≥1 indicates exceedance of an ecological SRA risk threshold and unacceptable ecological SRA risk. HQs for the ecological SRA are calculated for all assessment endpoints for maximum HQs for the incremental sampling methodology and discrete samples of surface soil to make final ecological SRA decisions for COPCs at the site.

Ecological SRA decisions for the Service Station Gulch are based on information for whether maximum detect or non-detect HQs are <1 for all assessment endpoints (i.e., acceptably low risk and a determination of no action for a COPC), maximum detect or non-detect HQs are ≥1 (i.e., unacceptable risk) for one or more assessment endpoint (i.e., plant, soil invertebrate, mouse, or cardinal), or whether data gaps (i.e., missing information) prevent calculation of HQs.

Ecological SRA decisions for COPCs for the Service Station Gulch are documented in Section 6.2 of the RI Report (AECOM 2011).

A COPC may be carried forward from the Tier 1 ecological SRA for additional evaluation in a Tier 2 BERA or be subject to a risk management decision because they exceed a screening risk threshold (i.e., ecological SRA HQ ≥1) or no decision regarding ecological SRA risk can be determined due to a data gap.

As a result of the range of chemicals that either exceeded SRA risk thresholds or were unable to be evaluated for SRA risk, all COPCs were carried forward and reevaluated in a Step 3a BERA. The BERA incorporated updates and adjustments for the water and soil bioaccumulation risk estimates to generate more realistic exposure values.

Based on a meeting held in March 2011 between the Navy, EPA, and DOH, a refined BERA was completed and is presented in the RI report (AECOM 2011). Results of the refined BERA indicate RME no-observed-adverse-effect level-based HQ >1 for metals (chromium and selenium) and Bis (2-ethylhexyl) phthalate (for mammals) in soil and aluminum in surface water. However, no chemicals in either media have lowest-observed-adverse-effect level-based HQ (L-HQ) >1.

2.7.3 Risk Assessment Conclusion

While the concentration of some chemicals (i.e., metals, PAHs, and PCBs) exceed EPA residential RSLs at one or more sampling locations, the RME concentrations produce a site risk that is within the risk range of 1E-4 to 1E-6. Therefore, it is highly unlikely that any receptors would be exposed to these chemicals in the amount or duration required to produce adverse health effects.

Because the Service Station Gulch habitat does not support any special status species, and no chemicals were detected in surface soil at concentrations exceeding a wildlife L-HQ of 1, no action is required to protect wildlife. Although the HQ is greater than 1 for aluminum in surface water, no action is recommended because aluminum appears to be associated with background conditions.

Based on the results of the RI human health risk assessment, the absence of critical aquatic or terrestrial wildlife receptors, the current site conditions, and potential future uses, no action is recommended for this site.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The PP recommended No Action as the final selected remedy for the Service Station Gulch. The PP was released for public comment on 21 May 2012, and a public meeting to present and discuss the PP was held on 24 May 2012. The public comment period for the PP was held between 21 May 2012 and 20 June 2012. None of the comments affect the preference for the selected final remedy. Therefore, no significant changes to the final remedy, as originally identified in the PP, were necessary or appropriate.

3. Responsiveness Summary

A public notice of availability for review of the PP was published in the *Honolulu Star-Advertiser* on 21 May 2012. The public comment period for the PP was held between 21 May 2012 and 20 June 2012. The public meeting for the PP was held on 24 May 2012 at the Oahu Veterans Center. The Responsiveness Summary provides a summary of the public comments received during the public meeting.

Members of the community present at the public meeting expressed verbal comments on the PP. Responses to the written and verbal comments received during the comment period and public meeting are presented as a Responsiveness Summary in Attachment A within this ROD. The complete transcript of the public meeting is available in the Administrative Record file.

3.1 STAKEHOLDER ISSUES AND LEAD AGENCY RESPONSES

The transcript of the public meeting conducted on 24 May 2012 was thoroughly reviewed by the Navy in preparation of the Responsiveness Summary. The comments and questions from the public have been condensed to provide a better understanding of each specific issue. The Navy and EPA, with concurrence from the DOH, have selected the final remedy for the Service Station Gulch only after careful consideration of the public's comments on the PP.

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues associated with the recommendation of No Action for the Service Station Gulch have been identified.

4. References

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Attachment A
Responsiveness Summary

Table A-1: Responses to Public Comments

Comment No.	Question/Comment
Questions and Comments Received During the Proposed Plan Meeting	
1	MR. DAU (General Public) wanted to know the location of the site and whether it was near Helemano or Wheeler or part of Schofield.
MR. KAITO (US Navy, NAVFAC Hawaii) indicated that Helemano is on the north side of the site. MS. FUKUMOTO (US Navy, NAVFAC Hawaii) indicated the site is within JBPHH Annex, previously called NCTAMS PAC. It is where the Navy has the large antennas.	
2	MR. MOBLEY (General Public) asked is this the Navy communications area.
MR. KAITO (US Navy, NAVFAC Hawaii) confirmed that it is part of the Naval communications area.	
3	MR. MOBLEY (general public) asked to go back to Slide 12 of the SSG presentation. On this slide, it indicates that chromium and selenium are above the ambience. Mr. Mobley defined ambiance as what is expected to be at the site. He then asked why are chromium and selenium values higher than what was anticipated (even higher than background values) and are they within DOH criteria.
MR. KAITO (US Navy, NAVFAC Hawaii) indicated that yes the values for chromium and selenium values are higher than expected. He also indicated that chromium and selenium and other chemical constituents were included in the Navy's risk assessment evaluation.	
4	MR. MOBLEY (general public) responded to Mr. Kaito and requested to have this information included in the report.
MR. MOW (Hawaii Department of Health, HEER) responded to Mr. Mobley and indicated that the first step is to understand the screening levels. He further explained, the first pass at when this type of investigation is conducted is to evaluate whether the detected values pass the screening levels or not. If results do exceed the screening criteria, often you have to go beyond that screening evaluation level to what is called a Tier 2. A Tier 2 is a site-specific level, as opposed to a Tier 3. But it takes those concentrations that exceed screening criteria into account. The concentrations that exceed are called contaminants of potential concern. When the contaminants of potential concern are evaluated through a risk assessment, the values are shown as 1×10^{-4} to 1×10^{-6}. However, even though the values exceeded the screening levels, that does not necessarily mean that they possess a risk. That is why for the chromium and selenium exceedances, they did a risk assessment. The evaluation moved from tier level to the risk assessment level.	
5	MR. ESTORES: (general public) asked when the term "No Further Action" is used, does that mean the Navy will not clean up the contaminant.
MS. FUKUMOTO (US Navy, NAVFAC Hawaii) Indicated for the sites discussed, the Navy is addressing the soil contamination. For the sites that we're speaking about tonight, we've been through the evaluation process to determine whether a risk from the contamination exists that may have been released to the environment. Once we've determined the risk and that the risk is within the risk range and acceptable, like the sites that we have discussed tonight, then, yes, the Navy does not clean them up further. That is where the "No Further Action" terminology comes in place. However, if it is determined that the risk is not acceptable, then the Navy would take action and possibly move it.	
6	MR. ESTORES (general public) confirmed that he understood. Then asked when the effects on the water are evaluated, whatever flow it has. When the testing was conducted, was it after a heavy rain, during a heavy rain, or when there was no rain?
MR. KAITO (US Navy, NAVFAC Hawaii) indicated that soil samples were collected before a heavy rain, and the surface water samples were collected after a heavy rain.	
7	MR. ESTORES (general public) asked whether there is any testing on the effects on the aquifer.
MS. FUKUMOTO (US Navy, NAVFAC Hawaii) indicated that the Navy conducts a tiered evaluation approach. Usually for Navy sites, we initially investigate sites where we suspect there is a release. In the case of the SSG site discussed tonight, we collected soil samples at the gulch and within the intermittent stream area. The sampling results were evaluated through the risk assessment process and were determined acceptable, thus no action was necessary. If sampling results had indicated that levels were higher than screening criteria it was considered acceptable, then the Navy would have taken additional action. An evaluation is then conducted to determine whether or not the release has impacted the groundwater or how deep the release has gone in the soil.	

Attachment B
Detailed Reference Table

Table B-1: Detailed Reference Table

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
1	Federal Facility Agreement	Section 1.1 Page 1-1	Environmental Protection Agency Region 9, State of Hawaii, and United States Department of the Navy (EPA Region 9, State of Hawaii, and DON). 2009. *Final Federal Facilities Agreement, NCTAMS PAC, Oahu, Hawaii*. October, Section IV, page 7.
2	No Action	Section 1.3 Page 1-1	AECOM Technical Services, Inc. (AECOM). 2011. *Final Remedial Investigation, Service Station Gulch, Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. October.
3	RI	Section 2.2.2 Page 2-2	AECOM Technical Services, Inc. (AECOM). 2011. *Final Remedial Investigation, Service Station Gulch, Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. October.
4	Proposed Plan (PP)	Section 2.2.2 Page 2-3	Department of the Navy (DON). 2012. *Proposed Plan, Service Station Gulch, Joint Base Pearl Harbor-Hickam Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. May.
5	Restoration Advisory Board (RAB)	Section 2.3 Page 2-3	Environmental Protection Agency Region 9, State of Hawaii, and United States Department of the Navy (EPA Region 9, State of Hawaii, and DON). 2009. *Final Federal Facilities Agreement, NCTAMS PAC, Oahu, Hawaii*. October, Section XXXIV, page 57.
6	conceptual site model (CSM)	Section 2.5.2 Page 2-7	AECOM Technical Services, Inc. (AECOM). 2011. *Final Remedial Investigation, Service Station Gulch, Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. October.
7	SRA	Section 2.7.1 Page 2-16	AECOM Technical Services, Inc. (AECOM). 2011. *Final Remedial Investigation, Service Station Gulch, Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. October.
8	BERA	Section 2.7.2 Page 2-18	AECOM Technical Services, Inc. (AECOM). 2011. *Final Remedial Investigation, Service Station Gulch, Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii.* JBPHH, HI: Naval Facilities Engineering Command, Pacific. October.

Attachment C
Analyte Concentrations and Distributions

NW-31	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	90	J	ug/kg
Aroclor 1260	20	UJ	ug/kg

NW-32	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	46	J	ug/kg
Aroclor 1260	20	UJ	ug/kg

NW-30	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	91		ug/kg
Aroclor 1260	20	U	ug/kg

NW-01	S01-D0.5		D02-D0.5		
Chemical	Result	Qual	Result	Qual	Units
Aroclor 1254	210	J	220	J	ug/kg
Aroclor 1260	130	J	120	J	ug/kg

NW-33	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	110		ug/kg
Aroclor 1260	20	U	ug/kg

NW-29	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	57	J	ug/kg
Aroclor 1260	20	UJ	ug/kg

NW-02	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	20	UJ	ug/kg
Aroclor 1260	33	J	ug/kg

NW-38	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	510		ug/kg
Aroclor 1260	200	U	ug/kg

NW-08	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aroclor 1254	1400	J	20	UJ	ug/kg
Aroclor 1260	420	J	20	UJ	ug/kg

NW-34	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	260		ug/kg
Aroclor 1260	200	U	ug/kg

NW-12	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	220	J	ug/kg
Aroclor 1260	80	J	ug/kg

NW-04	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	340	J	ug/kg
Aroclor 1260	620	J	ug/kg

NW-10	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	150	J	ug/kg
Aroclor 1260	96	J	ug/kg

NW-39	S01-D0.5		D02-D0.5		
Chemical	Result	Qual	Result	Qual	Units
Aroclor 1254	720		560		ug/kg
Aroclor 1260	200	U	200	U	ug/kg

NW-35	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	380		ug/kg
Aroclor 1260	200	U	ug/kg

NW-27	S03-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	18	J	ug/kg
Aroclor 1260	20	UJ	ug/kg

NW-36	S01-D0.5		D02-D0.5		
Chemical	Result	Qual	Result	Qual	Units
Aroclor 1254	18	J	28		ug/kg
Aroclor 1260	20	U	20	U	ug/kg

NW-06	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	410	J	ug/kg
Aroclor 1260	220	J	ug/kg

NW-28	S03-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	76	J	ug/kg
Aroclor 1260	200	U	ug/kg

NW-37	S01-D0.5		
Chemical	Result	Qual	Units
Aroclor 1254	63		ug/kg
Aroclor 1260	20	U	ug/kg

473
340
321
Anzio Dr
63
22
88
198
329
379
363
Center Street
Leyete Street

LEGEND

- Soil Sample (June 2003)
- Soil Sample (August 2003 follow-on)
- 720 Result exceeded EPA 2009 RSL
- 1400 Result exceeded TSCA High - Occupancy Criteria and EPA RSL
- Building/Structures
- Former Buildings

NOTES

J = Estimated quantity
U = Nondetect
ug/kg = microgram per kilogram
UJ = Estimated Nondetect
RSL = Regional Screening Level
TSCA = Toxic Substances Control Act

Aroclor 1254 residential RSL = 220 ug/kg
Aroclor 1260 residential RSL = 220 ug/kg
Aroclor 1254 TSCA = 1000 ug/kg
Aroclor 1260 TSCA = 1000 ug/kg

D0.5 = surface soil sample (0.5' bgs)
D2.0 = subsurface soil sample (2.0' bgs)

"August 2003 follow-on" includes step-out and additional vertical delineation samples on this figure.

SOURCE

Base Map: U.S. Navy 2001

City and County of Honolulu
GIS Website

N

0 80 Feet

Figure C-1
PCB Exceedances and Follow-on Soil Samples
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

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NW-21	S01-D0.5		S02-D2.0		D03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	5	U	ug/kg
Benzo(b)fluoranthene	7		5	U	5	U	ug/kg

NW-24	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	ug/kg
Benzo(b)fluoranthene	4	J	5	U	ug/kg

NW-47	S01-D0.5		
Chemical	Result	Qual	Units
Benzo(a)pyrene	4	J	ug/kg
Benzo(b)fluoranthene	13	J	ug/kg

NW-23	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	6		5	U	ug/kg
Benzo(b)fluoranthene	14		5	U	ug/kg

NW-44	S01-D0.5		
Chemical	Result	Qual	Units
Benzo(a)pyrene	30	J	ug/kg
Benzo(b)fluoranthene	78	J	ug/kg

NW-25	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	83		5	U	ug/kg
Benzo(b)fluoranthene	290		5	U	ug/kg

NW-19	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	ug/kg
Benzo(b)fluoranthene	5	U	5	U	ug/kg

NW-45	S01-D0.5		
Chemical	Result	Qual	Units
Benzo(a)pyrene	5	J	ug/kg
Benzo(b)fluoranthene	9		ug/kg

NW-18	S01-D0.5		S02-D2.0		D03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	4	J	5	U	5	U	ug/kg
Benzo(b)fluoranthene	5	J	5	U	5	U	ug/kg

NW-46	S01-D0.5		
Chemical	Result	Qual	Units
Benzo(a)pyrene	10		ug/kg
Benzo(b)fluoranthene	33		ug/kg

NW-20	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	ug/kg
Benzo(b)fluoranthene	5	U	5	U	ug/kg

NW-26	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	21		5	U	ug/kg
Benzo(b)fluoranthene	51		5	U	ug/kg

NW-17	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	10		20		ug/kg
Benzo(b)fluoranthene	25		53		ug/kg

NW-16	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	8		5	U	ug/kg
Benzo(b)fluoranthene	16		5	U	ug/kg

NW-13	S01-D0.5		S02-D0.5		S03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	23		18	J	5	U	ug/kg
Benzo(b)fluoranthene	83		64	J	5	U	ug/kg

NW-22	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	ug/kg
Benzo(b)fluoranthene	10		5	U	ug/kg

NW-14	S01-D0.5		D02-D1.5		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	37		ug/kg
Benzo(b)fluoranthene	410		45		ug/kg

NW-27	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	5	U	5	U	ug/kg
Benzo(b)fluoranthene	6		5	U	ug/kg

NW-15	S01-D0.5		D02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Benzo(a)pyrene	23		10		ug/kg
Benzo(b)fluoranthene	92		18		ug/kg

NW-28	S01-D0.5		
Chemical	Result	Qual	Units
Benzo(a)pyrene	11	U	ug/kg
Benzo(b)fluoranthene	41		ug/kg

473
S130
Anzio Dr
63
363
379
Street

LEGEND

- Soil Sample (June 2003)
- Soil Sample (August 2003 follow-on)
- 290 Result exceeded EPA 2009 RSL
- Building/Structures
- Former Buildings

NOTES

J = Estimated quantity
U = Nondetect
ug/kg = microgram per kilogram
RSL = Regional Screening Level

Benzo(a)pyrene residential RSL = 15 ug/kg
Benzo(b)fluoranthene residential RSL = 150 ug/kg

D0.5 = surface soil sample (0.5' bgs)
D2.0 = subsurface soil sample (2.0' bgs)

"August 2003 follow-on" includes step-out samples in this figure.

PAH detections in lower gulch (NW-01 thru NW-12) did not exceed EPA 2009 RSLs and are therefore not shown in a figure. Results are presented in Appendix B.

SOURCE

Base Map: U.S. Navy 2001

City and County of Honolulu
GIS Website

N

0 80 Feet

Figure C-2
Upper Gulch PAH
Exceedances and Follow-on Soil Samples
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

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NW-23	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	65500	J	69500		mg/kg
Arsenic	14	J	18.5	J	mg/kg
Chromium	415		462		mg/kg
Cobalt	19.5	J	22.1	J	mg/kg
Iron	201000		197000		mg/kg
Lead	23.9		17.9		mg/kg

NW-25	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	72700	J	92900		mg/kg
Arsenic	10.9	J	11.8	J	mg/kg
Chromium	437		519		mg/kg
Cobalt	21.3	J	20.2	J	mg/kg
Iron	200000		165000	J	mg/kg
Lead	28.9		11		mg/kg

NW-26	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	81700	J	124000		mg/kg
Arsenic	13.8	J	6.3	UJ	mg/kg
Chromium	435		302		mg/kg
Cobalt	23.8	J	33.1	J	mg/kg
Iron	171000		120000		mg/kg
Lead	780		13.5		mg/kg

NW-14	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	31400	J	55000	J	mg/kg
Arsenic	8.1	J	16.5	J	mg/kg
Chromium	191		444		mg/kg
Cobalt	38.9	J	15.7		mg/kg
Iron	89300		212000	J	mg/kg
Lead	15.3		28.8	J	mg/kg

NW-43	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	62000		mg/kg
Arsenic	17.3	J	mg/kg
Chromium	354		mg/kg
Cobalt	14.1	J	mg/kg
Iron	175000	J	mg/kg
Lead	24.9	J	mg/kg

NW-40	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	54400		mg/kg
Arsenic	13.5	J	mg/kg
Chromium	374		mg/kg
Cobalt	15.1	J	mg/kg
Iron	152000	J	mg/kg
Lead	215	J	mg/kg

NW-42	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	62900		mg/kg
Arsenic	11.3	UJ	mg/kg
Chromium	313		mg/kg
Cobalt	17.1	J	mg/kg
Iron	134000	J	mg/kg
Lead	307	J	mg/kg

NW-21	S01-D0.5		S02-D2.0		D03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Aluminum	88000	J	95600		95200		mg/kg
Arsenic	5.5	J	14.8	J	5.2	UJ	mg/kg
Chromium	573		484		288		mg/kg
Cobalt	157	J	26.8	J	32.3	J	mg/kg
Iron	126000		160000		106000		mg/kg
Lead	28.6		15.7		5.2		mg/kg

NW-41	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	71000		mg/kg
Arsenic	16.2	J	mg/kg
Chromium	406		mg/kg
Cobalt	19.2	J	mg/kg
Iron	185000	J	mg/kg
Lead	71.8	J	mg/kg

NW-18	S01-D0.5		S02-D2.0		D03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Aluminum	62800	J	114000	J	115000	J	mg/kg
Arsenic	9.0	J	3.2	J	7.2	J	mg/kg
Chromium	349		388		545		mg/kg
Cobalt	25.1	J	25.7	J	38.2	J	mg/kg
Iron	115000		125000		161000		mg/kg
Lead	22.6		9.6		24.3		mg/kg

NW-27	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	113000	J	106000		mg/kg
Arsenic	2.1	J	8.6	UJ	mg/kg
Chromium	983		903		mg/kg
Cobalt	18	J	15	J	mg/kg
Iron	139000		151000		mg/kg
Lead	15.4		2.5		mg/kg

NW-19	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	67700	J	114000		mg/kg
Arsenic	3.4	UJ	4.7	J	mg/kg
Chromium	415		623		mg/kg
Cobalt	25.6	J	148	J	mg/kg
Iron	95300		152000	J	mg/kg
Lead	21.1		6.8	J	mg/kg

NW-28	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	61700	J	mg/kg
Arsenic	14.6	J	mg/kg
Chromium	417		mg/kg
Cobalt	21.1	J	mg/kg
Iron	199000		mg/kg
Lead	251		mg/kg

NW-17	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	63800	J	85300	J	mg/kg
Arsenic	20.2	J	5.5	J	mg/kg
Chromium	367		417		mg/kg
Cobalt	18.2	J	26.1	J	mg/kg
Iron	192000		124000		mg/kg
Lead	58.4		14		mg/kg

NW-13	S01-D0.5		S02-D0.5		S03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Aluminum	52800	J	46600	J	47600	J	mg/kg
Arsenic	12.6	J	14.1	J	3.2	UJ	mg/kg
Chromium	343		356		435		mg/kg
Cobalt	21.8	J	19.5	J	24.4		mg/kg
Iron	185000		178000		120000	J	mg/kg
Lead	30.8		29		8.5	J	mg/kg

NW-16	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	49500	J	123000	J	mg/kg
Arsenic	19	J	16.8	J	mg/kg
Chromium	290		587		mg/kg
Cobalt	15.1	J	27.1	J	mg/kg
Iron	159000		210000		mg/kg
Lead	64.2		30		mg/kg

NW-20	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	84100	J	135000	J	mg/kg
Arsenic	7.6	J	1.2	UJ	mg/kg
Chromium	403		322		mg/kg
Cobalt	23.7	J	29.6	J	mg/kg
Iron	140000		121000		mg/kg
Lead	59.4		4.4		mg/kg

NW-22	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	70300	J	113000	J	mg/kg
Arsenic	11.1	J	7.0	J	mg/kg
Chromium	332		344		mg/kg
Cobalt	18.3	J	18.2	J	mg/kg
Iron	137000		120000		mg/kg
Lead	39.2		4.2		mg/kg

NW-15	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	18000	J	74200	J	mg/kg
Arsenic	9.6	J	21.6	J	mg/kg
Chromium	108		354		mg/kg
Cobalt	20.2	J	12.9	J	mg/kg
Iron	62600		187000	J	mg/kg
Lead	66.1		128	J	mg/kg

NW-24	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	79300	J	120000		mg/kg
Arsenic	14.5	J	7.1	UJ	mg/kg
Chromium	415		480		mg/kg
Cobalt	19.1	J	23.9	J	mg/kg
Iron	186000		114000		mg/kg
Lead	20.4		6.0		mg/kg

473
340
321
22
88
198
379
Anzio Dr
Leyete St

LEGEND

- Soil Sample (June 2003)
- Soil Sample (August 2003 follow-on)
- 16.8 Result exceeded EPA RSL (2009) and 95th Percentile Background Concentration
- Building/Structures
- Former Buildings

NOTES

Screening Criteria
RSL = Regional Screening Level (for residential soil)
BG = 95th Percentile Background Concentration
Units = milligrams per kilogram (mg/kg)

Aluminum	RSL = 77,000	BG = 93,900
Arsenic	RSL = 0.39	BG = 15
Chromium	RSL = 280	BG = 483
Cobalt	RSL = 23	BG = 105
Iron	RSL = 55,000	BG = 177,000
Lead	RSL = 400	BG = 100

J = Estimated quantity
UJ = Estimated non-detect
D0.5 = surface soil sample (0.5' bgs)
D2.0 = subsurface soil sample (2.0' bgs)

SOURCE

Base Map: U.S. Navy 2001
City and County of Honolulu GIS Website

N

0 80 Feet

Figure C-3
Upper Gulch
Metal Exceedances and Follow-on Soil Samples
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

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NW-01	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	53200		72400		mg/kg
Chromium	329		446		mg/kg
Iron	123000		169000		mg/kg

NW-02	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	71400		mg/kg
Chromium	544		mg/kg
Iron	199000		mg/kg

NW-03	S01-D0.5		D02-D2.0		S03-D2.0		
Chemical	Result	Qual	Result	Qual	Result	Qual	Units
Aluminum	44700		45800		156000		mg/kg
Chromium	414		453		465		mg/kg
Iron	170000		155000		181000		mg/kg

NW-04	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	74200		91000	J	mg/kg
Chromium	504		510		mg/kg
Iron	175000		162000	J	mg/kg

NW-05	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	71300		mg/kg
Chromium	553		mg/kg
Iron	177000		mg/kg

NW-06	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	64000	J	mg/kg
Chromium	488		mg/kg
Iron	164000		mg/kg

NW-07	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	55500	J	108000	J	mg/kg
Chromium	498		484		mg/kg
Iron	158000		189000	J	mg/kg

NW-08	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	75300	J	mg/kg
Chromium	526		mg/kg
Iron	174000		mg/kg

NW-09	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	57300	J	115000		mg/kg
Chromium	503		578		mg/kg
Iron	198000		164000	J	mg/kg

NW-10	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	83700		mg/kg
Chromium	587		mg/kg
Iron	215000		mg/kg

NW-11	S01-D0.5		S02-D2.0		
Chemical	Result	Qual	Result	Qual	Units
Aluminum	76600	J	123000	J	mg/kg
Chromium	480		470		mg/kg
Iron	164000		148000	J	mg/kg

NW-12	S01-D0.5		
Chemical	Result	Qual	Units
Aluminum	81800	J	mg/kg
Chromium	591		mg/kg
Iron	194000		mg/kg

473
S130
340
321
Anzio Dr
63
22
88
198
329
Center Street
Leyete S
379

LEGEND

- Soil Sample (June 2003)
- 591 Result exceeded EPA RSL (2009) and 95th Percentile Background Concentration
- Building/Structures
- Former Buildings

NOTES

Screening Criteria
RSL = Regional Screening Level
(for residential soil)
BG = 95th Percentile Background Concentration
Units = milligrams per kilogram (mg/kg)

Aluminum	RSL = 77,000	BG = 93,900
Chromium	RSL = 280	BG = 483
Iron	RSL = 55,000	BG = 177,000

J = Estimated quantity
UJ = Estimated non-detect
D0.5 = surface soil sample (0.5' bgs)
D2.0 = subsurface soil sample (2.0' bgs)

SOURCE

Base Map: U.S. Navy 2001
City and County of Honolulu GIS Website

N

0 80 Feet

Figure C-4
Lower Gulch
Metal Exceedances in Soil Samples
Record of Decision
Service Station Gulch
NCTAMS PAC NPL Site
JBPHH Wahiawa Annex, Oahu, Hawaii

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