US Army Corps of Engineers

Defense Environmental Restoration Program
For
Formerly Used Defense Sites

PRELIMINARY ASSESSMENT

Makalapa Crater Navy Salvage Yard

Halawa, District of Ewa, Island of Oahu, HI

FUDS Property Number – H09HI0484

Final – 30 June 2016

Prepared by
U.S. Army Corps of Engineers, St. Louis District
for the
U.S. Army Corps of Engineers, Honolulu District

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) administers the Defense Environmental Restoration Program (DERP) Formerly Used Defense Site (FUDS) program. The St. Louis District of the Corps of Engineers prepared this Preliminary Assessment (PA) for **Property No. H09HI0484, Makalapa Crater Navy Salvage Yard**, in support of DERP-FUDS. St. Louis District completed this effort in coordination with the USACE Honolulu District and the U.S. Army Engineering and Support Center, Huntsville (USAESCH), Environmental & Munitions Center of Expertise (EM-CX).

This PA compiles information obtained through historical research at various archives and records holding facilities. The investigation was primarily a textual, cartographic and photographic research and analysis effort. It also makes use of property visits and interviews to gather information concerning the property. The research team directed efforts towards determining the presence of hazardous substances as a result of previous use, storage, and/or disposal. The research procedures placed emphasis on establishing the types, quantities and areas of Hazardous, Toxic and Radioactive Waste (HTRW), munitions and explosives of concern (MEC), and chemical warfare (CW) activities. This process obtains information for use in developing recommendations for further action at the former Makalapa Crater Navy Salvage Yard.

The Makalapa Crater Navy Salvage Yard FUDS consists of 19.2705 acres near Halawa, District of Ewa, Island of Oahu, Hawaii, located in Island of Oahu County. The Navy acquired the majority of the site (18.577 acres) in 1939 as part of the Makalapa Crater expansion of the Pearl Harbor Navy Yard. The Navy used the crater for dredge spoil disposal and placed housing and administrative facilities on the west side of the crater. The east side of the crater remained undeveloped except for open storage until after the beginning of WWII, when the Navy established a scrap material salvage yard on the northeast side of the crater by January 1943. The Navy also established an open burn area to the south of the salvage yard and began filling the eastern perimeter of the crater with non-burnable refuse, practices that would continue until April 1946.

Following the end of salvage and dump operations at Makalapa Crater, the Navy leased and eventually deeded lands to the City and County of Honolulu for the athletic fields for Radford High School (15 acres) beginning in August 1956 and the Makalapa Elementary School (3.577 acres) beginning in August 1971. The remaining FUDS portion (0.6935 acres) appears to have remained undeveloped by the military and was transferred in 1985 to Radford High School.

In January 2014, improvements to the track at Radford High School (RHS) resulted in the discovery of contaminants related to the fill, including munitions related scrap identified as material potentially presenting an explosive hazard (MPPEH). On 25 August 2014, the Navy began a Time-Critical Removal Action (TCRA) to address contaminated soil and debris encountered in the subsurface.

Analysis of the information gathered during this PA investigation identified HTRW related to the Navy's operations of a material scrap salvage yard, open burning trash disposal area and solid waste land fill on 18.577 acres from approximately 1943 to 1946. Analytical data from soil sampling conducted in February 2014 in and around the RHS field indicated that the soils contained arsenic, barium, cadmium, lead, mercury, benzo(a)pyrene, polychlorinated biphenyls (PCBs), and dioxins/furans at concentrations exceeding Department of Health Tier 1 Environmental Action Levels (EALs).

There is clear potential for additional munition debris scrap to be found in this fill, which inadvertently included MEC on occasion. Excavation at the athletic fields at Radford High School in 2013 and 2014 recovered over 800 pieces of munition related items / MPPEH including cartridges, cartridge cases, fuzes, igniter/flash tubes, practice bombs, practice grenades, small arms projectiles, and packaging. The items found were determined to be primarily expended, empty or inert. All of the recovered items found during the TCRA field efforts had *"no explosive hazard"*, including two items turned over to Navy EOD for confirmation. Additionally, there is negligible, MC potential from the subject FUDS being within the range fan of the former Makalapa Crater Pistol Range (target berm and firing lines under the current Interstate Highway H-1).

Any potential MEC from munition scrap and potential MC would be comingled with the fill material located on site. To date, there is very limited evidence available to support potential for MEC at the two munitions related AOIs reviewed during this PA When complete, the TCRA would meet the intent and purpose of a CERCLA Site Inspection (SI). Further consideration and action on the HTRW project will originate from the Honolulu District and could include the next step in the CERCLA process, a Remedial Investigation/Feasibility Study (RI/FS) to delineate the nature and extent of HTRW contaminate potential.

ACKNOWLEDGEMENTS

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1 INTRODUCTION

1.1 AUTHORITY

Under the authority of the Defense Environmental Restoration Program (DERP) [10 USC §§ 2701 et seq.], and its policies and procedures relating to Formerly Used Defense Sites (DERP-FUDS), including Department of Defense (DoD) Management Guidance for the DERP dated 9 March 2012, and Engineering Regulation 200-3-1, Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy, the U.S. Army Corps of Engineers (USACE) St. Louis District investigated the Makalapa Crater Navy Salvage Yard on the Island of Oahu, HI. Completion of this investigation on the former military property supports several Federal laws and rules, DoD Directives and Standards, and Army Regulations as outlined in the subsequent sub-paragraphs.

1.1.1 Laws

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as Superfund, to respond to threats posed by historic releases of hazardous substances into the environment. CERCLA was amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA), which established the process for undertaking remedial actions at inactive waste sites containing hazardous substances, as well as reporting requirements for releases of hazardous substances. SARA expanded the provisions of CERCLA and added major new authorities. These amendments included the addition of Section 120, Federal Facilities and Section 121, Cleanup Standards. Section 120 requires departments and agencies of the federal government to comply with the provisions of CERCLA as amended by SARA. Section 121 establishes the procedures for the selection of remedial actions and the determination of the degree of remediation.

In 1986, Congress established the DERP at 10 USC §§ 2701 et seq. This program directed the Secretary of Defense to carry out a program of environmental restoration at "Each facility or site which was under the jurisdiction of the Secretary and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances." Executive Order 12580 (EO 12580, 23 January 1987), Superfund Implementation, delegated the DoD to be the lead agency and response authority for releases or threatened releases of hazardous substances, pollutants and contaminants from any facility or vessel under the jurisdiction, custody, or control of DoD, subject to Sections 120 and 121 of SARA. In March 1990, the U.S. Environmental Protection Agency (USEPA) issued a revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Under 40 Code of Federal Regulations (CFR) §300.120, DoD is identified as the lead agency and response authority for incidents involving DoD military weapons and munitions under the jurisdiction, custody and control of DoD.

1.1.2 Regulations and Guidance

Since the beginning of DERP, the U.S. Army Corps of Engineers has acted as the agency responsible for environmental restoration at FUDS. The U.S. Army Corps of Engineers, St. Louis District, began conducting historical research and analysis for environmental site characterization in 1992. This research and analysis was originally captured in Archive Search Reports (ASRs) at FUDS, active DoD installations, and installation transitions under Base Realignment and Closure (BRAC) recommendations. Engineering Regulation 200-3-1, Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy dated 10 May 2004, dictates requirements of the CERCLA process as outlined in the NCP. As such, previous historical records research and analysis reports are incorporated into Preliminary Assessments (PA), which now include pathway and environmental hazard assessment.[1] The U.S. Army Corps of Engineers, St. Louis District, prepared this PA pursuant to ER 200-3-1 using USACE Formerly Used Defense Sites (FUDS) Program Guidance for Performing Preliminary Assessments under FUDS, September 2005 as a guide.[2]

1.2 SUBJECT

The **Makalapa Crater Navy Salvage Yard** FUDS consists of 19.2705 acres near Halawa, District of Ewa, Island of Oahu, HI, located in Island of Oahu County. The Navy acquired the majority of the site (18.577 acres) in 1939 as part of the Makalapa Crater expansion of the Pearl Harbor Navy Yard. The Navy used the crater for dredge spoil disposal and placed housing and administrative facilities on the west side of the crater. The east side of the crater remained undeveloped except for open storage until after the beginning of WWII, when the Navy established a scrap material salvage yard on the northeast side of the crater by January 1943. The Navy also established an open burn area to the south of the salvage yard and began filling the eastern perimeter of the crater with non-burnable refuse, a practice that would continue until April 1946.

Following the end of salvage and dump operations at Makalapa Crater, the government leased and then deeded lands to the City and County of Honolulu for the athletic fields for Radford High School (15 acres) beginning in August 1956 and the Makalapa Elementary School (3.577 acres) beginning in August 1971. The remaining portion (0.6935 acres) appears undeveloped by the Army and Navy and was transferred in 1985 for Radford High School.

In January 2014, improvements to the track at Radford High School resulted in the discovery of contaminants relating to the fill including munitions related scrap identified as material potentially presenting an explosive hazard (MPPEH). On 25 August 2014, the Navy began a Time-Critical Removal Action (TCRA) to address contaminated soil and debris encountered in the subsurface. The final TCRA report was not available at the time of this FUDS PA.

1.3 PURPOSE

This PA compiles information obtained through historical research at various archives and records holding facilities. The investigation was primarily a textual, cartographic and photographic research and analysis effort. It also makes use of a visual property visit. No sampling or quantitative field assessment techniques were conducted to gather data. The research team directed efforts toward determining presence of hazardous substance as a result of previous DoD use, storage, and/or disposal. This process obtains information for use in developing recommendations for further action at the former Makalapa Crater Navy Salvage Yard.

1.4 SCOPE

The investigation team focused potential Hazardous, Toxic and Radioactive Waste (HTRW), MEC, and/or chemical warfare materials (CWM) contamination remaining on the former Makalapa Crater Navy Salvage Yard. The DERP-FUDS property number is H09HI0484.

This report presents the following:

- A review of related property investigations;
- Description and characteristics of the immediate surrounding area, including real estate information, past and present;
- A brief history of Makalapa Crater Navy Salvage Yard;
- Description of HTRW, munitions and chemical warfare (CW) activities identified at the property;
- A map and aerial photography analysis of the property;
- Findings of the visual property visit;
- Evaluation of potential contamination on the property;
- A pathway and environmental hazard assessment; and
- Conclusions regarding Military Munitions Response Program (MMRP), HTRW, Containerized HTRW (CON/HTRW), and Building Demolition / Debris Removal (BD/DR) projects and recommendations for further action.

These factors represent the basis for the evaluation of potential HTRW, MEC and CWM contamination and associated risks at Makalapa Crater Navy Salvage Yard.

A description of the sources researched and a detailed listing of records reviewed is presented in Appendix A. A full bibliography of references is contained in Appendix B.

2 PREVIOUS INVESTIGATIONS

2.1 CORPS OF ENGINEERS INVESTIGATIONS

2.1.1 Findings and Determination of Eligibility - Makalapa Crater Navy Salvage Yard (H09HI0484), August 2015[3]

The Pacific Ocean Division Commander signed and approved the Findings and Determination of Eligibility (FDE) for the subject FUDS property totaling 19.2705 acres on 3 August 2015.

NOTE: In 1996, USACE completed an FDE on the similarly named and nearby but completely separate 7.52 acres Makalapa Military Reservation (H09HI0202). Although eligible for DERP- FUDS, USACE did not identify any eligible projects for that property.

2.1.2 Inventory Project Report - Makalapa Crater Navy Salvage Yard (H09HI0484), September 2015[4]

Concurrent to the preparation of this PA in 2015, USACE Honolulu District prepared an Inventory Project Report (INPR) for the Makalapa Crater Navy Salvage Yard. The INPR identified one HTRW project (H09HI048401) which consisted of remediation of contaminated soil and buried debris beneath the top soil under the western portions of Radford High School and Makalapa Elementary School, including the athletic fields and playgrounds. The Pacific Ocean Division Commander approved the INPR and HTRW project on 23 September 2015.

2.2 OTHER INVESTIGATIONS

The Navy has conducted numerous environmental studies at or in the vicinity of Makalapa Crater Navy Salvage Yard. The following paragraphs discuss the relevant information gained from these reports. These paragraphs do not include a comprehensive inventory of these studies or review all of their contents. Not all the reports and studies reviewed contained information directly used in this investigation.

2.2.1 Initial Assessment Study - Pearl Harbor Naval Base, October 1983[5]

In 1983, the Naval Energy and Environmental Support Activity (NEESA) completed an Initial Assessment Study (IAS) regarding possible contaminants at the Pearl Harbor Naval Base (PHNB). The IAS identified thirty possibly contaminated sites, including three in proximity to Makalapa Crater (Site 1, 2 and 3).

IAS Site 1 pertains to Makalapa Crater itself. Reportedly, the crater previously held a lake, and in the 1930s the Navy began using the crater for dredge spoils. During WWII,

the Navy disposed of damaged equipment such as metal scrap, empty ammunition casings as well as engine, ship and airplane parts in the crater. In the 1940s, the Navy installed drains in the crater to release collecting water. Interviewees reported that in the late 1950s and the early 1960s, the Navy disposed of general wastes for approximately five years in a Landfill Area on the south side of the crater on land currently occupied by the Instate highway H-1 and the Navy Hale Keiki School (see following figure). During construction of H-1, a great deal of WWII era metal debris was encountered and removed. From 1972 to 1976 the Navy allowed contractors to develop a clean fill area with non-combustible materials such as rock, asphalt, and concrete. The Navy's Public Works Center (PWC) issued licenses to contractors (including Tajiri Lumber Ltd.; Teval Corporation; Maitland Brothers, Co.; Richard H.S. Lee and E.E. Black) for use of this Landfill Area during this period and documentation is included in Appendix C of the IAS. The identified clean fill area was on the north side of the crater (see following figure). As no hazardous waste was specifically reported to have been disposed, the IAS concluded that no threat to human health or the environment existed at Site 1 and did not recommend a confirmation study.

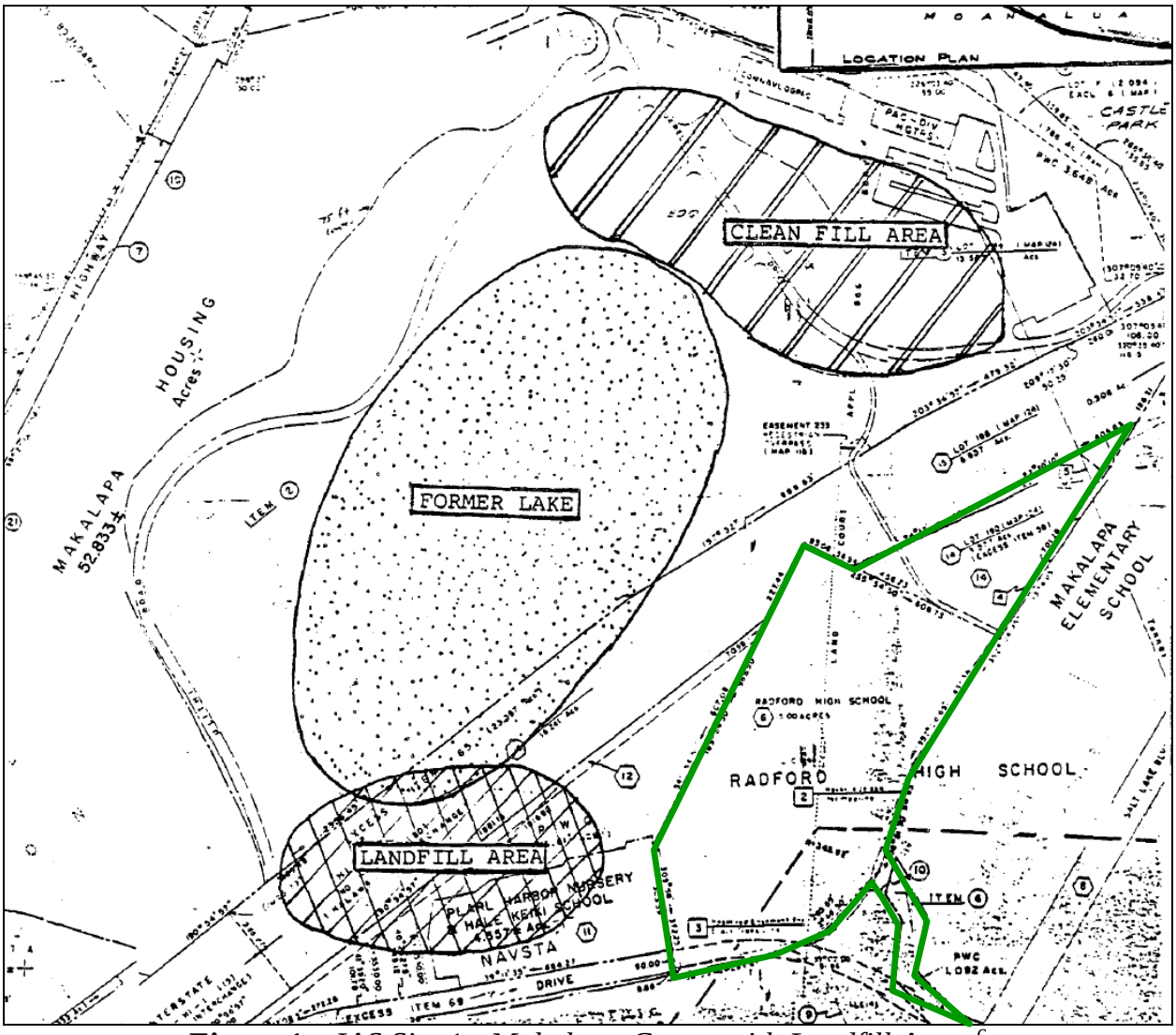


Figure 1 *– IAS Site 1 - Makalapa Crater with Landfill Areas*[6]
Note: approximate FUDS boundary in green annotated on figure excerpt

IAS Site 2, Makalapa Pesticide Rinseate Pit, concerned a disposal pit operated from 1974 to 1978 and took in rinse water used for pesticide tank rinsings. The IAS noted that on average, contractors dumped 25-50 gallons of rinse water per tank, and disposed of 2-3 tanks per day, 5 days a week. This equates to between 250 and 750 gallons of rinse water per week. The pit handled pesticides such as Krovar, Telvar, and Dalapon as well as others. IAS Site 2 was located a few thousand feet southeast of the crater and about a half mile south of Radford High School.

IAS Site 3 is in closer proximity to the subject FUDS, about 500 feet from the Radford High School athletic fields, just west of Navy Hale Keiki School (see following figure). The Navy used Site 3, the Former Pesticide Rinseate Area, in the late 1950s to early 1960s. Disposal occurred directly into the soil as opposed to a pit. The average dumping of rinse water was approximately the same as at Site 2 Makalapa Pesticide Rinseate Pit

(250-750 gallons per week). The IAS surmised that during construction of Highway H-1 the soil was dug up and removed or redistributed and hence did not recommend a confirmation study.

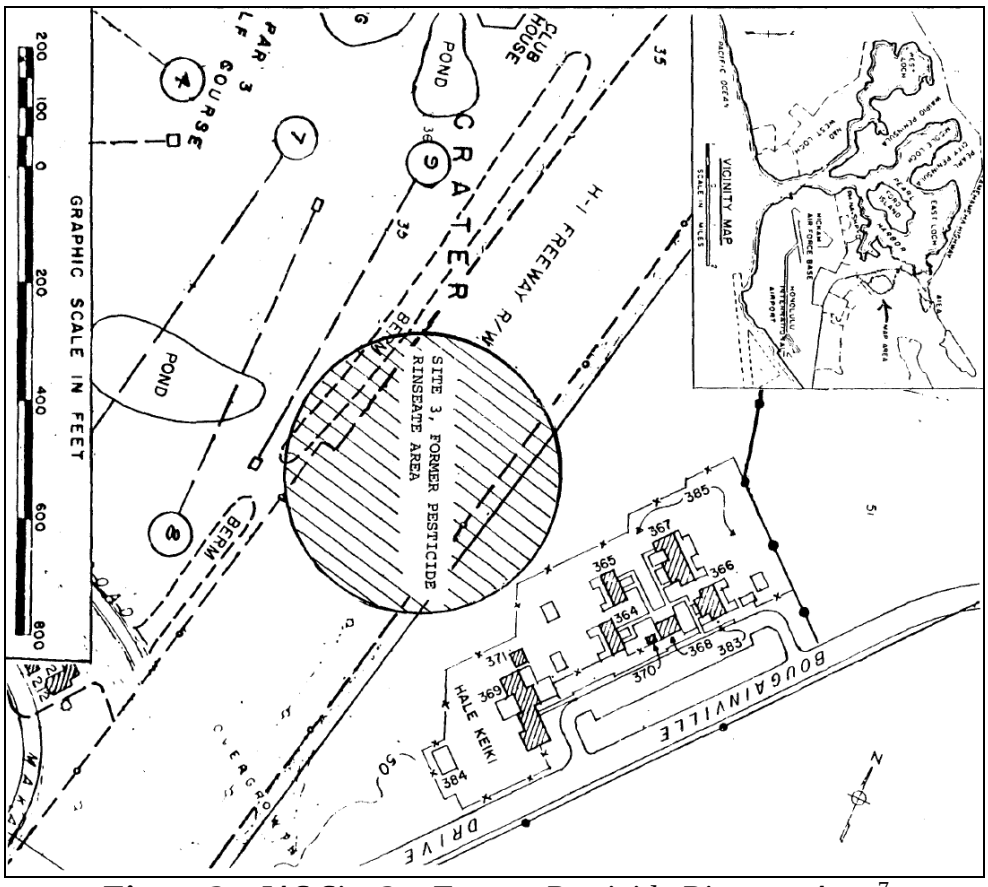


***Figure 2** – IAS Site 3 – Former Pesticide Rinseate Area*[7]

2.2.2 RCRA Facility Assessment - Pearl Harbor Naval Complex, January 1987[8]

This Resource Conservation and Recovery Act (RCRA) Facility Assessment (FA) included examination of the Navy's Public Works Center (PWC) facilities, shops and storage facilities associated with the Makalapa Crater. The RCRA FA, completed under contract to A.T. Kearny, Inc., identified 24 Solid Waste Management Units (SWMU) associated with the PWC including five previously discussed in the 1983 IAS:

- IAS Site 1 Makalapa Crater
  - Early Disposal - SWMU No. PWC-16
  - Clean Fill Area - SWMU No. PWC-17
  - Landfill Area - SWMU No. PWC-18
- IAS Site 2, Makalapa Rinseate Pit (Inactive) - SWMU No. PWC-7
- IAS Site 3, Former Pesticide Rinseate Area - SWMU No. PWC-l5

The RCRA FA did not include significant additional descriptions related to the use of the SWMUs. However it did delineate Contractor areas of the Clean Fill Area PWC-17 across the crater, as opposed to just the northern end as depicted in the IAS (see following figure, red annotation denote specific contractor fill areas). The RCRA FA recommended further action (investigation) at all these areas except the Clean Fill Area.

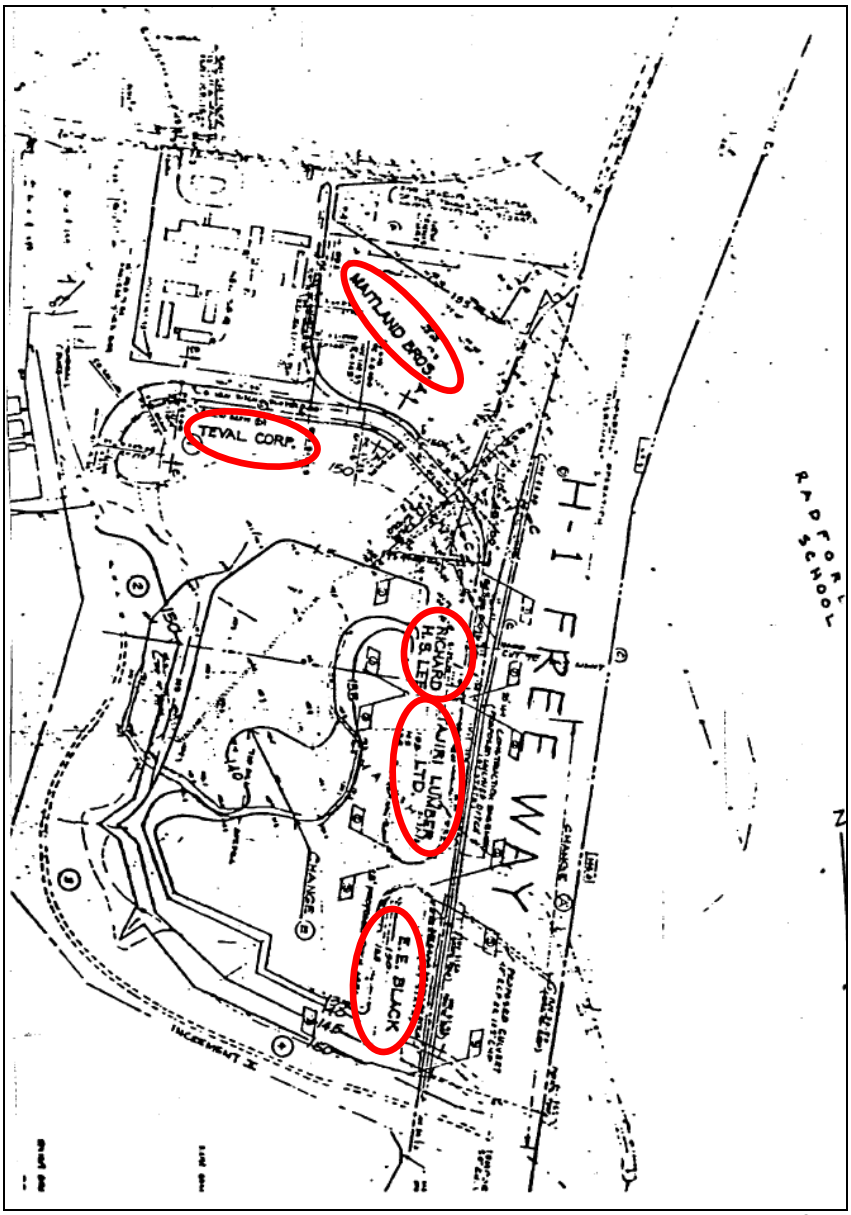


Figure 3 *– RCRA FA Clean Fill Area SWMU PWC-17*[9]

2.2.3 RCRA Facility Investigation - Pearl Harbor Naval Complex, October 1992[10]

The Comprehensive Long-Term Environmental Action Navy (CLEAN) for the Pacific Division of the Naval Facilities Engineering Command (NAVFAC) in Pearl Harbor, Hawaii, completed a RCRA Facility Investigation (FI) for the Pearl Harbor Naval

Complex via contract with Ogden Environmental and Energy Services Company, Inc. at 17 SWMU Groups. The RCRA FI studied Makalapa SWMUs noted in the RCRA FA (see previous section) as SWMU Group 7.6 (including PWC-15 and 18) and 7.7 (including PWC-16 and 17) (see following figure).

The report shows the approximate boundaries of the Makalapa Crater as including the athletic running track of Radford High School (see solid line in following figure). The report also delineates the Early Disposal Area, PWC-16 as the former boundary of the previous lake (see dashed-dot line in following figure) and appears more accurate than the simple oval depiction in the 1983 IAS. The delineation of the Clean Fill Areas, PWC-17, by specific contractors follows the findings of the RCRA FA and are more clearly depicted (see dashed lines in following figure). The Former Pesticide Rinseate Area, PWC-15, is depicted as previously identified (see dotted circle in following figure), but with the description that operations occurred from the 1950s to 1974, when the operation moved to building X-1, Makalapa Rinseate Pit (i.e. PWC-7). The RCRA FA found no records that confirm or deny a liner on the landfill area, or any record of waste generation or disposal.

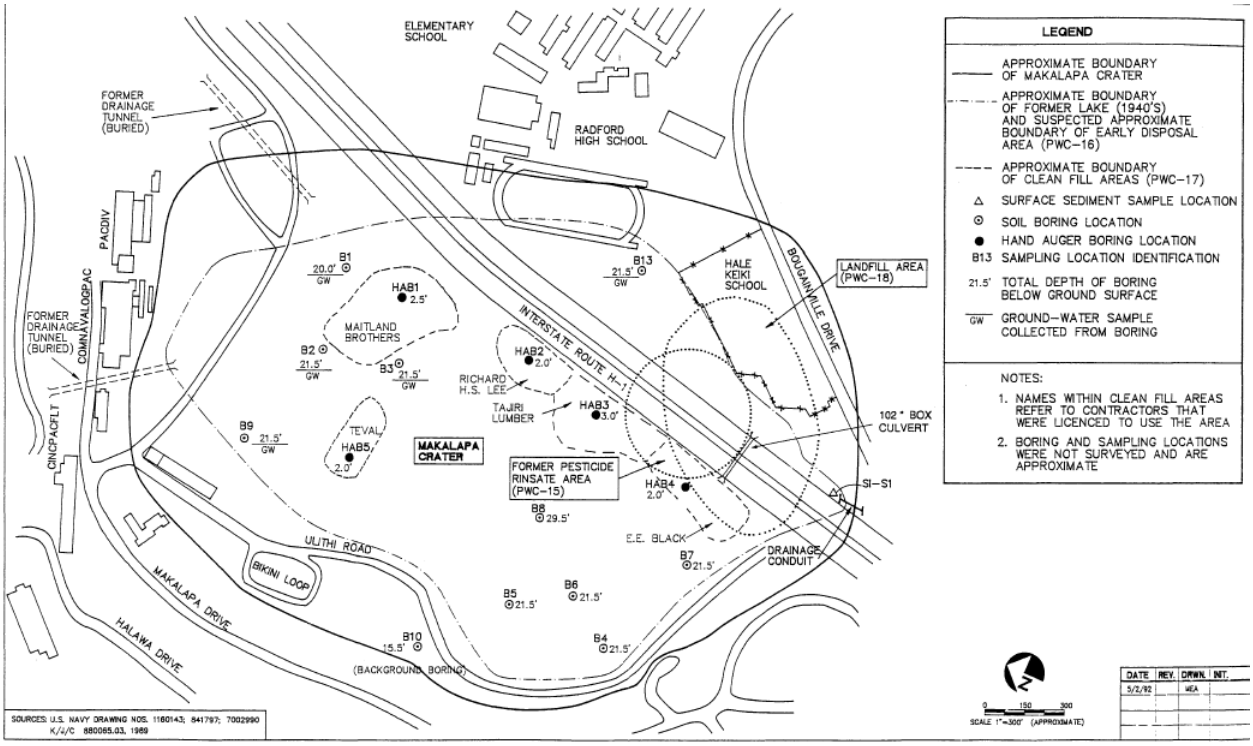


Figure 4 *– RCRA FI Makalapa Crater Boring and Sampling Locations SWMU Groups 7.6 and 7.7*[11]

The RCRA FI gathered soil samples in the crater and tested them for metals, volatile organic compounds, fuel hydrocarbons, pesticides, and herbicides. At one particular site, test results indicate the presence of arsenic, barium, beryllium, chromium, cobalt, copper,

lead, mercury, molybdenum, nickel, silver, vanadium, and zinc in the crater soil. The report believes that these observed concentrations are "*representative of background conditions at the site.*" Furthermore, the tests found only 2 instances of TFH (Total Fuel Hydrocarbons) in the soil; one at 651 mg/kg, and the other at 96 mg/kg, 5 feet below the surface. The tests also confirmed the presence of acetone, methylene chloride, and toluene at levels below 1 mg/kg.

The report concludes that no immediate threat to human health or the environment exists with regards to these contaminants. Along with this statement, the report recommends that additional sampling take place in the Former Rinseate Area, Landfill Area, Clean Fill Area, and Early Disposal Area (i.e. SWMUs PWC-15).

2.2.4 Historical Radiological Assessment - Pearl Harbor Naval Complex, January 1997[12]

In 1997, the Naval Nuclear Propulsion Program completed a Historical Radiological Assessment (HRA) for the Pearl Harbor Naval Complex. The report focuses mainly on the types of radiological hazards and General Radioactive Material (G-RAM) in and around the Complex. The report briefly describes the uses for the Makalapa Crater. In 1954, a Naval Public Works Center was built on the Makalapa Compound. The Public Works Center controlled public works operations for all area installations such as maintenance, utilities, and transportation. Also, the crater housed materials from cleanup operations and damaged equipment from the Pearl Harbor raid. The area where this took place existed in the 1950s and 1960s, and represents the landfill area in the following figure. The HRA found no reports of hazardous waste disposal in the crater area but conjectures that since disposal of airplane and ship parts occurred in the crater, it is possible that radioluminescent materials such as dials and clocks were disposed of in the crater (These objects contain Radium-226, a natural occurring radionuclide that emits high levels of energy). The HRA concludes that the activities at Pearl Harbor Naval Complex relating to GRAM have "*no adverse impact on the human population or ecosystem of the region*" and that there was no further action regarding GRAM warranted in the PHNC area.

2.2.5 Site Summary Report - Makalapa Crater Geographic Study Area, February 2002[13]

In 2002, the Pacific Division of the Naval Facilities Engineering Command (NAVFAC) completed a Site Summary Report (SSR) for the Makalapa Geographic Study Area (GSA). The SSR outlines 40 existing and demolished facilities within the Makalapa Crater GSA including fuel storage facilities, hazardous materials/hazardous waste management sites, IR program sites, lead disposal/release sites, and transformers. Of these 40 facilities or sites within the GSA, the SSR recommends no further action for 35 of them. The five remaining sites include: Transformer M-13, Clean Fill Area, Early Disposal Area, Pesticide Rinseate Area, and Landfill Area (see following figure; the red

triangle in the top left corner represents Transformer M-13 and the other areas are labeled). Transformer M-13 is a Pad-mounted Transformer outside buildings 373-380 (Bachelor Officer's Quarters), about 1,500 feet away from the subject FUDS and not considered potentially relevant to the FUDS.

***Figure 5** – SSR Areas recommended for further action at Makalapa Crater GSA*[14]

No additional sampling was conducted as part of the SSR and all the data discussed in the SSR came from previous investigations, such as the IAS and RFI.

At the Clean Fill Area, samples indicated that mercury and lead may have been released to shallow soils in the area. Sampling also showed elevated concentrations of arsenic and beryllium. However, the report claims that these elevated levels likely result from background conditions at the site. The SSR claims that no immediate threat to human or environmental health exists in the Clean Fill Area; however, the SSR recommends further action and sampling in this area.

The SSR found that the Early Disposal Area remained enclosed by fences and vegetated. Sampling revealed elevated levels of metals (i.e., arsenic, beryllium, lead, mercury) in the

soil but concluded that no potential threat exists from direct exposure to soils in this area. The SSR recommends additional soil sampling and removal action for this site.

At the Former Pesticide Rinseate Area, the SSR contractor conducted testing for pesticides and herbicides, finding that the pesticides and herbicides tested for in this area remained in concentrations below the laboratory limit. The SSR recommends no further action regarding hydrocarbon contamination in the area and concludes that no immediate threat to Navy Hale Keiki School or the environment exists in the area. Accordingly, the SSR recommends no further action within the Former Pesticide Rinsate Area except as part of the Landfill Area (which overlaps with the Former Pesticide Rinsate Area).

In regard to the Landfill Area, the SSR reports that waste oil and solvents disposed of in this area are a concern. The SSR notes that arsenic and beryllium were found at elevated levels in this area; however it asserts that these represented the site's background character. Sampling also indicated elevated levels of TPH as diesel fuel in the oil. The SSR claims that a comparison with the appropriate action levels and background character suggests that the site presents no immediate threat to the school or environment from any of the identified contaminants. The SSR recommends additional sampling for Total Petroleum Hydrocarbons (TPH), Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), and Polynuclear Aromatic Hydrocarbons (PAHs) in the Landfill area to further examine hydrocarbon contamination.

2.2.6 Cultural Landscape Prefinal Report - Pearl Harbor Naval Complex, October 2010[15]

In 2010, the NAVFAC Pearl Harbor drafted a cultural landscape analysis of the Pearl Harbor Naval Complex (PHNC) and surrounding areas (including Makalapa Crater). In regards to the history of Makalapa Crater, the report notes that in the 1930s, the crater reportedly housed sugar cane cultivation along the outer rims and an irrigation ditch inside the crater. Following condemnation proceedings for acquisition of the Makalapa Crater in federal court in 1939, the Navy acquired 350 acres of land, with the Honolulu Plantation Company Railroad defining the eastern edge of the Makalapa Crater. The Navy used approximately 225 acres for housing developments and administration along the crater's western and southern flanks. The report also reiterated the Navy use of the crater itself for depositing dredging spoils and establishing a salvage yard on the north-northeast rim as evidenced by a 1944 site plan (see following figure).

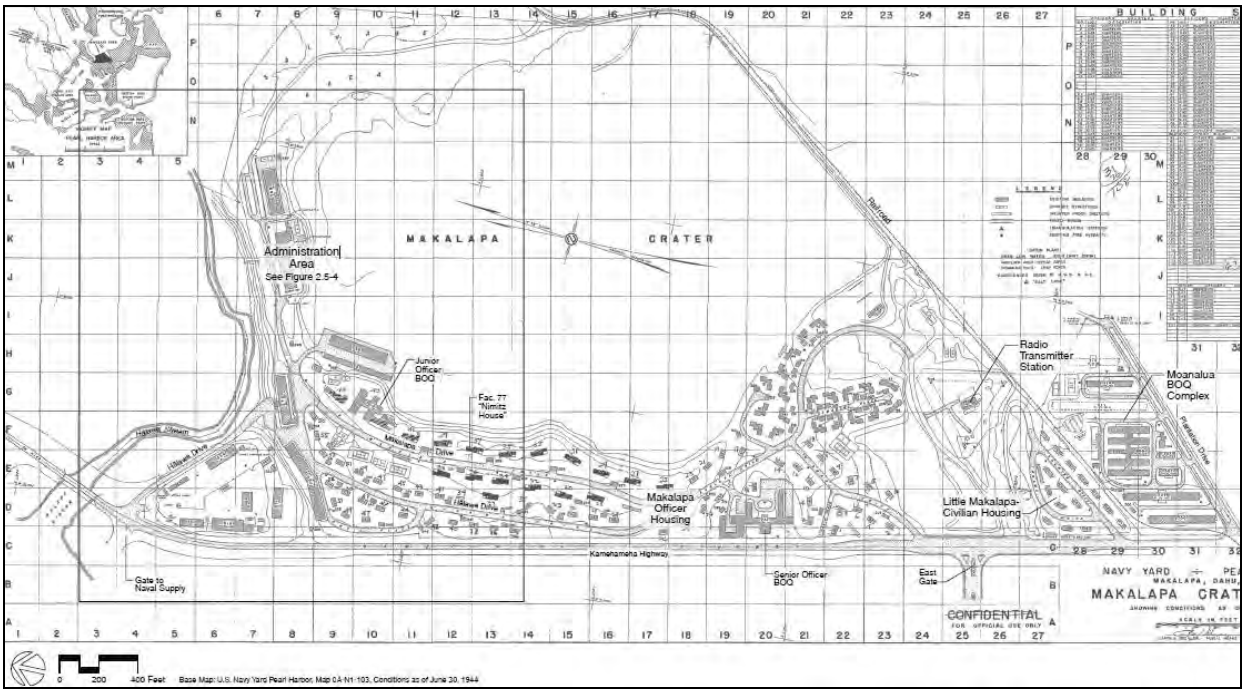


Figure 6 *– Makalapa WWII Overview based on "Makalapa Crater Area Showing Conditions as of June 30, 1944"*[16]

2.2.7 Preliminary Assessment for Munitions - Makalapa Crater, May 2011[17]

In 2011, AECOM Technical Services, Inc. of Honolulu completed a Munitions PA on behalf of the NAVFAC for the Joint Base Pearl Harbor-Hickam (JBPHH). The PA concerned the potential for MEC within the Makalapa Crater GSA of the JBPHH (see black outline on following figure).

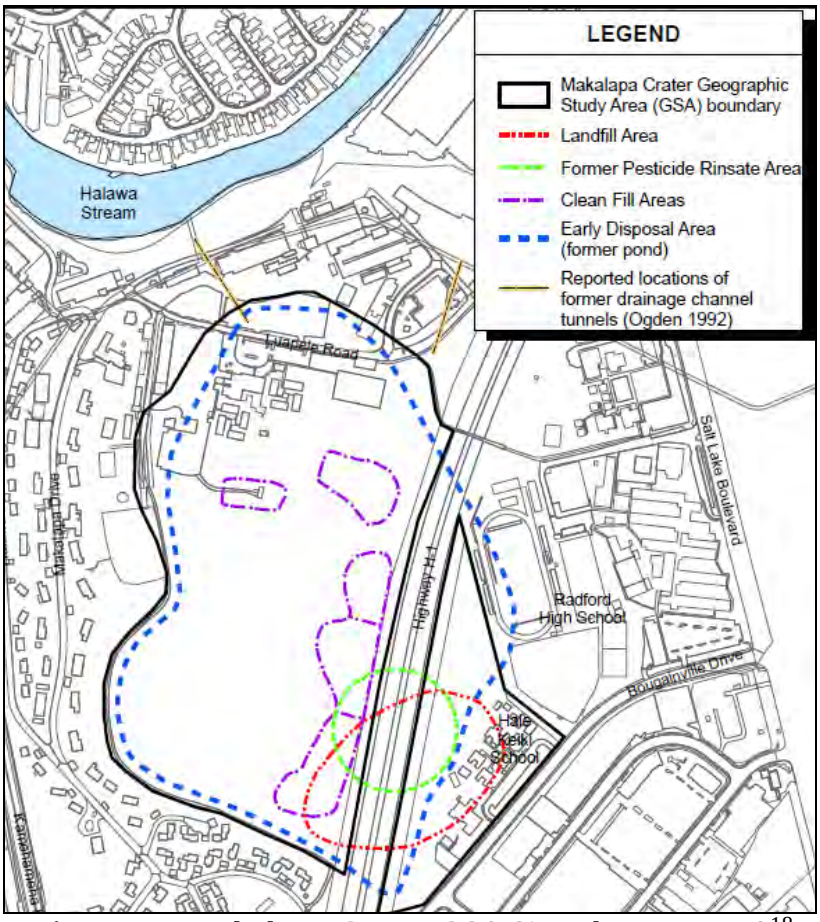


***Figure 7** – Makalapa Crater GSA Site Plan – pre-PA*[18]

The PA outlined the Naval history of Makalapa Crater and the surrounding area, noting that in 1909, extensive dredging began in Pearl Harbor, with the dredge materials being used for the development of Fort Kamehameha and the Pearl Harbor dry docks. In 1939, the Navy purchased the crater, which consisted primarily of a pond (see blue dashed line of previous figure), with the plan to place approximately 8-10 million cubic yards of "soupy" dredged material into the crater.[19] The dredge disposal line originated along the southeast shore of Ford Island and pumped spoils into the crater. On 28 July 1941, the dredge received orders to stop pumping materials into Makalapa Crater. The PA reports that the former pond (a.k.a. Early Disposal Area) contained a former pesticide rinseate area (5.1 acres), landfill (9.6 acres), and clean fill area (7.4 acres). The Navy established a salvage yard along the northeastern rim of the crater where various metal and other heavy scrap materials salvaged off the damaged ships in the harbor could be sorted. The 2011 PA found no historical records indicating that Makalapa Crater received empty ammunition casings, MECs, or any other potential ordnance or explosive hazard.

The 2011 PA recommends further expanding the Makalapa Crater GSA to include portions of the Early Disposal Area currently occupied by the Radford High School

athletic fields for a total of 78.8 acre area outlined as Areas A, B and C (see following figure).

- Area A (25.7 acres) – including the Drainage Basin, Former Pesticide Rinseate Area, and Former Landfill area.
- Area B (49.4 acres) – including a large portion of the Crater Area (mostly unused), and parts of the Former Clean Fill Area. The expanded area includes the athletic fields of Radford High School.
- Area C (3.7 acres) indicates the Former Dredge Outfall Area, where the PA suggests the possible presence of MEC and/or MC in the dredge spoils deposited by pipeline in the northwest corner of the crater

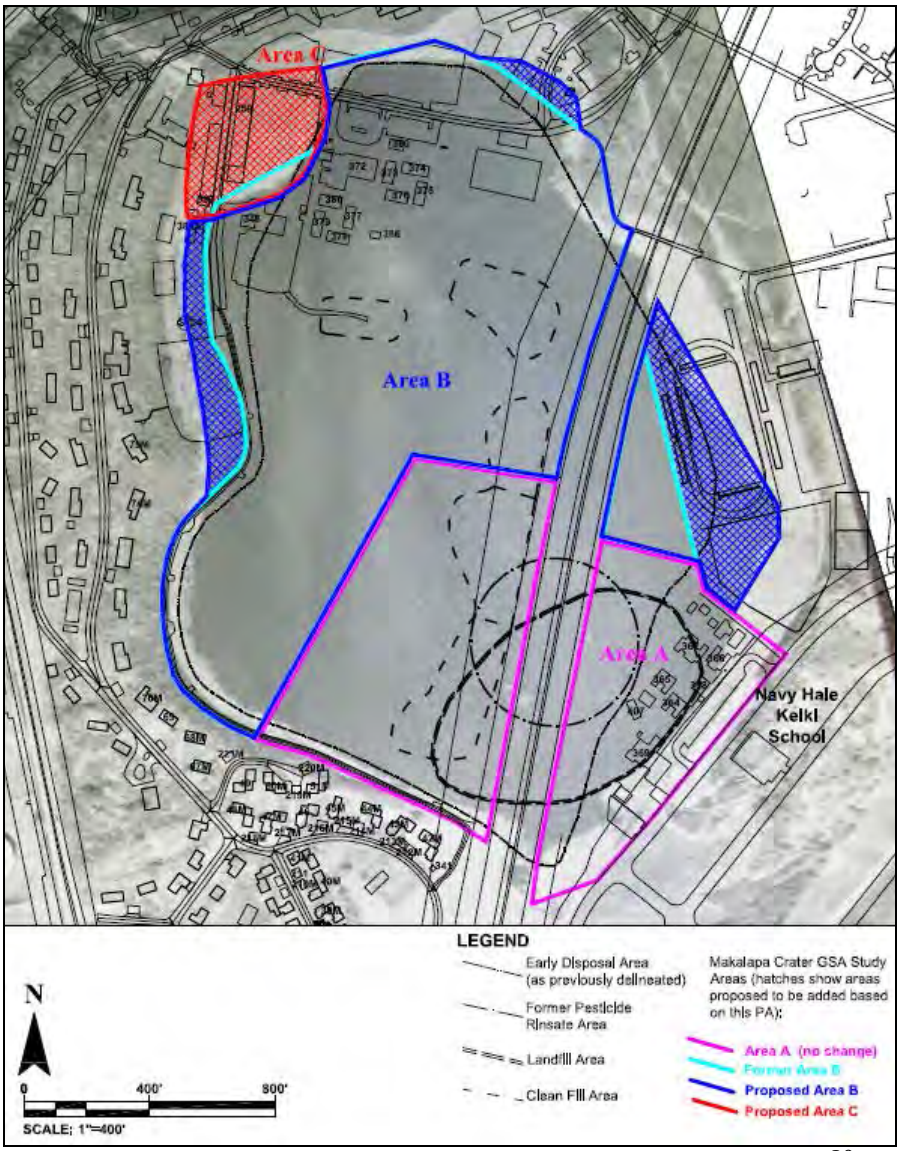


Figure 8 *– Makalapa Crater GSA PA Modified Site Plan*[20]

NAVFAC and AECOM provided the extensive backup reference documentation for the 2011 PA to support completion of this FUDS PA.

2.2.8 Initial Site Characterization - Radford High School Track and Field Excavation, March 2014[21]

On 19 December 2013, during excavation work to replace the old cinder running track at Radford High School (RHS) with a new all-weather (synthetic) track, the State of Hawaii Department of Education (DOE)'s construction contractor encountered buried debris. DOE retained Bureau Veritas North America, Inc. (Bureau Veritas) to collect and analyze soil samples and suspect Asbestos Containing Material (ACM) from the track and field area at RHS on 20 December. Some of the suspect ACM samples tested positive for asbestos. The asbestos was subsequently bagged and stored temporarily before being removed for offsite disposal. Analysis of a multi-increment soil sample from the northeastern portion of the track where buried debris was uncovered indicated that the soil concentrations of arsenic, cadmium, lead and dioxin exceeded their respective Hawaii Department of Health (HDOH) Tier 1 Environmental Action Levels (EALs). DOE stopped construction work and closed off the track and field in January, securing the excavated material.

On 4-5 February 2014, Bureau Veritas conducted follow-up soil investigation, as approved by DOH, taking multi-increment soil samples from 29 Decision Units (DU) in and around the field including: the excavated track area; the soil stockpiles; and the grassy/original field area (see following figure). Analysis of the samples showed that concentrations that were equal to or exceeded the HDOH Tier 1 EAL as follows:

- Benzo(a)pyrene (3 of 29 samples)
- Arsenic (7 of 29)
- Barium (1 of 29)
- Cadmium (1 of 29)
- Lead (15 of 29)
- Mercury (22 of 29)
- PCB, Aroclor 1260 (5 of 29)
- Dioxin (6 of 29) with Toxicity Equivalent (TEQ) concentrations above the HDOH Tier 1 EAL

Based on the analytical results, Bureau Veritas recommended proper disposal of the stockpile DUs and additional site characterization investigation to further delineate the horizontal and vertical extent of contamination.

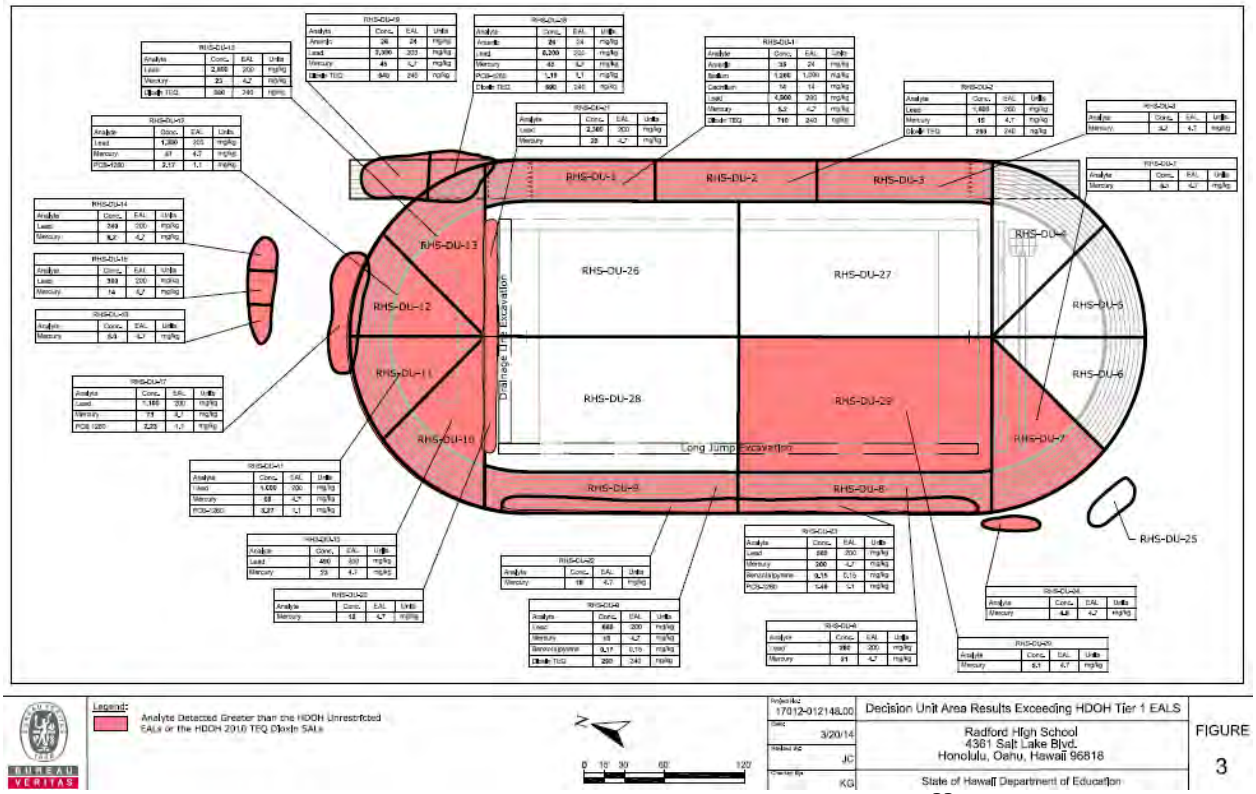


***Figure 9** – RHS Decision Area Units at track*[22]

2.2.9 Navy Time-Critical Removal Action - Radford High School, 2014-2015[23]

On 24 January 2014, the Hawaii DOH Hazard Evaluation and Emergency Response (HEER) office notified the Navy of the conditions at the school. Also, DOE also found munitions related debris, including a small projectile fuze and expended cartridge cases, in the excavated soil. Subsequently, the Navy contracted for sampling and removal and disposal of stockpiled soil. In May 2014, DOE notified the Navy that DOE's construction contractor transported some RHS excavated material to two other locations, one in Kaneohe and the other in Kapolei, prior to the work stoppage at RHS. On 25 August 2014, the Navy received Right of Entry approval and began work that day on the Time-Critical Removal Action (TCRA) to address contaminated soil and debris encountered in the subsurface during construction activities at the RHS running track in December 2013.

The TCRA objectives were to remove contaminated soil within the construction footprint at the RHS field and athletic complex (see following figure) to depths that will allow the DOE to resume construction work safely; to remove contaminated soil from the two outlying sites; to screen the excavated debris for material potentially presenting an explosive hazard (MPPEH); to properly address any MEC identified with support of EOD; and to properly dispose of the excavated soil and debris.

Figure 10 *– TCRA Site Location and 2013 Makalapa Crater RI Study Area*[24]

The TCRA included:

- **Access Road** - Establishing a temporary access road behind the Navy Hale Keiki School, close to the H-1 Freeway to reduce traffic on school grounds. Completed 8 September 2015.
- **Track** – Excavation to 1 foot deeper than DOE planned to excavate for the new track followed by placement of an orange geotextile fabric liner and 1 foot of clean fill. Completed 6 March 2015.
- **Football Field** – Removal of top 1 foot of clean soil and an additional 1-3 feet of contaminated soil and debris followed by placement of an orange geotextile fabric liner and 1 foot of clean fill. Completed 6 March 2015.
- **Private Property -** Removal of RHS excavated material at two other locations (~2459 tons). Completed 4 November 2014.
- **Debris Screening –** Screened all debris in stockpiles and excavated material (~18,690 tons); inspected all metal debris. All munitions related items found during the TCRA (hundreds) were inspected and confirmed safe (no explosive hazard). Completed 4 March 2015.
- **Disposal –** Excavated and screened soil and debris were transported to a permitted disposal facility.
- **Miscellaneous -** Placement of concrete cap at former visitor's bleachers and a layer of gravel and gunite (shotcrete) under the home bleachers. Placement of

geotextile liner, six inches of top soil and grass at other locations of soil contamination (i.e. north of track).

- **Site restoration** – after DOE installed new irrigation system, Navy completed sod installation on football field on 22 February 2016.

The Navy provided a TCRA status update to the public (including Fact Sheet) at the Joint Base Pearl Harbor-Hickam (JBPHH) Restoration Advisory Board meeting held on 14 July 2015, though a final TCRA report was not completed at the time of the FUDS PA investigation.

2.2.10 Navy Remedial Investigation - Makalapa Crater GSA, June 2015 Draft[25]

NAVFAC contracted AECOM Technical Services, Inc. to prepare a Remedial Investigation (RI) for the Makalapa Crater GSA, a draft of which was completed in June 2015. The RI report divided the Makalapa Crater GSA into three study areas, based on AOC locations, historical disposal activities for each area, and soil and groundwater data acquired during previous investigations (see following figure):

- Study Area A - portions of the Early Disposal Area and Clean Fill Area, all of the Former Pesticide Rinsate and Landfill Areas, and all of the grounds of the Navy Hale Keiki School (NHKS) and former Child Development Center (CDC);
- Study Area B - portions of the Early Disposal Area and the Clean Fill Areas; and
- Study Area C - the northwest corner of the Early Disposal Area.

Figure 11 *– Makalapa Crater RI Study Areas - 2015*[26]

Although the contaminant source identified for Study Area C is the same as the principal source identified for Study Area B (the Early Disposal Area dredge spoils), the area was identified as a distinct Study Area because MEC associated with dredge spoils discharged from a hydraulic dredge pipe outfall may have been deposited in this area.

The RI was designed to evaluate the nature and extent of contamination within Makalapa Crater; to investigate and quantify potential impacts to surface soil, subsurface soil, groundwater, and soil gas; and to assess potential threats to human health and the environment. The RI was also designed to provide the data and information required to conduct a feasibility study (FS), if necessary to evaluate alternatives for remedial action.

While Makalapa Crater GSA Study Area B extends into and includes a significant portion of the RHS athletic fields as outlined in purple (see previous and following figures), it did not include test pits or sample locations as part of the RI (see following two figures). RI field observations of the surface and subsurface conditions at the site confirm the presence of the dredge spoils underlying the site and the prevalence of construction and demolition debris at the test pit locations. The RI did not find municipal wastes as expected within the Landfill Area, with the exception of evidence petroleum hydrocarbons in the subsurface soils and soil gas. Anomalies related to MEC were not found in Study Area C.

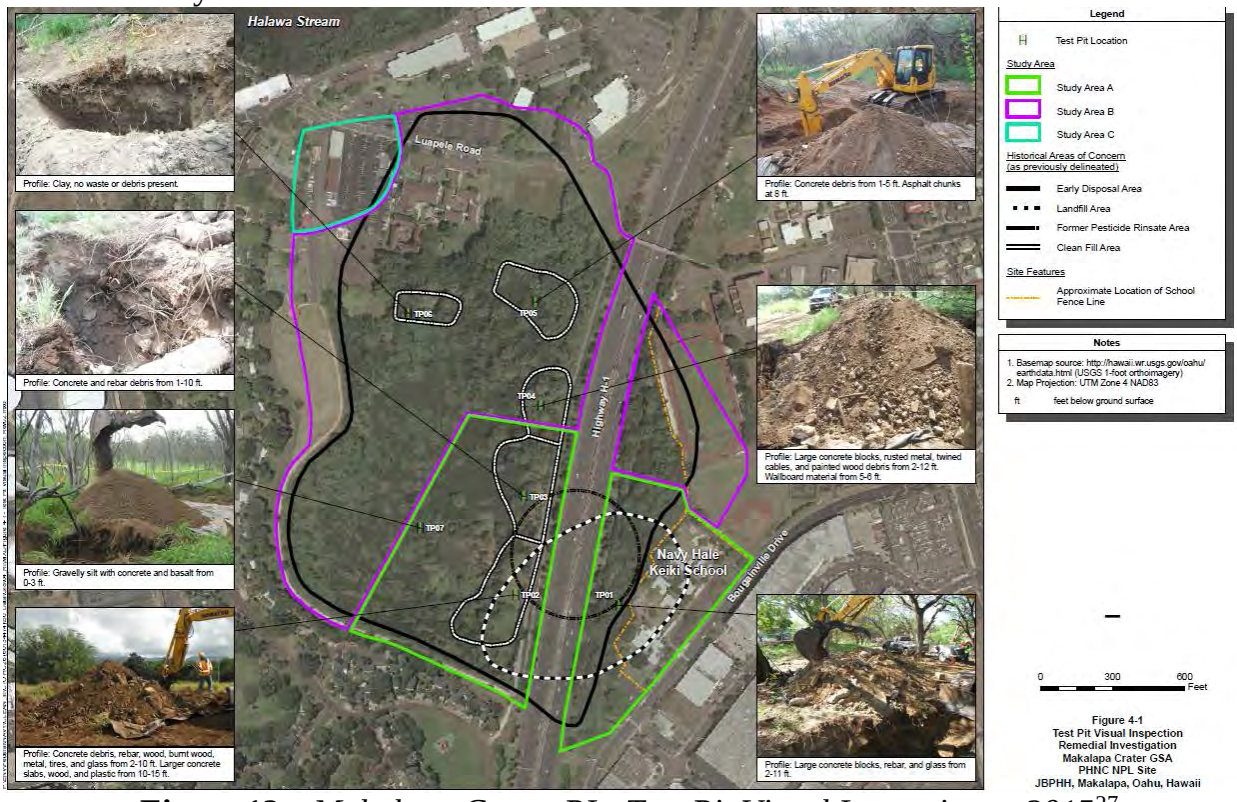


Figure 12 *– Makalapa Crater RI - Test Pit Visual Inspections - 2015*[27]

The RI detailed that groundwater at the site was not hydraulically connected to the surrounding caprock aquifer outside of the crater. Additionally, the RI substantiates that *"surface water runoff generated within Makalapa Crater would not flow out of the crater, and runoff generated outside of the crater would not flow into the crater*".

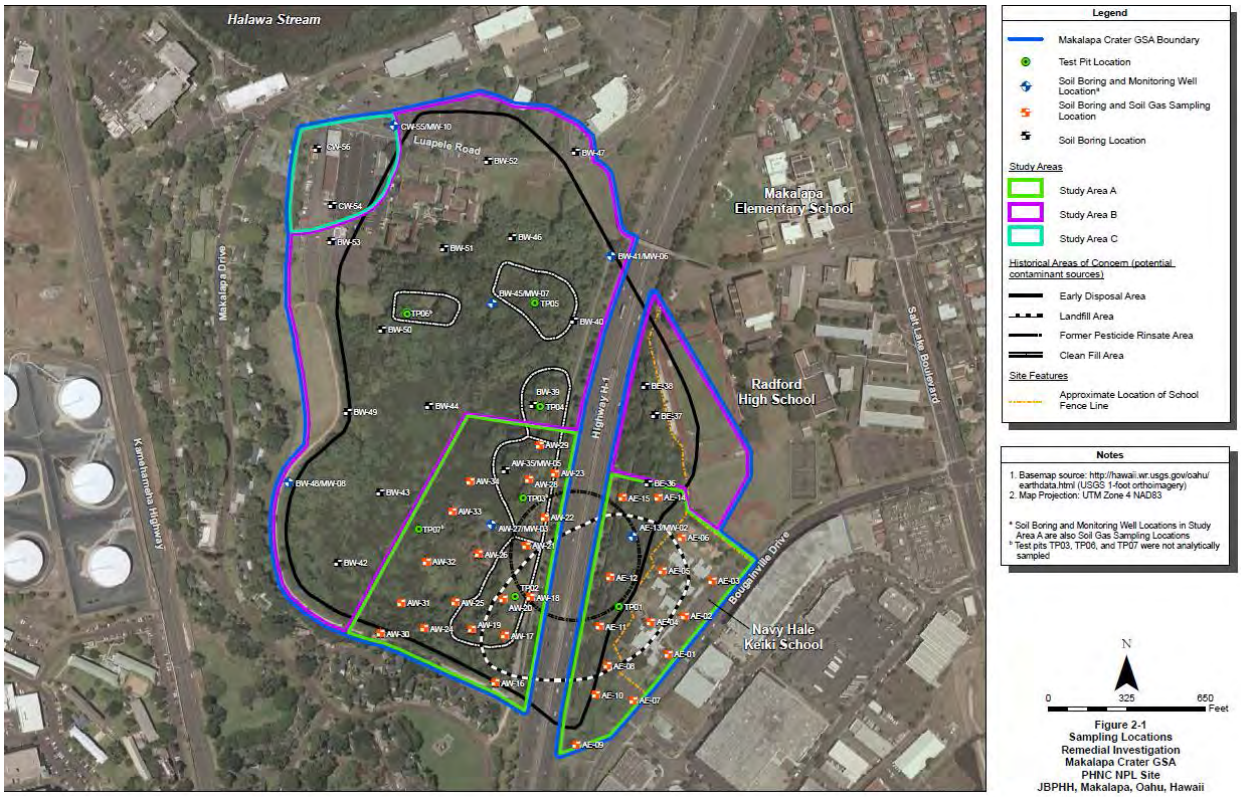


Figure 13 *– Makalapa Crater RI – Sampling Locations - 2015*[28]

RI results confirmed that Contaminants of Potential Concern (COPCs) including volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, dioxins, and metals occur at concentrations exceeding the protection action levels (PALs) in surface and subsurface soil in some areas of the crater. Metals were the only COPCs detected in groundwater at concentrations exceeding the PALs. Furthermore, the distribution of VOCs in the subsurface soil and soil gas indicates that contamination is most likely attributable to a source located east of the Makalapa Crater GSA (e.g., commercial/industrial area east of the property).

Based on the results of the RI, the report concluded that *"unrestricted land use/unlimited exposure (no further action) may not be appropriate for the Makalapa Crater GSA."* The RI recommended a feasibility study (FS) to evaluate remedial alternatives for the GSA.

3 PROPERTY DESCRIPTION, ACREAGE AND LAND USE

3.1 LOCATION

Makalapa Crater Navy Salvage Yard consisted of 19.2705 acres on the Island of Oahu, Hawaii. This property lies immediately east of Interstate H-1 and Naval Station Pearl Harbor, which is now part of the active Joint Base Pearl Harbor Hickam (JBPHH) in Halawa, District of Ewa, Island of Oahu, HI. The property is currently covered by athletic fields and parking for Radford High School, playground fields for Makalapa Elementary School, and a portion of H-1 and Bougainville Drive (see vicinity and location maps on following figures). The approximate center of the property is at Latitude N21° 21' 34" Longitude W157° 55' 46". The property is located within EPA Region 9, Hawaii Congressional District 1, and zip code 96818.

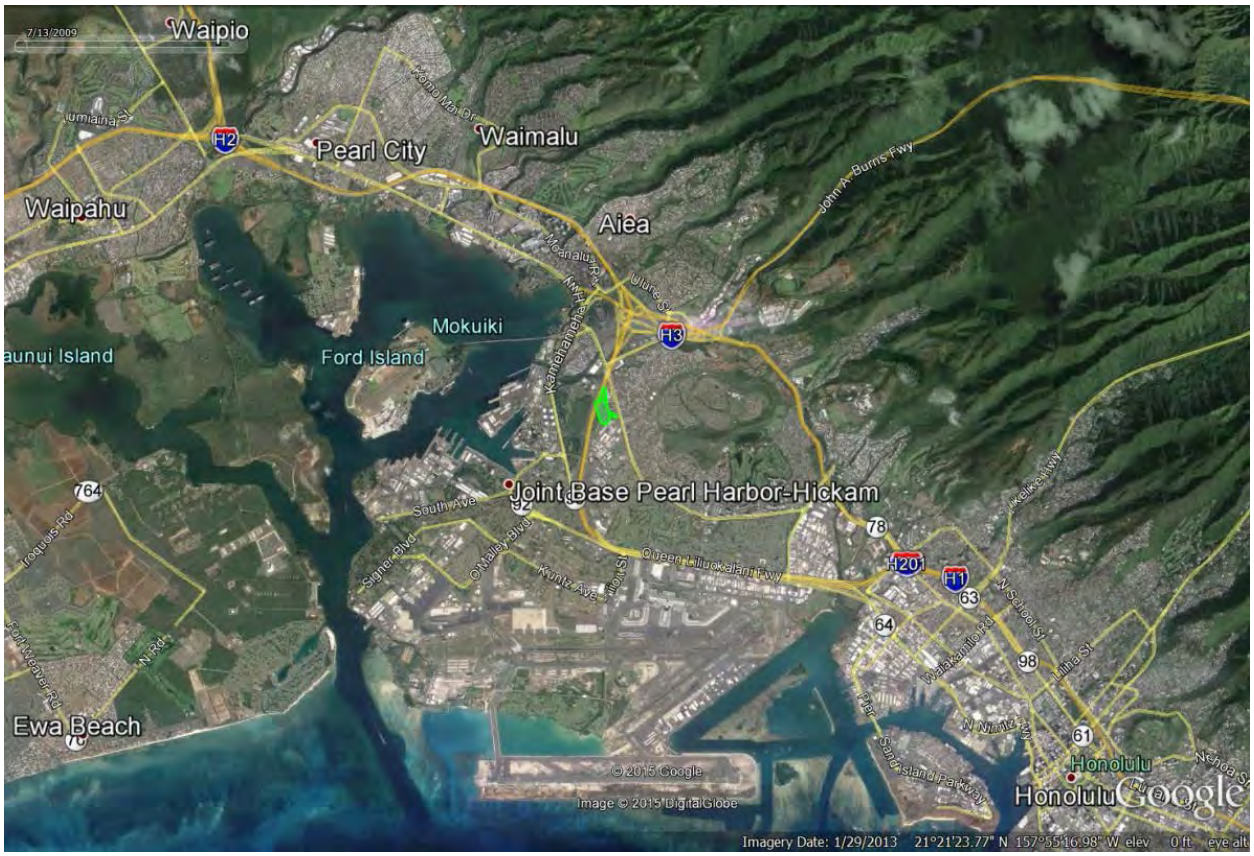


Figure 14 – *Makalapa Crater Navy Salvage Yard Vicinity Map – Imagery 1 January 2013*

Legend

- Confirmed FUDS Property No. H09HI0484 (19.2705 acres)

Figure 15 – *Makalapa Crater Navy Salvage Yard Property Map – 1 January 2013*

Legend

- Confirmed FUDS Property No. H09HI0484
- Joint Base Pearl Harbor Hickam (JBPHH)
- Radford High School (including FUDS and non-FUDS portions)
- Makalapa Elementary School (including FUDS and non-FUDS portions)

3.2 FUDS ELIGIBLE PROPERTY

3.2.1 Confirmed FUDS

The confirmed eligible FUDS for the former Makalapa Crater Navy Salvage Yard is 19.2705 acres.

The Navy acquired the majority of land for the former Makalapa Crater Navy Salvage Yard FUDS (18.577 acres) as part of the 1939 expansion of Naval Yard Pearl Harbor, which included Makalapa Crater. The Navy acquired the acreage by an Order on Declaration of Taking, Civil No. 416, in the United States District Court for the Territory of Hawaii filed on 30 October 1939 as amended on 5 August 1941 and 2 November 1944. The land was part of the Estates of (Queen) Emma Kaleleonalani and Bernice P. Bishop.[29]

The legal descriptions of this land, included as three parcels, are as follows (the first two equating to the 15 acre RHS tract):

- Being Lot B-3-B-2, containing 6.591 acres, as shown on Map 24 filed with the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application 966, and being a portion of the land described in Land Court Certificate of Title No. 20890 issued to the United States of America.[30]

- Being a portion of Royal Patent 6717, Land Commission Awards 7712 and 8516-B to M. Kekuanaoa and Kamaikui, and containing an area of 8.409 acres, the same being a portion of the land described in that certain "Order Amending Description of Real Estate Condemned" as Parcel 4-B, acquired by the United States of America in Civil Action No. 416 in the United States District Court in the State of Hawaii.[31]

- Being all of Lot 190 containing 3.577 acres, as shown on Map 124 of Land Court Application 966, and being a portion of the land described in Transfer Certificate of Title No. 20,890 issued to the United States of America[32].

The War Department (Army) acquired the third tract of 0.130 acres by Condemnation on 19 October 1916 in Civil No. 87 in the United States District Court for the Territory of Hawaii to provide transportation access to and from the Aliamanu (Crater) Military Reservation.[33] The legal description of this land is: Being a portion of Royal Patent 6717, Land Commission Awards 7712 and 8516-B to M. Kekuanaoa and Kamaikui (Exclusion 9 of Land Court Application 966), containing an area of 0.6935 acres.[34]

In March 1957, by Agreement of Lease No. NOy(R) 61046, the Navy leased 15 acres (6.591 acres and 8.409 acres parcels) to the City and County of Honolulu for a public school (i.e., Radford High School) for 25 years backdated to August 1956.[35] On 5 March 1962, the United States deeded the 15 acres to the City and County of Honolulu through the Department of Health, Education, and Welfare (HEW) to be used for educational purposes. A small portion of the northwestern most corner of this tract would later be used for H-1.[36] The Navy issued a license NF(R)-10828 to the State of Hawaii for a second tract consisting of 3.577 acres for school parking and playground (i.e., Makalapa Elementary School) beginning 15 August 1971.[37] On 10 November 1975, HEW deeded the 3.577 acres tract to the State of Hawaii for education.[38] On 17 April 1985, the Naval Facilities Engineering Command (NAVFAC) deeded a third tract, consisting of 0.6935 acres, to the State of Hawaii for use of the Radford High School.[39] The Army had transferred this land previously to the Navy on 1 October 1957 as part of a 1.092-acre portion of land with no buildings or improvements.[40]

These real estate details concur with the acreage number stated in the FDE signed on 3 August 2015.[41]

3.2.2 Additional Areas of Use

The investigation team did not identify any additional areas of potential or undocumented military ownership or land use associated with Makalapa Crater Navy Salvage Yard.

3.2.3 Potential FUDS

To the east of the subject PA FUDS lies a potential FUDS used as a gun emplacement from 1942 to 1946 for the Hawaiian Antiaircraft Artillery Command; however, available documentation does not conclusively substantiate this. Tract 16-L of Aliamanu Military Reservation (MR), consisting of 2.00 acres, lies immediately east and adjacent to the subject FUDS and is currently the southeastern most part of Radford High School (see following figure).

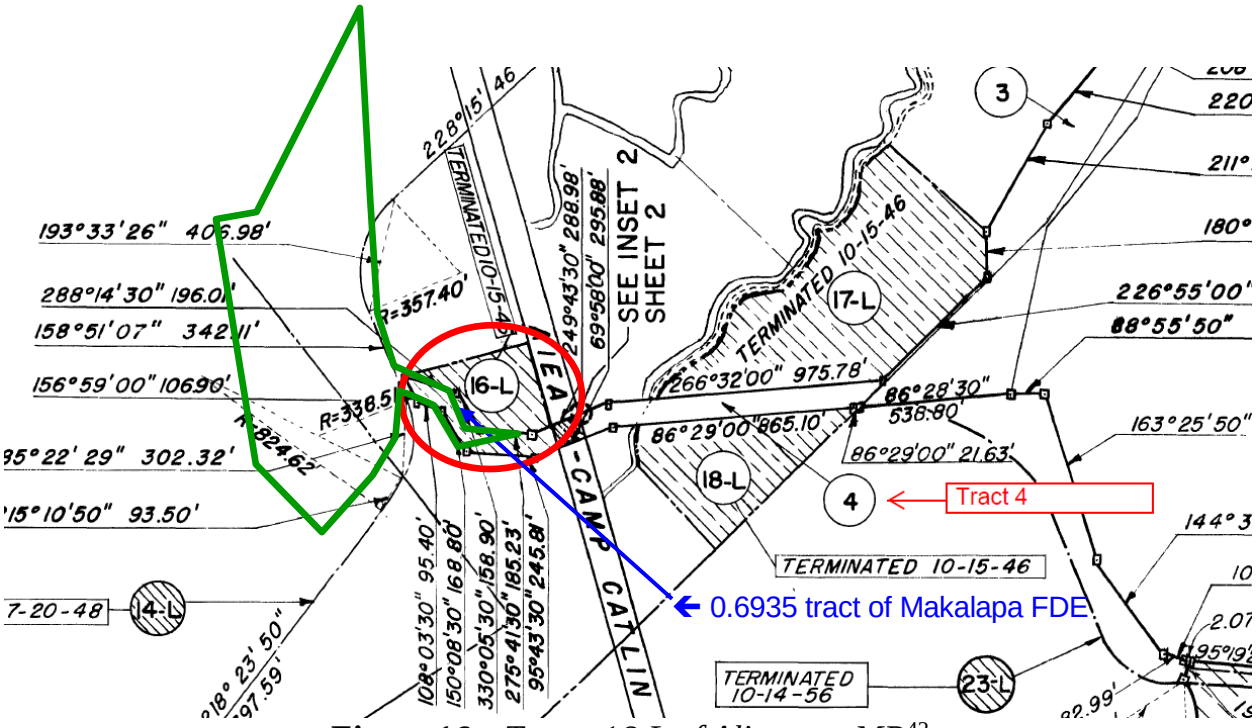


***Figure 16** – Tracts 16-L of Aliamanu MR*[42]

The Acquisition Tract Registration Remarks for Tract 16-L on the Aliamanu MR Real Estate map notes: *"License dtd 11-7-44, previously under license dtd 3-19-42 & Lease W-414-eng-5234."*[43] The location data in Release (License) RE 1128 dated 19 March 1942 is very broad "*South Halawa, Oahu*" and the owner "*Honolulu Plantation Company*" has so much land in the area, that the ownership is not a discriminator or indicator of a specific location. 2.00 acres is penciled-in, possibly annotated after the fact.[44] Lease W-414-eng-5234 dated 3 July 1942, RE 187-E, is for 20 acres with Honolulu Plantation Company and includes four parcels: 7, 14, 25 and 38 as depicted on an attached map (see circled notations and areas in red on following figure).

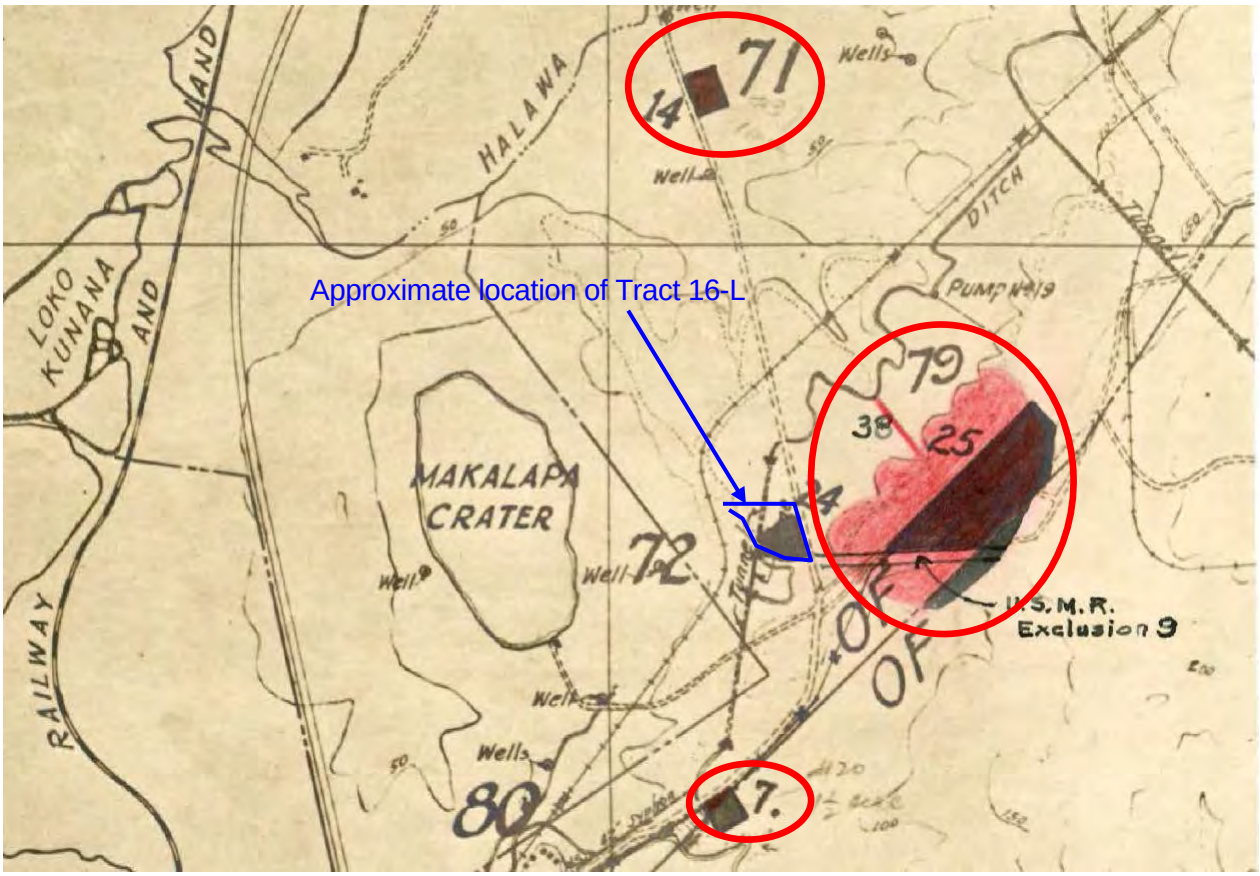


Figure 17 – *Parcels Tracts 7, 14, 25 and 38 of Lease W-414-eng-5234 - 3 July 1942*[45]

Aliamanu MR Tracts 17-L and 18-L are depicted as location. The footprint of Tract 16-L appears to coincide with location 24. Though it is not specifically described in the text of the lease, it is depicted on the attached map (see previous figure; locations 7 and 14 are not included within the Aliamanu MR).[i46] The lease states that it is specifically for location "*25 Land at Makalapa, S. Halawa, in Field 79 '' 18.75"* acres. The lease has been annotated with penciled-in notations that it covers "*Tracts 16-L, 17-L & 18-L".*[47] Supplemental Agreement #2 to Lease W-414-eng-5234 dated 7 November 1944, notes that locations 7 and 14 were returned on 20 January 1944. A License RE 187-E on the same date notes the lease began on 3 July 1942. An attached site plan to this license, RE 187-E, clearly labels the 18.75 acres (see circled polygon on following figure) that are the subject of the agreement but do not include the delineation of Tract 16-L (see approximate delineation in blue). Once again there are penciled-in notations regarding Tracts 16-L, 17-L & 18-L but there is no support for the inclusion of Tract 16-L.[48]

[i] The purpose of the map is unclear but based on the dispersed nature and diminutive size of the parcels it appears to be for acquisition of temporary gun emplacements. This is supported by the Supplemental Agreement to license RE 187-E from 15 October 1946 canceling use of the 18.75 acres which notes the presence of a 16 foot by 16 foot gun position, presumably from use of tracts 17-L & 18-L.

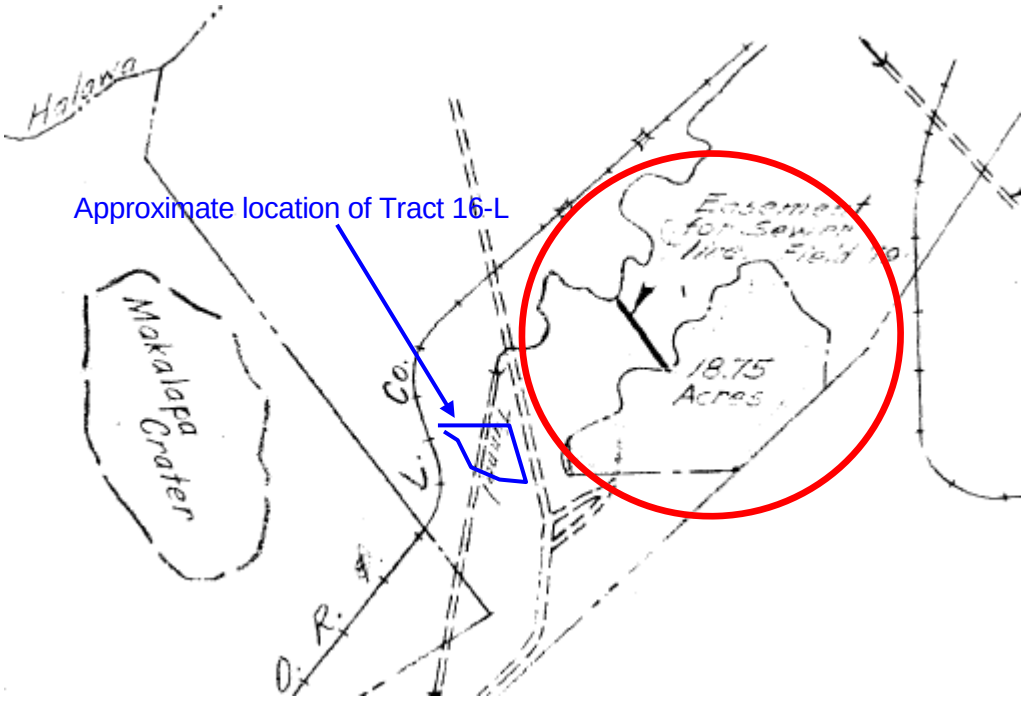


Figure 18 – *License RE 187-E Showing 18.75 acres – 7 November 1944*[49]

The Army's use of the site appears to be as one of the many Anti-Aircraft (AA) gun positions established in the months following the United States entry into World War II. In December 1941/January 1942, the 53rd Coast Artillery (AA) began real estate actions for a gun position at "*Location: 1008.160 – 2679.519"* on leased land from "*Honolulu Plantation Company*"[ii]. By 29 April 1942, the site was associated with the Battery B of the 64th Coast Artillery (AA) on property of "*wasteland at South Halawa, Oahu"*. It included "*approx.. 2 acs. Adj. North bdry. Of Exclusion 9 of said Lot 1 and also Adjoining West bdry. Of Puuloa Rd."*. Nine days later, "*This position is being prepared for 90mm gun battery of 93rd C.A (AA)."* [50]

[ii] Using a topographic map from that era, places Tract 16-L at 1007.95 – 2679.50, a few hundred feet to the west.

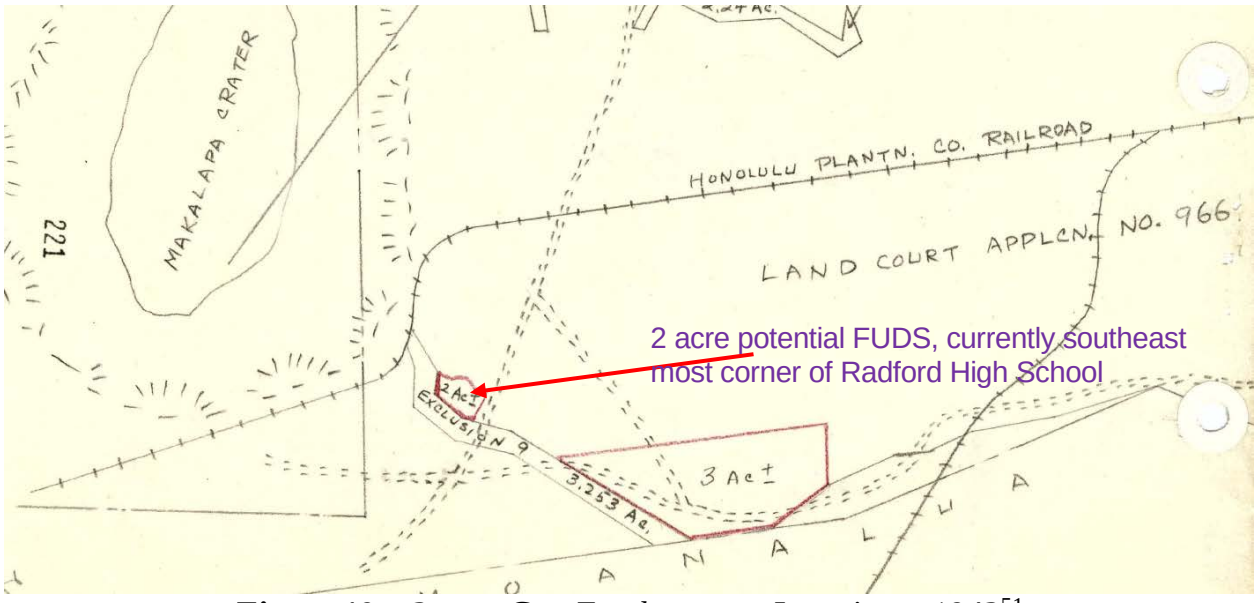


Figure 19 – *2 acre Gun Emplacement Location – 1942*[51]

By August - Setember 1942, the gun position "*in the vicinity of Makalapa Crater*" is assigned to Battery G of the 97th Coast Artillery (AA).[52] In December 1943, reorgainzations of the AA regiments in Oahu had the 97th CA (AA) Regiment become the 97th Anti-Aircraft Artillery (AAA) Group with Battery G becoming Battery C, of the 754th AAA (Gun) Battalion. In March and December 1945, the Hawaiian Antiaircraft Artillery Command (HAAC) noted the Battery C of the 754th AAA Gun Battalion was located to the North of Makalapa Crater, even though it appears to be on the east side.[53] The Aliamanu MR Real Estate map notes the lease for Tract 16-L was terminated on 15 October 1946.[54]

3.3 LAND USE AND OWNERSHIP HISTORY

3.3.1 Prior Land Use

Prior to Navy acquisition and operations at the FUDS property, Makalapa Crater had been developed as a freshwater fish pond, with the surrounding area undeveloped or used as sugar cane fields. The property was restricted by physical conditions within the crater; therefore, development within the boundaries of the crater was limited.

Figure 20 – *Makalapa Crater Used as a Freshwater Fish Pond*[55]

3.3.2 Current Land Use and Ownership

The public has unrestricted access to the former Makalapa Crater Navy Salvage Yard and there are no known land use restrictions or restrictive covenants limiting property development, except for the reserved water line easement along the northwest line of this parcel and a pipeline/subsurface tunnel easement along the eastern leg of this parcel.[56] The current property owners are the City and County of Honolulu and the State of Hawaii.

Following disposal of the property by the military, the land has subsequently been redeveloped for the Radford High School athletic fields and parking lots and the Makalapa Elementary School playground and parking, The main campus and facilities of both schools are immediately east of the FUDS. To the northeast there is a residential subdivision. To the south across Bougainville Drive, there is a commercial warehouse and power grid sub-station. To the west and southwest lies active Navy land including Navy Hale Keiki School (pre-school) and an undeveloped parcel. To the northwest lies Interstate Highway H-1. It is anticipated that the future land use in the area will remain the same. These areas do not appear to contain sensitive environments.

3.3.3 Condition of Facilities Constructed for the Military

The Navy constructed a few buildings on the FUDS during World War II, although none of the buildings are shown on available historical layout plans. The buildings are identifiable on aerial imagery between 1943 and 1945 on the eastern entrance to the site.

In February 1948, the Navy sought approval to sell by sealed bid an unnumbered, 10 by 24 foot building with shiplap siding and felt roof, constructed by Seabees in 1943 at the Makalapa Dump for a cost of $1300. The Navy no longer required use of the building and sought its removal. The building eventually sold for $11.[57] By 1949, the structures are no longer evident on aerial imagery. Details regarding specific building use by the Navy remain undetermined but it was ostensibly related to operations of the dump and/or salvage yard.

3.3.4 Population Demographics

The U.S. Census Bureau provided the following general county and state demographics:

TABLE 3.3.4
U.S. Census Bureau General County and State Demographics [58]

Census QuickFacts	Honolulu	Hawaii
Population, 2014 estimate	991,788	1,419,561
Population, percent change - April 1, 2010 to July 1, 2014	4.00%	4.40%
Population, 2013 estimate	983,429	1,404,054
Population, percent change - April 1, 2010 to July 1, 2013	3.20%	3.20%
Population, 2010	953,207	1,360,301
Persons under 5 years, percent 2013	6.50%	6.50%
Persons under 18 years, percent, 2013	21.70%	21.90%
Persons 65 years and over, percent, 2013	15.50%	15.60%
Female persons, percent, 2013	49.30%	49.50%
White alone, percent, 2013 (a)	23.00%	26.60%
Black/African American alone, percent, 2013 (a)	3.00%	2.30%
American Indian/Alaska Native alone, percent, 2013 (a)	0.40%	0.40%
Asian alone, percent, 2013 (a)	42.60%	37.70%
Native Hawaiian/Other Pacific Islander alone, percent, 2013 (a)	9.40%	10.00%
Two or More Races, percent, 2013	21.70%	23.10%
Hispanic or Latino, percent, 2013 (b)	9.20%	9.80%
White alone, not Hispanic or Latino, percent, 2013	19.70%	23.00%
Foreign born persons, percent, 2009-2013	19.60%	17.90%
High school graduate or higher, percent, age 25+, 2009-2013	90.30%	90.40%
Bachelor's degree or higher, percent, age 25+, 2009-2013	32.10%	30.10%
Households, 2009-2013	309,803	449,771
Persons per household, 2009-2013	3.00	2.96
Per capita income in past 12 months (2013 dollars), 2009-2013	$30,361	$29,305
Median household income, 2009-2013	$72,764	$67,402
Persons below poverty level, percent, 2009-2013	9.60%	10.80%

3.4 PHYSICAL PROPERTY CHARACTERISTICS

Information regarding general property geology, hydrogeology, terrain features, and climatic data is presented in this section. Threatened and endangered species, sensitive environments and places of historical significance (e.g., archeological sites, cemeteries, national historical landmarks, etc.) are also identified.

3.4.1 Climatic Data

Climatological data from the National Oceanic and Atmospheric Administration (NOAA) weather station in Honolulu, Hawaii, provided the following representative data:

TABLE 3.4.1
NOAA Weather Data (1981-2015) [59]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max. Temp. (degrees F)	84	84	85	86	89	89	91	91	92	90	88	85	92
Min. Temp. (degrees F)	59	59	62	64	66	69	71	71	70	68	65	61	57
Avg. Temp. (degrees F)	73.3	73.5	74.6	76.3	77.9	80.2	81.3	82.0	81.6	80.2	77.8	75.0	77.8
Precip. (inches)	2.24	1.87	2.09	0.69	0.74	0.29	0.51	0.72	0.79	1.80	2.27	3.03	16.85

The average maximum temperature has been recorded as 92°F, with an extreme high of 95°F. The average minimum temperature has been recorded as 57°F, with a recorded extreme low of 53° F. The average total precipitation is documented as 16.85 inches, with much of the rain falling from October through March.[60]

3.4.2 Topography

The topography of Oahu consists of two nearly parallel mountain ranges (Waianae and Koolau) that trend northwest to southeast and are separated by the Schofield Plateau. A large, relatively flat, gently sloping coastal plain borders the plateau on the south. Pearl Harbor lies primarily within this coastal plain on the south shore of Oahu. Nearly all of Ford Island and the Pearl City Peninsula are low-lying areas with ground elevations less than 20 feet above mean sea level (msl). To the east, the topography has a maximum elevation of 80 feet above msl at the rim of Makalapa Crater.[61]

Makalapa Crater is a bowl-shaped geologic structure formed by relatively low-permeability volcanic tuff deposits, filled with low-permeability clay and dredged sediment deposits, and overlain by relatively permeable surface and near-surface soils. The interior portions of the crater are relatively flat, although landfill activities with construction and demolition debris have affected local relief in some areas. Slopes, generally gentle to nearly flat, are approximately 0.2 percent within the crater. On the

north side of the crater, the slopes become steeper, up to approximately 20 percent. These slopes terminate at Halawa Stream, which discharges to the East Loch of Pearl Harbor, a few hundred feet west of Makalapa Crater. Drainage swales on both sides of Interstate Highway H-1 receive and direct stormwater flow from the roadway; a stormwater runoff culvert crosses under Highway H-1.[62]

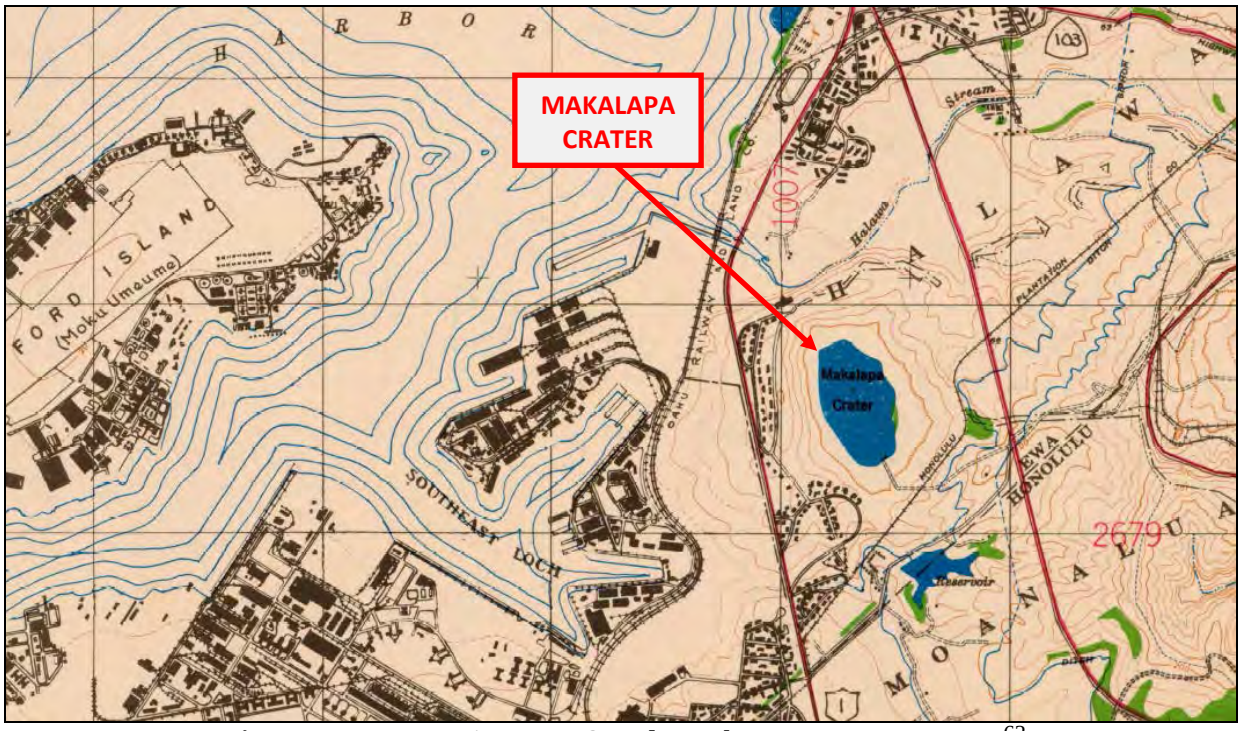


Figure 21 *– Terrain Map Quadrangle Topo Map – 1943*[63]

The undeveloped portions of Makalapa Crater are heavily vegetated. The Integrated Natural Resource Management Plan (INRMP) for Naval Station Pearl Harbor identifies the land use category for the undeveloped portions of Makalapa Crater as Areas with Significant Natural Resource Value. According to the City and County of Honolulu, Department of Planning Permitting, the land use designation of the parcels containing the Makalapa Crater are Conservation District and Urban District.[64]

Undisturbed areas of the crater floor are described as lowland dry and mesic (non-native) forest, woodland, and shrubland. The vegetation within the crater interior is dominated by introduced and alien species such as kiawe, koa haole, and buffelgrass. According to a study reported in the INMRP, three native species occur on the site: Kaunaoa or native dodder (Cuscuta sandwichiana), ilima, and popolo (Solanum americanum). A few low-lying spots support pickleweed and California grass. Although these are wetland indicator species, no area in the crater is defined as a U.S. Army Corps of Engineers jurisdictional wetland due to the absence of hydric soil and hydrology indicators.[65]

Kiawe trees form a closed-canopy forest on the north and east portions of the crater; on the south and west portions, the kiawe forest is open. The understory vegetation consists

of scattered shrubs of koa haole and dense tufts of Guinea grass, and green panicgrass (Panicum maximum var. trichoglume). Along the southern boundary, opiuma trees are locally abundant and form large stands. Thickets of koa haole shrubs are common. Buffelgrass forms a dense mat between woody components in open areas. Weedy annual plants such as hairy spurge (Chamaesyce hirta), coat buttons (Tridax procumbens), Boerhavia coccinea, swollen fingergrass, sowthistle (Sonchus oleraceus), and false mallow (Malvastrum coromandelianum) are present in open areas. The introduced weed Sida ciliaris has been observed along the road that parallels Interstate Highway H-1.[66]

3.4.3 Regional Geology and Physiology

Pearl Harbor is located within the Coastal Plain geomorphic province of Oahu, and is underlain by a thick sequence of coral-reef limestones, volcanic rocks, and alluvium comprising a complex sedimentary formation known as "caprock". The caprock strata include volcanic tuff and ash deposits extruded during the most recent mountain-building stage of volcanism on Oahu. The coral-reef limestones include calcareous beach-sand deposits and finely laminated lagoon limestones interbedded with volcanic tuff and alluvial deposits. Near Pearl Harbor, the caprock formation forms a shelf roughly 6 miles wide at its widest point and more than 1,000 feet thick at the entrance to the main navigation channel. The caprock formation is underlain by older basaltic volcanic rocks extruded as lava flows.[67]

Makalapa Crater is the westernmost of six tuff and ash cones that compose the Salt Lake group of volcanic craters, which generally feature low cones with broad rims and wide craters that have filled with lake and pond sediments. Their shape is typical of vents that erupt explosively after rising magma encounters groundwater at shallow depth and flashes it into steam. In places, surges of steam blowing out of the vents have worked the tuff and ash deposits into cross-bedded dunes. Tuff deposits are formed by the rapid cementation of hot volcanic ash. The tuffs were deposited by explosive eruptions centered on the Aliamanu, Salt Lake, and Makalapa Craters. The oldest crater, Aliamanu, erupted during a period of high sea level, while the Salt Lake and Makalapa craters are younger and erupted during periods of low sea level (i.e., regression). In contrast to the underlying fractured basalts, which have hydraulic conductivity (K) values up to a few thousand feet per day (ft/day), the volcanic tuffs generally have relatively low hydraulic conductivity, typically ranging from about 1 to 100 ft/day.[68]

3.4.4 Regional Soils

Soils on the coastal plain surrounding Pearl Harbor (including the Makalapa Crater) are derived primarily from the caprock formation. The Navy's environmental background analysis guidance document for Oahu (Environmental Background Analysis of Metals in Soil at Navy Oahu Facilities) therefore classifies soils in the site area as part of the Caprock Soil Group (one of four major soil groups identified for Navy facilities on Oahu).[69]

The soils identified at the Makalapa Crater are of the Lualualei-Fill land, Ewa Association. These soils are typically level to moderately sloping, well drained, with a fine-textured to moderately fine underlying material. The soils within the crater are classified as Makalapa Clay and are dark grayish-brown, sticky, and very plastic soils formed in volcanic tuff. Permeability and runoff are very slow for these soils.[70]

Soils surrounding and on the outer slopes of the crater also include the Kokokahi clay series. This very dark gray soil is stony, very sticky, and very plastic. Permeability is slow to moderately slow, with a medium runoff. The native ash, tuff, and soil are overlain throughout most of the area by recent fill deposits. Based on soil borings from the 2015 RI field investigation, the maximum thickness of the dredge-spoil fill material in the crater is estimated at 45 feet near the center of the crater.[71]

3.4.5 Surface Water Hydrology

Pearl Harbor receives fresh water from perennial and intermittent streams, artesian springs, and shallow aquifers. Its three primary tributaries, West Loch, Middle Loch, and East Loch, are drowned riverbeds that formed a single ancient river when the sea level rose. This river flowed into the Pacific Ocean south of the Schofield Plateau, flooding the valley to form the entrance channel to the harbor. The headwaters of the perennial streams Halawa, Kalauao, Waimalu, Waiawa, and Waikele are in the high-rainfall forest reserve of the Koolau Range. The streams are supplemented by five large springs, some of whose water irrigates taro and watercress farms. These streams drain agricultural and newly urbanized lands before passing through highly urbanized areas near the harbor, where they remain brackish for short distances upstream. The drainage area of these streams encompasses approximately 110 square miles, producing an estimated volume of 50 to 100 million gallons per day (mgd) of fresh water and 350 tons per day of sediment entering Pearl Harbor, depending on the season. The State of Hawaii classifies Pearl Harbor as a Class 2 inland estuary. Industrial, agricultural, recreational, and fishery activities are permitted in Class 2 waters, but new industrial discharges are restricted.[72]

The lake that formerly occupied Makalapa Crater was originally formed by a combination of precipitation runoff and discharge from early artesian irrigation wells. During the time the lake was used as a commercial fish pond, two overflow tunnels were in operation near the north rim of the crater. The overflow tunnels led north to Halawa Stream, but are believed to have been sealed and buried prior to filling activities in the 1930s and 1940s. When the tunnels were in operation, surface water runoff near the crater would drain through the tunnels into Halawa Stream and eventually to Pearl Harbor. Reportedly, in the 1940s, two drains were installed; the water was drained and the crater was filled.[73]

During the construction of Interstate Highway H-1, an unknown quantity of fill was placed along the highway corridor to reduce the potential for roadway flooding during

significant rainfall events. It is believed that placement of the fill in the crater altered flow patterns within the crater. To facilitate the flow of water within the crater from one side of Interstate Highway H-1 to the other (generally east to west), a 102-inch box culvert was placed beneath the highway. Presently, surface water flow is reported to be from the northwest to the southeast portion of the crater, where it exits the crater, enters a culvert and ditch system, and eventually empties into Quarry Loch. [74]

Based on site reconnaissance observations performed during the 2011 Navy PA, *"it is likely that surface runoff in the undeveloped portion (i.e., the majority) of the Makalapa Crater is limited"* due to the relatively dry conditions, heavy vegetation, and permeable surface soils. The existing surface topography, soil conditions, and subsurface geology of the crater suggest that surface water generated by rainfall within the crater remains within the crater, infiltrates through the permeable surface and near surface soils, and flows toward the center of the crater as it encounters low-permeability clay and volcanic tuff in the subsurface. Drainage channels on both sides of H-1 Freeway receive storm water runoff from the roadway and direct the runoff southeast, out of the crater, without contacting soil in Makalapa Crater. The large storm water runoff culvert under H-1 Freeway near the southeast end of the crater connects the drainage channels on both sides of H-1 Freeway; therefore, the soils within Makalapa Crater are not likely to contribute significantly to the sediment load discharged to the H-1 Freeway drainage system. Furthermore, the drainage conditions indicate that surface water runoff generated within Makalapa Crater does not flow out of the crater, and that runoff generated outside of the crater does not flow into the crater. [75]

3.4.6 Ground Water Hydrology

Makalapa Crater is situated in the Waimalu system of the Pearl Harbor aquifer. Shallow groundwater, the upper caprock aquifer, occurs under unconfined conditions in the volcanic tuff and sediment deposits. The caprock confines the basal aquifer under artesian conditions. The depth to the caprock groundwater table is approximately 35 to 45 feet bgs. A deep "basal" aquifer occurs within fractured basalts that underlie the caprock formation. Migration of groundwater from the caprock aquifer to the deeper basal aquifer is unlikely because of artesian pressure in the saturated zone within the fractured basalts. [76]

While Makalapa Crater lies inland of the underground injection control line, the shallow groundwater is not considered a potential source of drinking water; RI data from 2015 indicate that the salinity of the groundwater is too high for use as a drinking water source. The RI data also indicate that the groundwater does not migrate to surface water outside of the crater (e.g., Halawa Stream or Pearl Harbor) because it is isolated by the low-permeability volcanic tuff that forms the base and walls of the crater and is confined beneath thick deposits of low-permeability clay that exist throughout most of the crater. [77]

3.4.7 Natural Resources (Threatened and Endangered Species)

According to the U.S. Fish and Wildlife Service (USFWS), Hawaii has the largest number of threatened and endangered wildlife species in the United States. Federally endangered and threatened species are protected by Federal law and must be considered prior to project development. The following wildlife surveys were conducted at Makalapa Crater in 1998 and 2006, as detailed in the 2015 RI Report: [78]

- ***Bird Species:*** The surveys observed 13 species in 1998 and 16 species in 2006; the majority were introduced species. The species observed include Pacific golden plovers (Pluvialis fulva) (protected under the Migratory Bird Treaty Act [MBTA] of 1918) and cattle egret (Bubulcus ibis) (MBTA-listed but are an introduced species and considered a pest in Hawaii). No seabirds, waterbirds, or native landbirds were recorded.

- ***Mammalian Species:*** Mammals documented include small Indian mongoose (Herpestes auropunctatus) and cats (Felis catus), both abundant. Black rats (Rattus rattus) were observed during the 2006 survey only; numbers appear to be low but due to trap interference during the survey (perhaps by mongoose), actual numbers could be higher. The federally listed endangered, endemic Hawaiian hoary bat (Lasiurus cinereus semotus) was not observed but could visit the site.

- ***Amphibian and Reptile Species:*** Reptiles documented include the house gecko (Hemidactylus frenatus) and mourning gecko (Lepidodactylus lugubris); neither species is considered native or protected.

No additional information on the occurrence of rare or endangered species or natural communities within the area of interest is known at this time. This does not mean that other State or Federally listed species may not be present. An on-site inspection by a biologist familiar with the project site and with the species listed is recommended to verify the presence, absence, or location of listed species or natural communities, and to definitively assess the potential for direct, indirect, and cumulative effects likely to result if remedial action is recommended.

3.4.8 Historical and Cultural Resources

Prior archaeological studies indicate that the physiography and climate of Oahu and the Pearl Harbor area have supported human occupation for nearly 2,000 years. At the time of the first contact with Western peoples, the Hawaiian Islands supported the largest and most densely settled population of the Polynesian islands. Most of the population centered on areas where environmental conditions favored intensive agriculture and fishing, especially the natural channels, lochs, and harbors that contained abundant fish and shellfish. Surrounding lands supported the extensive cultivation of taro and the

construction of fishponds and fish traps.[79]

Despite significant ground disturbance, evidence of prehistoric and historic occupation remains in the vicinity of the FUDS including traditional Hawaiian fishponds, agricultural sites, habitation sites, and possible human burial sites. A number of these sites are considered eligible for listing in the National Register of Historic Places (National Register). The former lake at Makalapa Crater was listed as a *"Fish Pond Site"* in an early archaeological survey of Oahu, and, as a result, has been assigned a State Inventory of Historic Places site number (Site 101). However, that early study indicated it was a freshwater pond believed to be of recent origin. The former lake is not considered to be eligible for the National Register. [80]

The National Register of Historic Places, as administered by the National Park Service, U.S. Department of the Interior, did not include any listings of historic places or structures within the boundaries of the Makalapa Crater Navy Salvage Yard. However, National Register properties (eligible or listed) in the vicinity of the subject FUDS include the U.S. Naval Base Pearl Harbor National Historic Landmark (NHL), USS Arizona NHL, USS Missouri NHL, USS Bowfin NHL, Makalapa Building 250 NHL, and over 600 historic facilities. [81]

4 HISTORICAL PROPERTY SUMMARY

***Figure 22** – Pearl Harbor Navy Yard and Adjacent Lands – 30 June 1939*[82]

4.1 CHRONOLOGICAL PROPERTY HISTORY

4.1.1 1937 – 1942, Naval Yard Pearl Harbor Dump and Salvage Lot - Pre-Makalapa Crater

On 14 April 1937, the Army and the Navy signed the Bishop Point Agreement, where the Navy transferred a few acres of land to the Army in exchange for the Naval facilities at Pearl Harbor and vicinity use of the trash dump at Hickam Field, immediately south of the naval yard. It reads in part:

> *"That the War Department agrees to permit the Navy Department to use the Hickam Field trash dump at any time it so desires; and that the Navy Department agrees to assume responsibility for the segregation, burning and policing of its own trash".*[83]

In the days following the 7 December 1941 Japanese attack on Pearl Harbor, the Navy established a Base Force Salvage Operation to reclaim equipment, ordnance, and material from the damaged vessels. In addition to the salvageable material, there was "*material unfit for any further use*" or "*trash*" to be disposed of. In early 1942, the salvage operations at the Pearl Harbor Navy Yard made use of the Hickam Field dump for

burnable and non-burnable "*trash*". For "*scrap*" *("all metal fit only for remelting"*), the Navy "*…stripped all fittings, separated it into ferrous and nonferrous piles and placed in the dump at Richardson Recreation Center"*.[84]

Subsequently, the Army and Navy filled in the low lying lands of Hickam Field suitable for dumping with garbage and rubbish until May 1942 when the medical authorities condemned the dump for unsanitary conditions. The unsanitary conditions resulted from extinguishing the burn piles nightly for blackouts due to the war. Additionally, sparks from the dump burn piles caused fires in an adjacent bunker storing B-17 aircraft. As a result, the Army established a temporary dump near the bomb storage magazine on the east side of Hickam Field but there was limited available space for this. The need for a better solution would be a source of friction between Hickam Field and the 14th Naval District in 1942.[85]

4.1.2 1939 Naval Yard Pearl Makalapa Crater expansion

By 1938, the Navy sought to expand the existing Navy Yard at Pearl Harbor (see previous figure). Following unproductive informal negotiations with property owners for land, the Navy acquired approximately 370 acres, by an Order on Declaration of Taking, Civil No. 416, in the United States District Court for the Territory of Hawaii filed on 30 October 1939. The land was part of the Estates of (Queen) Emma Kaleleonalani and Bernice P. Bishop.[86] The Declaration of Taking included lands to the east and northeast of the Navy Yard, with the eastern portion including Makalapa Crater (see pink area following figure).

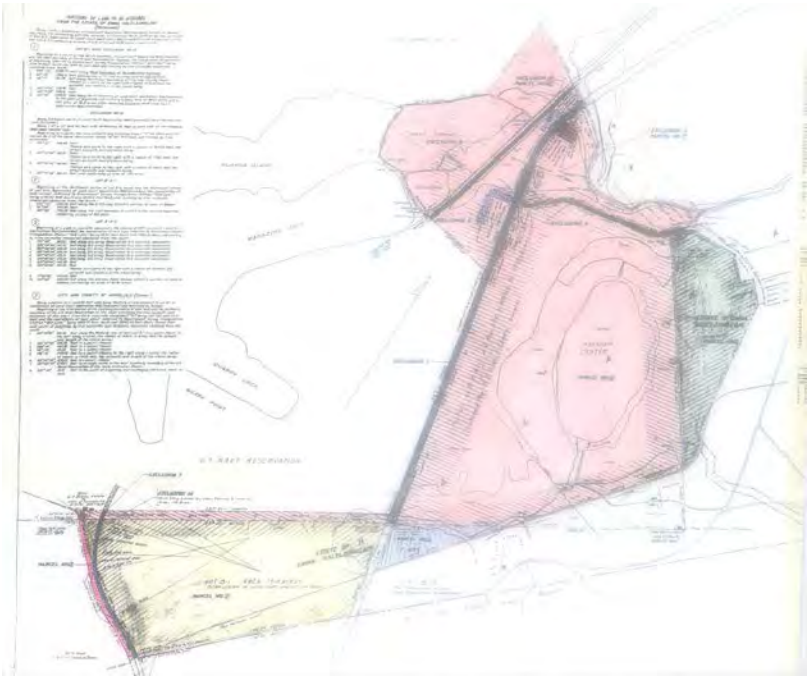


***Figure 23** – Lands Adjacent to Pearl Harbor Navy Yard to Be Acquired – 6 September 1939*[87]

The Navy used the newly acquired Makalapa Crater as a disposal area for material from their dredging operations in the nearby channels around the base. Previously, water in the crater had been used to raise fish in the existing pond. The crater provided an additional 8 to 10 million cubic yards of volume for the Navy to dispose of the soupy dredge spoils from the suction dredge pumped to the crater in submerged lines in Pearl Harbor. The dredge "soup" was an estimated 50 feet above the harbor level on 7 December 1941 and had a bomb struck the levee on the south end of the crater where the crater rim was broken out, the dredge material would have escaped, adding to the catastrophe (see following figure).[88]

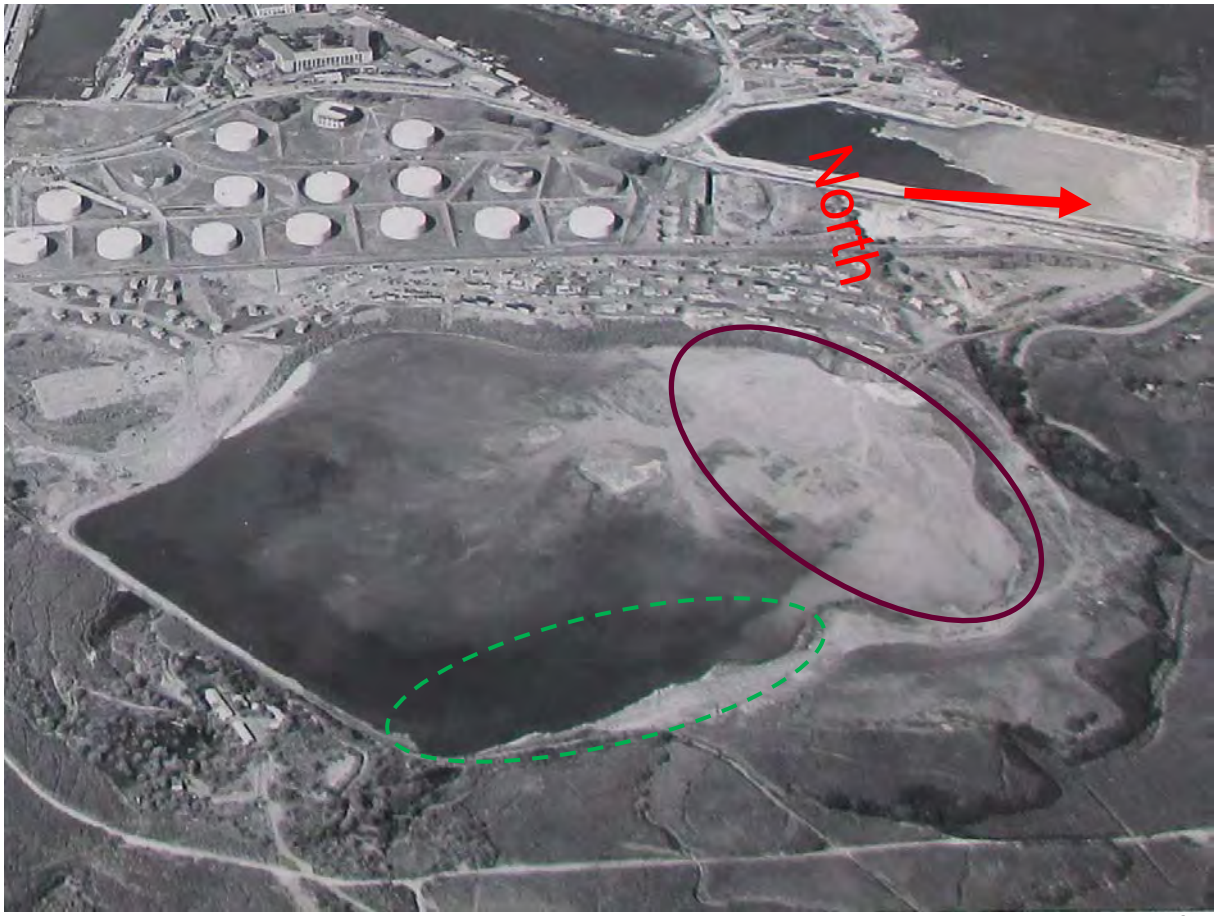


Figure 24 *– Oblique Aerial of Makalapa Crater looking west - 30 October 1941*[89]
Note: lighter toned dredge entering northwest side of crater as annotated with a brown ellipsoid and approximate area of FUDS with green dashed ellipsoid

Following the attack on Pearl Harbor and Oahu, Navy development and use of the Makalapa Crater and the surrounding area became more vigorous as the base entered into a war-time footing (see following figure for military facilities in vicinity within two years).

***Figure 25** – Navy and Army Installations – 1 January 1944*[90]
Note: approximate FUDS boundary annotation (green dotted line) added for clarity

4.1.3 1943 – 1946, Makalapa Salvage Yard and Dump

By January 1943, the Navy had also established a salvage facility at Makalapa Crater, in addition to the Richardson salvage facility (see following figure).

Figure 26 *– Handling Scrap Steel at Berth 23 headed for Makalapa Salvage - 18 January 1943*[91]

In 1943, the Navy shipped millions of pounds of salvaged material to the mainland including scrap steel, brass, manila rope, tires, rubber scrap and other needed material. The Navy Yard continued to use both the Richardson and Makalapa salvage lots during that period. At the Makalapa salvage yard all material was segregated into various piles of like metal, including cast iron, brass, copper, and lead for local Navy Yard use and aluminum to the mainland. By this time, the Richardson salvage lot received items that could be used again in the Navy Yard following repair, such as lockers, chairs, valves and other items. At Richardson, the material was cleaned, painted, fixed up and returned to the ships or shops in the area.[92]

Beginning approximately in January 1943, the Navy also established an open burn area on the east side of Makalapa Crater. As noted on 16 April 1943 by the Commandant of the 14th Naval District to the Army Corps of Engineers, Honolulu District:

> *"Owing to the necessity several months ago for the Navy to discontinue refuse burning in the Fort Kamehameha- Hickman Field area, an emergency disposal area for open burning was urgently required.* [sic] *Due to lack of other facilities, this open burning area was established at the present site East of Makalapa Crater.* [sic] *Results at this location have not been very satisfactory owing to the nuisance caused, congested traffic, and other objections."*

At that same time, the Army had proposed construction of an incinerator at this location, which the Navy disapproved due to the noted difficulties and a planned eventual use in the area for housing. Within a few months, the Navy began using Makalapa Crater *"as a dump, due to the discontinuance of dumping on the Hickman Field Reservation."*[93] Despite the less than ideal conditions, the open burning would continue for the next three years.

***Figure 27** – Oblique Aerial of Makalapa Crater looking south-southeast - 12 December 1943*[94]
Note: smoke from debris burning on east side of crater

At the end of July 1943, the Chief of Naval Operations formally established a Material Recovery Unit at Navy Yard Pearl Harbor under the Bureau of Supplies and Accounts with the supplies and personnel assembled at Port Hueneme.[95] Through November 1943, the Industrial Department and the Supply Departments jointly handled the scrap at Pearl Harbor. However, after securing additional personnel, the Supply Depot took over handling the scrap at Makalapa. The Supply personnel segregated the scrap and the Industrial personnel inspected and removed material for reconditioning to the Richardson

Center for rehabilitation. The Supply personnel assembled, packaged, and shipped the remaining scrap. The Navy's Public Works Division continued "…*to separate the wood and lumber disposal dump"* that was nearby.[96] The different naval organizational elements (i.e. Supply and Public Works) would operate the two different missions (i.e. salvage and disposal) on adjacent areas on the northeast and east side of the crater, though the separation between the areas was somewhat ambiguous, shifting and overlapping at times.

By September 1943, the Makalapa dump office complained that they also received undesired "*garbage*"[iii] from ships at the Navy Yard in addition to "*refuse*". The Navy Yard commander issued direction to stop this from occurring.[97] In the greater vicinity of Pearl Harbor, the Navy and Marine Corps also made use of the City and County of Honolulu dumps at Ewa and Waianae at this time.[98]

By spring 1944, the War Department policy relating to return of overseas scrap, which apparently paralleled Navy policy, excluded the following scrap materials from return:

> *Light sheet iron, including strapping, signal wire, tin cans, scrap rubber (other than Tires and tubes), empty wooden boxes and cases, empty ammunition· fibre containers [sic], lumber, damaged mattresses and pillows, metal drums thinner than 18 gauge [sic], cotton and woolen rags, leather, waste paper, and food waste will not be returned."*[99]

Evidently this material was disposed of locally.

By August 1944, reduced demand for scrap on the mainland resulted in scrap accumulation at Makalapa, to the point that the Navy Yard Commander requested the Army and its various posts *"to discontinue the dumping of all kinds of scrap at Makalapa*" but posing "*no objection to the Army's continuing to take away metal and lumber scrap from the dump as at present*." The Army agreed to this.[100]

[iii] To clarify, the historical definition of "garbage" is organic wastes such as meat, fish, fowl, vegetables, fruits, edible oils, and greases. At the time, refuse or waste was segregated between garbage and combustible and non-combustible rubbish. "Trash" referred to waste material that would burn. "Ashes" were the solid inert remains of burned materials.

***Figure 28** – Short Steel in Makalapa Salvage Yard - 29 October 1944*[101]

By May 1944, careless use of the Makalapa Dump for disposal of combustible refuse by the Navy Yard and outside activities left waste material scattered along the approach roads, causing extra work for the labor forces to pick it up. To address the problem, Yard Orders regulated the speed of the trucks and their condition (e.g. not overloaded, having a tailgate, having a tarpaulin cover when hauling light material). By July, enforcement of the regulations was turned over to the Marine Corps garrison.[102]

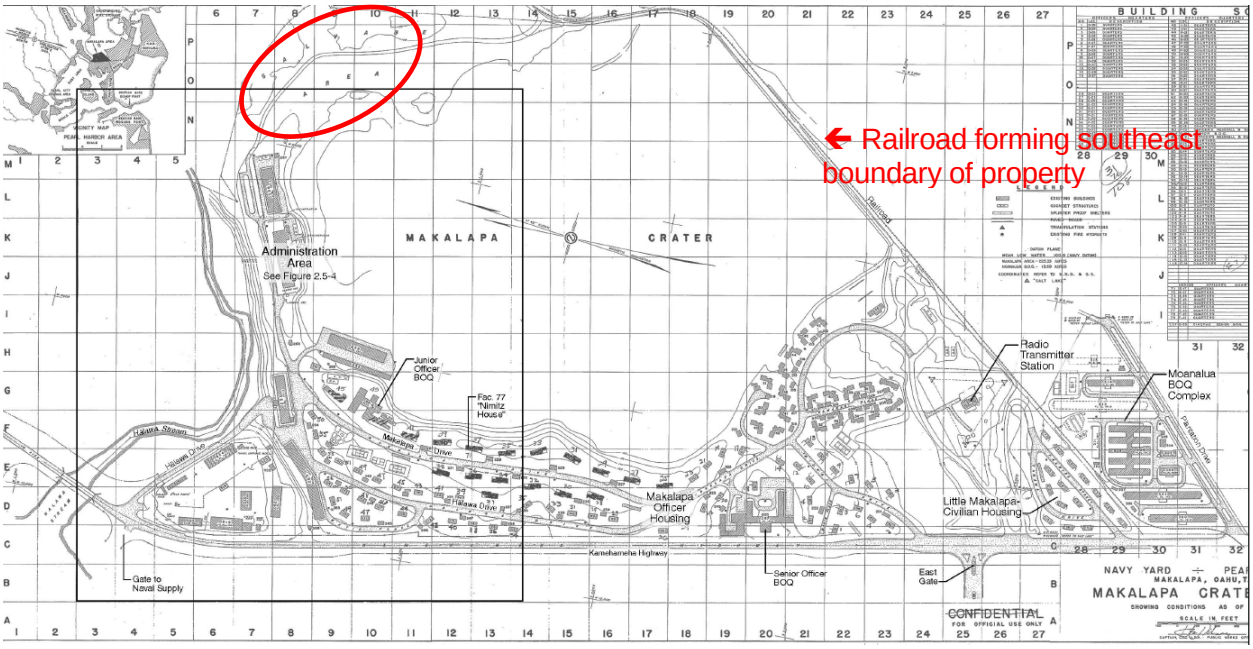


Figure 29 *– Navy Yard Pearl Harbor - Makalapa Craters Showing Conditions as of 30 June 1944*[103]

Note: "Salvage Area" designation (red ellipsoid annotation), but no designation of the dump on the east side of the crater.

On 16 August 1944, the Navy Yard entered into a contract to salvage material at the "Makalapa Rubbish Dump" through 30 June 1945. The contractor paid the government $1,001 a month to remove metals, rags and miscellaneous material other than lumber from the dump. The miscellaneous salvage contractor did not have access to the lumber segregation area, having use of the following area.

> *"Makalapa Rubbish Dump is hereby defined as that area at which waste or rejected matter such as trash and debris is dumped, pending salvage or destruction by burning. The area involved is at Makalapa Crater above Kamehameha Highway beyond Officers' Housing; its confines are staked off from the Metals Salvage Recovery Lot."*

The Navy signed a separate contract for removal of salvageable lumber from the Makalapa Dump. These contracts somewhat limited recovery of salvageable items, although the Pearl Harbor Commander still issued permits to persons or organizations deemed worthy (i.e., Queen's Hospital, among others, particularly throughout 1945) to recover material.[104]

By August 1944, the Makalapa Dumps serviced "*approximately 1,000 to 1,200 truck loads per day*" and the Navy studied alternative locations for the Makalapa Dump "*in view of the increasing nuisance of the burning of trash*" there. That October, personnel from the Navy Medical Department found:

a) The approach roads for more than a, mile in each direction are littered with material spilled from trucks.
(b) In spite of the fact this is supposed to be a dry trash dump much organic material and garbage is included in the trash delivered to the dump.
(c) This materiel accumulates for some time before it is burned and this provides ample attraction for flies which are everywhere evident. It also allows time for breeding.
(d) Cans are throw on the dump unflattened and containing food material. The food material attracts flies and each unflattened can becomes a potential mosquito breeding place after each rain. Burning does not remove the latter hazard.
(e) The odors created by the rotting organic material end the burning trash is distinctly obnoxious.
(f) There is a constant stream of heavily loaded, bulky vehicles on the access highways to the dump".[105]

Figure 30 *– Unprepared Scrap at Makalapa Salvage Yard – 29 October 1944*[106]

Although the Navy proposed five alternative locations, all proved objectionable due to fire hazards and smoke nuisances and it does not appear that any of the proposed alternative locations were ever used. On 28 October, the Commander in Chief of the Pacific Fleet and Pacific Ocean Area approved moving "*the central trash burning dump around the rim of the Makalapa Crater to an area on the southeast side…as a temporary trial expedient*" (see following figure).[107]

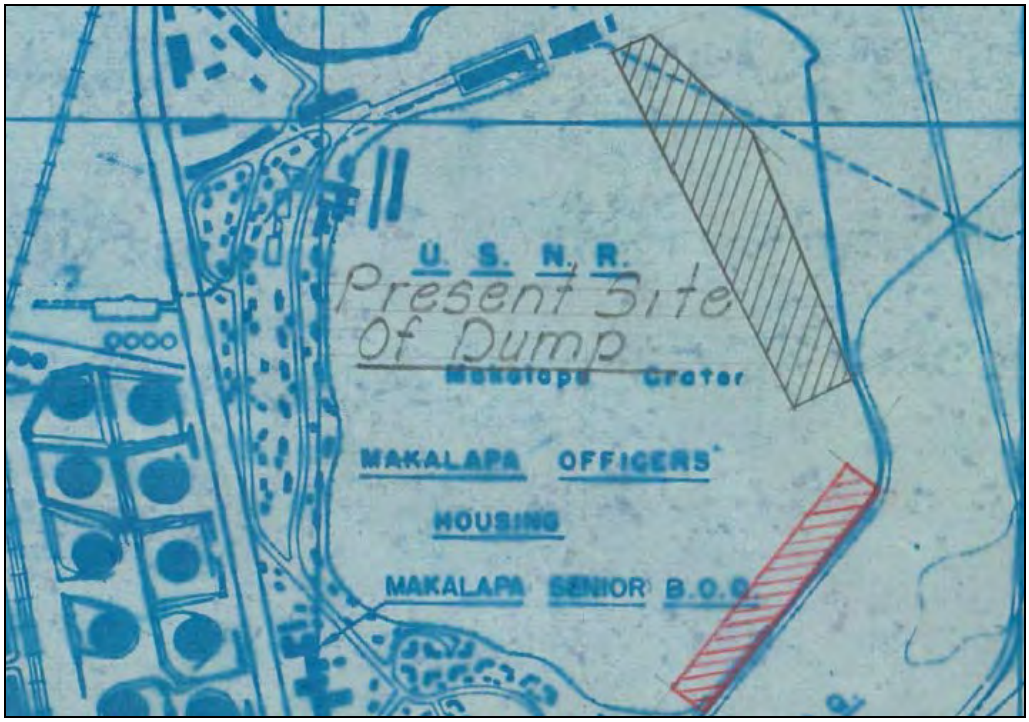


Figure 31 *– "Present Site of Dump" and Approved Relocation – 28 October 1944*[108]
Note: the approved "trial" location (red hatching) translates to the current location of the Navy Hale Keiki School and the baseball field of Radford High School.

Figure 32 *– Oblique Aerial of Makalapa Crater looking northeast - 29 December 1944*[109]
Note: smoke from debris burning on east side of crater

In December 1944, the Navy Yard determined that on average 950 trucks hauled rubbish and trash into Makalapa Dump daily, with a high of 1,200 and a low of 750 trucks a day. The breakdown of users was:

45% Naval Seabees
25% Naval Supply Depot (Damon Track)
15% Marine Corps (USMC Barracks, Camp Catlin and USMC Transient Center)
10% Navy Yard Pearl Harbor (Shop 70, Shop 08, Naval Housing, SubBase)
5 % All other Naval Activities (Aiea Receiving Barracks, Honolulu Naval Air Station, Moanalua Naval Hospital, Royal Hawaiian Hotel, Aiea Hospital & Ford Island)[110]

In January 1945, the Navy's Bureau of Yards and Docks recognized that disposal of refuse in "open dumps" was not sanitary, recommending substituting the "*sanitary fill*" method "*unless such substitution is clearly impractical because of nature of subsoil and lack of available suitable material for cover*."[111]

A survey of the Makalapa Dump in January 1945 determined that initially the "*dump was solely for the disposal of combustible matter but the dump is now used as a garbage disposal area by many district activities, who do not segregate their garbage and refuse*". Furthermore, the report concluded:

> *"Practically the whole dump is a potential breeding area as garbage, swill, trash, refuse and salvage materials are all being haphazardly dumped apparently without the benefit of adequate supervision. It has been the practice to dump all materials to be burned the day after dumping on one side of the dump while the material dumped the day before was being burned on the other side. There has been no banking nor regularity of dumping to insure proper burning.*
>
> *[sic]A tremendous amount of wet garbage and swill has been mixed with the refuse materials dumped consequently the burning as has been accomplished was not efficient enough to destroy all organic matter leaving great quantities of it that remained warm , fermented and became breeding spots for the flies."*

This use resulted in a fly infestation around the dump. Suggested changes to the operations of the Makalapa Dump included:

- Rejection of loads with garbage or refuse, returning it to the activity dispatching it
- No salvage dumping allowed excepting in designated salvage area.
- Sufficient fill material be thrown on the dump to cover present burned over areas to a depth of 18 inches

- Conversion of the present dump "*into a bank fill dump with a face not less than 8 feet nor more than 12 feet in height. The face of the dump should be kept vertical if possible and full combustible material burned daily; as the dump fills in it should be covered with earth, ashes, etc.*"[112]

The problems in part stemmed from muddled organization of the activities of the Supply Department and the Yard Refuse Disposal Organization under the Public Works Officer. In late 1944, the Naval Supply Depot extended their Material Reclamation function to cover Makalapa Dump, while responsibility for maintaining the burning function of the dump, its sanitation, etc., remained under the Public Works Officer. Enlisted men driving the incoming trucks, including garbage, ignored directions of the civilian supervisor attempting to control the material coming to the dump.[113]

Within a week, the Navy Yard Commandant directed that an officer armed with a pistol inspect trucks arriving at the dump and inform the commanding officers of any activity sending "garbage" to the Makalapa Dump. The officer then prepared a written daily log of the offending organizations and the commanders contacted them through the end of the month.[114]

Eventually the responsibility for checking the loads garbage fell to a Chief Petty Officer in Shop 00-70 of the Public Works Office, who was in charge of four civilians. The civilians put out fires, cleared areas after burning and directed dumping. By September 1945, the foremost issue facing operations at Makalapa Dump apparently concerned the continuing disposal of usable material at the dump.[115]

In July 1945, the Army's Ammunition Storage Area (Aliamanu Crater), just to the east of the crater, hauled its burnable trash to the Honolulu dump near Sand Island and sought permission to use the "*Pearl Harbor dump*" a mile away. On 17 September the 14th Naval District approved the burning of 30 to 50 trucks of trash daily on a trial basis, provided it only consisted of burnable material (e.g. dry grass, brush, scrap lumber). No metal was permitted unless acceptable to the metal salvage area. It is unclear how this arrangement worked out; however at most it lasted less than 6 months. By early 1946, Army units in the vicinity were directed to use the dump at Fort Kamehameha and on 12 February 1946 Army units were directed to cease using joint Army Navy dumps and only use Army dumps effective immediately.[116]

By early November 1945, the contract to salvage miscellaneous material at the Makalapa Rubbish Dump paid the government $1,800 a month, raising speculation that in order to justify that rate, significant amounts of material was present that should have never been deposited at the dump. The Supply Officer recommended canceling the contract in light of this and a request by the contractor to lower the monthly fee due to reduced activities following the end of the war.[117] Anecdotes by citizens in the surrounding area also recounted the disposal of much usable material at Makalapa.[118]

After the end of the war in November 1945, control of all the operations at the Makalapa Dump remained somewhat muddled between the Material Recovery Unit under the Naval Supply Depot and the Publics Works Office of the Navy Yard. Some of the issues revolved around permits issued by the Navy Yard Commandant to governmental agencies and charitable and civic organizations to procure scrap material from the dump but not the Material Recovery Unit area. Following the cessation of hostilities, the Navy limited the policy to only governmental agencies and shifted the responsibility for responding to the requests to the Naval Supply Depot.[119]

Use of the "*Makalapa Dump*" was roughly divided between the "*Burn"* area on the east side of the crater and the salvage area on the northeast side of the crater. The "*Burn"* area was for burning trash collected and brought there by activities in and around Pearl Harbor. The salvage area operated for the recovery of usable material, the preparation of scrap metal, issuance of reclaimed or reclaimable items and preparation of the scrap metal for shipment to CONUS. Following the end of WWII, CONUS scrap metal shipments were halted indefinitely, reducing required operations to only the salvage function. Prior to December 1945, there was "*no sharp line of demarcation…established either as to area or performance of functions, and men from the Navy Yard, from the District Public Works Office organization and from the Navy Supply Depot were all working in the same area.*" As such the Supply Officer completed a partially constructed fence to separate the salvage work, under the Naval Supply Depot, from the trash disposal area operated by the Public Works Officer. The Navy Supply Center completed the fence on or about 10 January 1946 (see following figure).[120]

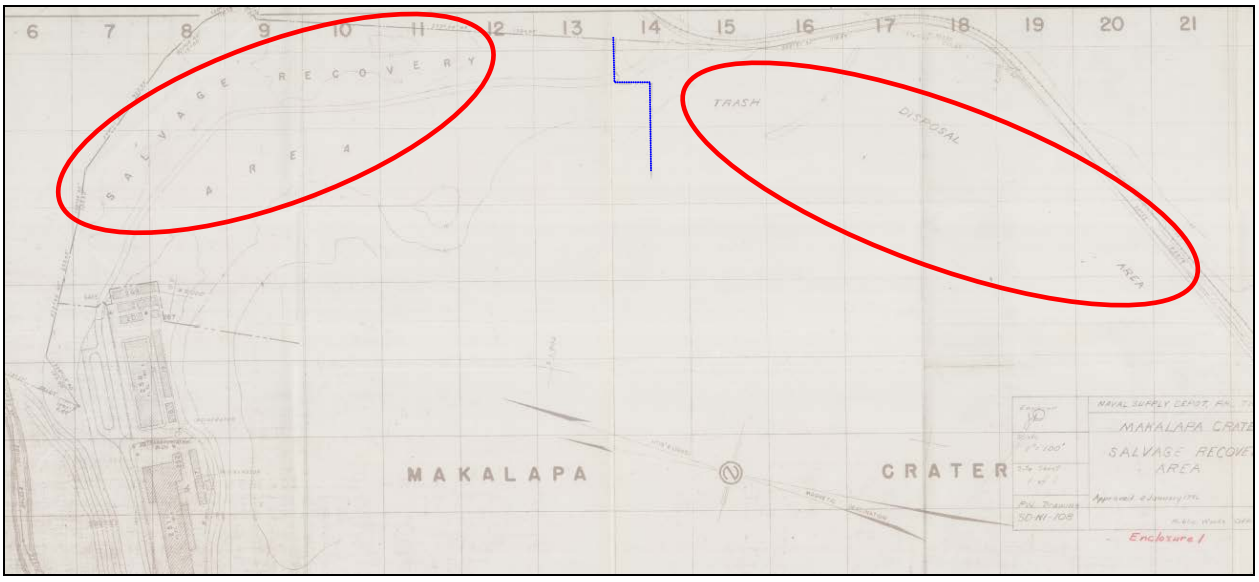


Figure 33 *– Fence between Salvage Recovery Area and Trash Disposal Area – 3 January 1946*[121]

Note: "Salvage Recovery Area" and "Trash Disposal Area" designations. Blue dotted line annotation add to fence location for clarity

Base orders in January 1946 directed that "*Only combustible trash and scrap lumber should be hauled to the trash area of the dump"* and that *"Loads shall be dumped as directed by the Public Works representative at the dump"*.[122] The 14th Naval District continued directing that "*Scrap metal is hauled to the Makalapa Dump*".[123]

In Mid-February, all Naval activities in the Pearl Harbor area continued using the eastern rim of Makalapa Crate as a burning area for trash, although smoke and flying ash continued to be a nuisance to the CinC Pacific Fleet and the adjacent residential area.[124]

Naval Base Pearl Harbor closed the Makalapa Dump effective 14 April 1946 with the establishment of a new trash burning pit and dumping area for all Naval Activities in the Pearl Harbor area on the Pearl City Peninsula. The new facility did not support salvage operations.[125]

4.1.4 1946 – 1985

Following closure of the Makalapa Dump, it appears that operations in the area were mostly idled but the Navy would continue to fill the crater over the subsequent years. In June 1949, the Navy granted a permit to the Navy Hale Keiki School, a cooperative association of parents, to relocate from a closing facility to Quonset Buildings Nos. 30-32 in the Makalapa Area to provide nursery and prekindergarten services to children of service personnel.[126] Aerial photography confirms these buildings were on the land immediately adjacent to but not on the subject FUDS, where the school currently sits.

In 1951, a local scrap metals firm, Pacific Suppliers, Ltd., described the Makalapa dump as follows while seeking permission from the 14th Naval District to purchase or lease a portion to acquire additional scrap, citing the National Production Authority: *"…Makalapa dump was at one time a major dumping ground for scrap iron and was sold at various times for scrap. However, it was finally covered over leaving many hundreds of tens forgotten."*[127] No evidence was found to confirm this request was ever allowed.

In May 1952, the 14th Naval District granted permission to the Hawaii Board of Commissioners of Agriculture and Forestry, Division of Fish and Game, to stock Makalapa Pond with Tilapia Mossambica on an experimental basis for two years in order to help control the nuisance algae growth. Previous attempts to control the algae by chemical means and other fish had not proved successful. Among the stipulations to the agreement was that "*The Department of the Navy will continue its fill operations on the shores of Makalapa Pond under the present program of land restoration. No responsibility will be assumed by the Navy s to the effect of this filling operation on the fish.*"[128] The results of this experiment are unknown, as are the details of the Navy's fill operations. By June 1953, Navy Development Plans acknowledge that the soil bearing qualities for Makalapa Crater are unsuitable for buildings and that the area was to be kept in grass, with a golf course in the vicinity.[129] Aerial imagery shows that within five years

the area of ponded water within Makalapa Crater is essentially all gone, either having evaporated or having been replaced by fill that is covered by vegetation (see section 4.4 for aerial photo analysis).

By August 1956, the City and County of Honolulu acquired a 10 acre site for construction of a new high school to serve the Pearl Harbor area adjacent to the Makalapa Crater with the understanding the Navy would lease 15 acres to the school completing the site. In March 1957, the Navy formally leased 15 acres to the City and County of Honolulu for a public school, specifically Radford High School (RHS) for 25 years, with the lease retroactively starting on 1 August 1956. At the time, the Navy's projected land use for the parcel did not meet the criteria for surplus and complete land transfer (see following figure).[130]

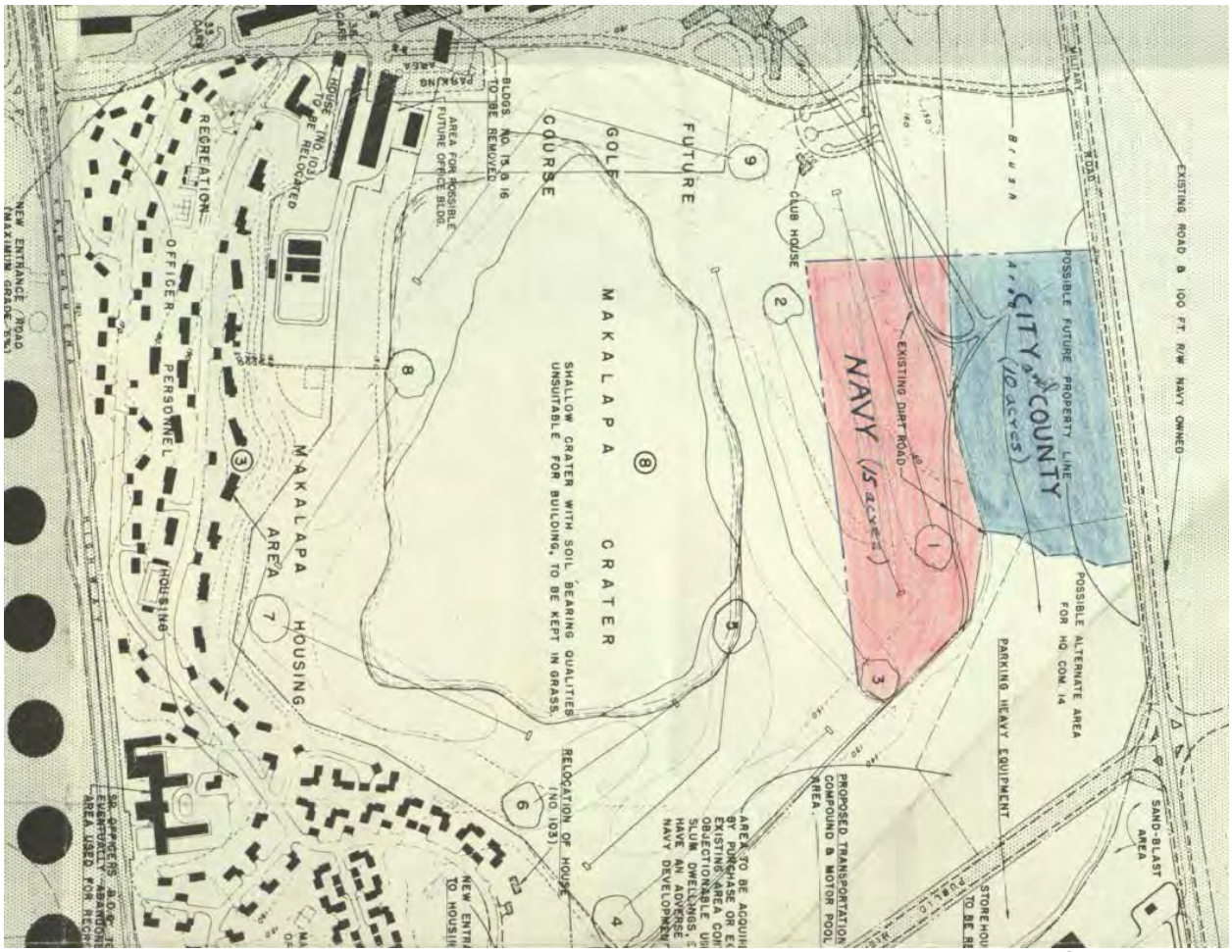


Figure 34 *– Makalapa Complex Development Plan – August 1956*[131]
Note: 1956 Annotations to 1953 Master Development Plan denote approximate location of RHS (red shaded area ~15 acre parcel and is a portion of subject FUDS). Also note, many features depicted, such as the golf course, are only possible development plans.

In May 1957, the Army granted a permit to the Navy to build a power line on an undeveloped portion of the extreme western end of the Aliamanu Military Reservation. The Army acquired the parcel in 1916 with the intent ostensibly of providing transportation access from Aliamanu to the Honolulu Plantation Company Railroad that defined the southeastern edge of the Makalapa Crater. The Army formally transferred this land, 1.092 acres, to the Navy on 1 October 1957. 0.6935 acres of this transfer is part of the subject FUDS.[132]

The RHS developed the 15 acre lease land for athletic and recreational purposes, sporting outdoor basketball courts, a football field with lights and bleachers by 1961 (see following figure). Based on the limited amount of fill present, the Public Building Service, a federal movement disposal agency, evaluated the site and determined it did not lend itself for building subdivisions and recommend transferring it to the state.[133] On 5 March 1962, the United States, through the Department of Health, Education, and Welfare (HEW), deeded the 15 acres to the City and County of Honolulu.[134]

***Figure 35** – 15 acre RHS "Looking* [at] *south central portion of site" – 22 June 1961*[135]

In the late 1960s with the planned construction of Interstate Highway H-1, a three and a half acre parcel of land on the northeast side of the crater would be separated from the rest of the Makalapa Naval Reservation as the highway alignment would cut across the crater. The triangular parcel would be landlocked between RHS, the highway and the newly planned Makalapa Elementary School (MES). Construction on MES began in 1970 and would continue through 1971, before accepting students in January 1972. The

Navy issued a license to the State of Hawaii for the 3.577 acre triangular parcel for school parking and playground "Until area conveyed to State; otherwise from 15 Aug 1971 to 14 Aug 1974". Following a declaration of surplus, on 10 November 1975, HEW formally deeded the 3.577 acre tract to the State of Hawaii for education.[136] A decade later on 17 April 1985, the Naval Facilities Engineering Command (NAVFAC) deeded the third and final FUDS tract, consisting of 0.6935 acres, to the State of Hawaii for use of the RHS.[137]

4.1.5 1983-2015, Naval Investigations

Since 1983, the Navy has been conducting environmental assessment of the Pearl Harbor Naval Base (PHNB)/JBPHH including portions of Makalapa Crater. As a result of the initial investigations, the Environmental Protection Agency (EPA) proposed listing the Pearl Harbor Naval Complex (PHNC) geographic area (EPA Facility Number HI4170090076) for inclusion on the National Priorities List (NPL) on 29 July 1991 with a final date of 14 October 1992. In March 1994, the Navy, U.S. EPA and the State of Hawaii Department of Health (DOH) signed a Federal Facilities Agreement to address investigations and cleanup activities. The PHNC is divided into 18 Geographic Study Areas (GSAs), including one for Makalapa Crater (see section 2.2 of this PA for overview of relevant studies).[138]

Between December 2013 and January 2014, a construction contractor for the State of Hawaii Department of Education (DOE) encountered buried debris and stained soil during excavation work to replace the old cinder running track at RHS with a new all-weather (synthetic) track. Preliminary data determined that the soil was contaminated, and DOE stopped construction work and closed off the track and field in January, securing the excavated material. Samples collected by DOE found elevated levels of arsenic, lead, mercury, and dioxins in the excavated soil. DOE also found munitions related debris, including a small projectile fuze and expended cartridge cases, in the excavated soil. In March 2014, the DOH conducted sampling of surface soil and bare areas of the RHS campus and MES.

On 24 January 2014, the Hawaii DOH Hazard Evaluation and Emergency Response (HEER) office notified the Navy of the conditions at the school. Subsequently, the NAVFAC contracted for sampling and removal and disposal of stockpiled soil. On 25 August 2014, NAVFAC received Right of Entry approval and began work that day on the Time-Critical Removal Action (TCRA). The TCRA included:

- **Access Road** - Establishing a temporary access road behind the Navy Hale Keiki School, close to the H-1 Freeway to reduce traffic on school grounds. Completed 8 September 2015.
- **Track** – Excavation to 1 foot deeper than DOE planned to excavate for the new track followed by placement of an orange geotextile fabric liner and 1 foot of clean fill. Completed 6 March 2015.

- **Football Field** – Removal of top 1 foot of clean soil and an additional 1-3 feet of contaminated soil and debris followed by placement of an orange geotextile fabric liner and 1 foot of clean fill. Completed 6 March 2015.
- **Debris Screening –** Screened all debris in stockpiles and excavated material (~18,690 tons); inspected all metal debris. All munitions related items found during the TCRA (hundreds) were inspected and confirmed safe (no explosive hazard). Completed 4 March 2015.
- **Disposal –** excavated and screened soil and debris were transported to a permitted disposal facility.
- **Miscellaneous -** Placement of concrete cap at former visitor's bleachers and a layer of gravel and gunite (shotcrete) under the home bleachers. Placement of geotextile liner, six inches of top soil and grass at other locations of soil contamination (i.e. north of track).

Completion of the NAVFAC TCRA efforts at RHS continued in 2015, concurrent to this FUDS PA.

4.2 MILITARY OPERATIONS

4.2.1 Operations Involving Military Munitions

4.2.1.1 Munitions Scrap and Debris Disposal at Makalapa Crater Dump

Munitions activities at the former Makalapa Crater Navy Salvage Yard included the disposal of munitions scrap during landfill operations that inadvertently included MEC on occasion. By January 1943, the Navy had established a salvage facility as well as an open burn area on the east side of Makalapa Crater. During 1943, the Navy noted that there had been a number of times when items surveyed as scrap and delivered to the Makalapa Salvage Lot, such as spent machine gun cartridges, had not been properly examined for live loads and explosives. This posed a hazard to the employees charged with burning trash and salvaging scrap and was against district orders.[139] The scrap shipment of explosive materials (e.g. ammunition, booby traps, mines, bombs, sealed gasoline drums and fuel tanks) to U.S. ports would remain a sporadic issue, requiring diligence of salvage personnel to prevent this through 1944.[140]

In December 2013, a construction contractor for the State of Hawaii DOE encountered buried debris and stained soil during excavation work to replace the running track at RHS. Among the debris, the DOE contractor found munitions related debris and scrap in the excavated soil. Initial site surveillance support by the Air Force 647th Civil Engineering Squadron Explosive Ordnance Disposal Flight (647th CES AF EOD Flight) observed a projectile fuze at the site. Subsequent site walks and photograph reviews by the 647th CES AF EOD Flight and Naval Ordnance Safety and Security Activity (NOSSA) identified three other items: a 105 mm projectile cartridge base, a 90 mm

howitzer cartridge, and a cartridge case for the 5-inch Mk 4 Mod 0 Navy projectile. As such, the Navy initiated a TCRA to screen the excavated debris for material potentially presenting an explosive hazard (MPPEH) properly address any MEC identified address potential explosive hazards at the site.[141]

Preliminary data shows between 9 September and 20 November 2014, the TCRA contractor recovered 844 pieces of munitions / MPPEH during field efforts, including but not limited to cartridges, cartridge cases, fuzes, igniter/flash tubes, practice bombs, practice grenades, small arms projectiles and packaging. The items found were primarily determined to be expended, empty or inert. Of the 844 items, the contractor considered two items as possibly containing explosives: one M100 series bomb fuze and one Type 89 Japanese Powder Time fuze. The contractor turned both items over to Navy EOD personnel.[142] Analysis by Navy EOD confirmed that neither item contained explosives.[143]

The Navy provided a TCRA status update to the public (including Fact Sheet) at the Joint Base Pearl Harbor-Hickam (JBPHH) Restoration Advisory Board meeting held on 14 July 2015. At that time, the Navy reported that *"All munitions related items found during the TCRA were inspected and confirmed safe (no explosive hazard)."* [144] A final TCRA report was not completed at the time of the FUDS PA investigation.

4.2.1.2 Makalapa Crater Pistol Range

The Navy established a small arms pistol range in near proximity but not on the subject FUDS. A 1944 Navy site plan depicts firing lines and target line / berm approximately 25 yards apart with a "*Target Range Gallery*" building (Building 256) 50 yards from the target line. The pistol range is immediately adjacent to the southern end of Makalapa Crater, just to the west. The direction of fire was northeast towards Makalapa Crater (see following figure).[145]

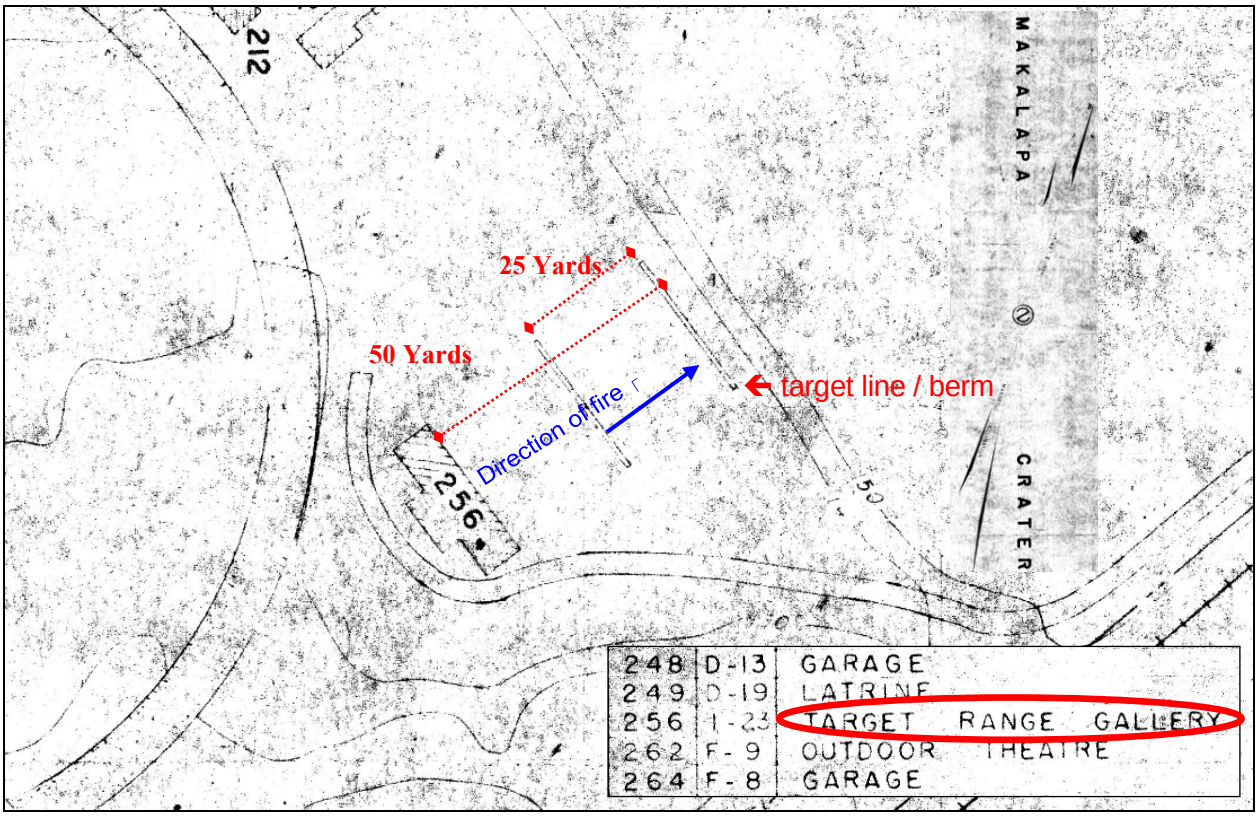


Figure 36 *– Navy Pistol Range - June 1944* [146]
Note: annotations added for clarity

Although, the range is not on the subject FUDS property, the range fan for pistol firing (1,600 yards) would extend onto the Makalapa Crater Navy Salvage Yard FUDS property.[147] On 19 March 1946, a civilian was shot in the head by an overshot from the Makalapa Crater Pistol Range. Prior to that, the Base Security Officer recommended closing the range due to frequent complaints and safety concerns from personnel working at the Makalapa Dump.[148] The Pistol Range is readily discernable on aerial imagery in the 1940s, with the main salvage yard area about 1,000 yards away but fill areas existing as close as 250 yards (see following figure). The former range firing lines and targets are currently covered by Interstate Highway H-1.

***Figure 37** – Makalapa Crater Pistol Range - Aerial Imagery 14 July 1945*

Legend

- Confirmed FUDS Property boundary
- Naval Yard Pearl Harbor boundary 1941
- Crater water levels 26 November 1941
- Pistol Range

4.2.1.3 Summary of CW Activities

The investigation team uncovered no documentation relating to CW activities at the former Makalapa Crater Navy Salvage Yard. The investigation team found no indication that the DoD conducted CW activities training, storage or disposal at this property.

4.2.1.4 Certificates of Clearance / EOD Incidents

This investigation did not reveal any certificates of ordnance clearance, decontamination, or dedudding associated with the Makalapa Crater Navy Salvage Yard FUDS property. Additionally, no EOD incidents associated with the subject FUDS were identified other than those noted as part of the RHS TCRA (see section 2.2.9).

4.2.2 Operations Involving HTRW

4.2.2.1 Waste Disposal Areas / Landfills

By January 1943, the subject FUDS included a material scrap salvage yard, open burning trash disposal area and a solid waste land fill. The salvage and disposal operations occurred on adjacent areas on the northeast and east sides of the crater, though the separation between the areas was somewhat ambiguous, shifting and overlapping at times, though in early 1946 a fence eventually separated the salvage and disposal operations (see following figure).

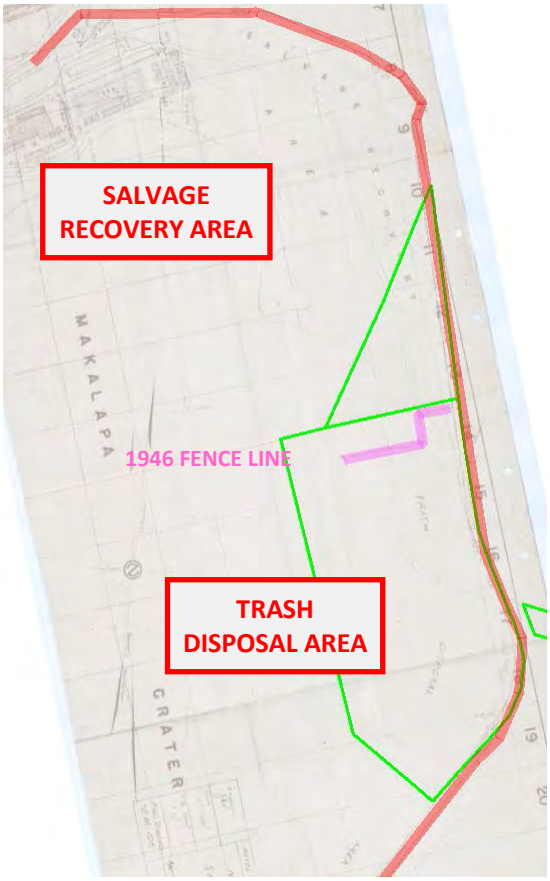


Figure 38 – *Navy "Salvage Recovery Area" and "Trash Disposal Area" - January 1946*[149]

Salvage activities included segregated materials into like piles, including cast iron, brass, copper, lead, and aluminum at the salvage yard.[150] By the end of 1943, the Navy Supply Depot handled the scrap at Makalapa. Personnel would inspect and remove material for reconditioning with the remaining scrap being assembled, packaged, and shipped off-site. Following WWII, scrap metal shipments were halted indefinitely, leaving only salvage operations.

Immediately south of the salvage yard, the Navy established an open burning area on the east side of Makalapa Crater. The open burn area was for burning trash collected and brought there by activities in and around Pearl Harbor.
Available documentation does not explicitly state what the Navy did with the non-combustible material left after burning or non-burnable material brought to the dump. Analysis of the historic aerial imagery clearly show the expansion of land along the eastern perimeter of the crater in 1943 and 1945 as compared to 1941. The "new" land includes areas of piled material or fill (see section 4.4)

In addition to refuse, the Makalapa dump office complained during 1943 that they were receiving undesired garbage from ships at the Navy Yard.[151] By mid-1944, the Makalapa Dump reportedly serviced "*approximately 1,000 to 1,200 truck loads per day*" and by the end of the year, an average of 950 trucks a day.[152] In October 1944, the Commandant approved a shift of the *"Present Site of Dump"* on the east side of the crater to the southeast side of the crater on a trial basis.[153] Initially the *"dump was solely for the disposal of combustible matter but the dump is now used as a garbage disposal area by many district activities, who do not segregate their garbage and refuse*".[154]

By January 1945, standard Navy guidance directed that *"the practice of refuse disposal by open dumping should be discontinued as soon as practicable and the dumps covered over with a minimum of two feet of suitable fill".*[155] It is unclear if earthen cover was used at the Makalapa Crater, and if so where fill was taken from.

The Makalapa Dump was officially closed in April 1946 with the establishment of a new trash burning pit and dumping area for all Naval Activities in the Pearl Harbor area on the Pearl City Peninsula.[156] It is unclear when salvage operations ceased at the FUDS. However, aerial imagery confirms that by 1949, there is no clear evidence of material piles, indicating salvage operations had ceased prior to that.

Operations at Makalapa Crater generally match standard military practice of the time which dictated establishing a garbage and refuse collection system that allowed the segregation of salvageable materials (i.e., grease, paper, cardboard, glass, tin cans, wood, metal, ash) with the remaining materials typically further segregated into burnable and non-burnable waste (i.e. refuse). The burnable waste was burned and the remainder was sent to a landfill [157] Additional details regarding Navy waste management practices of the period after the war can be found in the Navy Technical Publication on Refuse Disposal (TP PU-1) from September 1952.[158]

4.2.2.2 Pesticides [iv]

As part of general facility maintenance, the Navy likely used pesticides at the subject FUDS, although specific details concerning the pest control activities are undetermined.

In October 1944, personnel from the Navy Medical Department determined that organic material and garbage included with the trash at Makalapa "*accumulates for some time before it is burned and this provides ample attraction for flies which are everywhere evident. It also allows time for breeding."* In addition, "*cans are thrown on the dump unflattened and containing food material. The food material attracts flies and each unflattened can becomes a potential mosquito breeding place after each rain. Burning does not remove the latter hazard."*[159]

Additionally, standard Navy guidance from January 1945 provides details regarding recommended "*Refuse Disposal*" operations. *"Attention is directed to the disposal of refuse on open dumps at Naval activities. This method of disposal is neither sanitary nor economical. Such dumps encourage rodent breeding with attendant nuisances and hazards to health. The burning of refuse on open dumps creates a further nuisance and does not eliminate rodents."*[160]

By January 1945, operations at the Makalapa Dump resulted in a pest infestation (i.e. flies, mosquitoes, and rodents). Infestations caused the Navy to suggest operations changes at the dump, including rejecting improper garbage/refuse loads and adding sufficient fill material to cover present burned over areas to a depth of 18 inches.[161]

No available documentation confirms use of pesticides on the FUDS to control pest infestation from the dump, much less specific details regarding types, quantities, and locations of use. However, the proximity of the dump to the Naval housing on the west and southwest side of the crater, particularly when the dump location shifts to the southeast side of the crater after October 1944, makes pesticide application appear probable.

4.3 MAP ANALYSIS

The investigation team located several site-specific layout plans for the former Makalapa Crater Navy Salvage Yard. The relevant information from those maps and plans are discussed elsewhere in this PA.

[iv] The EPA considers herbicides under the "pesticides" category which also include insecticides, fungicides, antimicrobials and other substances and pest control devices used to control insects, weeds or microorganisms such as bacteria and viruses.

The map-located structures related to possible HTRW storage, usage, and disposal on the property are discussed in detail in Section 4.2. In addition, maps located a small arms pistol range in the vicinity of the FUDS, as discussed in Section 4.1. Real estate features of the site are discussed in Section 3.2

4.4 AERIAL PHOTOGRAPHIC INTERPRETATION

Government and contractor personnel conducted an aerial photography database search (see Appendix A.2). The aerial photography retrieved covered the former Makalapa Crater Navy Salvage Yard during and following military use. The imagery acquired includes the following.

Table 4.4.1 - Aerial Photography Dates
26 November 1941
24 September 1943
14 July 1945
29 November 1949
21 June 1950
3 April 1952
April 1957
19 January 1959
4 December 1962
15 February 1965
26 February 1968
30 October 1960
24March 1972
5 January 1978
2 May 1985
25 September 1993
18 April 2013

The analysis used stereo viewing of photography, which allows more accurate identifications than monoscopic interpretations. The resolution and scale of the imagery limited the identification of features discussed in this study. The analyst delineated imagery containing important areas on hard copy plots and digitized it using Geographic Information System (GIS) software. The digitized features overlay scanned aerial photography, resulting in the figures below. The analyst used the word “probable” when discussing features for which identification is reasonably accurate. The analyst used the term “possible” when identification was not positive, but the object/area matched known features/locations on other sources. Analysis of the aerial photographs references the site maps discussed in Section 4.3 above. (Note: Feature description numbers are not transferable between imagery figures of different years.) The sub-paragraphs below describe the relevant features identified on the imagery.

The measurements of features in the aerial photo analysis are all approximations, whether specifically stated or not. Measurements from the photo prints are converted to distances based on the stated accuracy of the imagery, which vary between frames and flight lines. Another factor affecting the measurements of features is the scale of the imagery. At the higher scales, the features being measured are smaller and more difficult to measure. The interpretation measurements are estimated to be within approximately 20% of the actual values.

4.4.1 26 November 1941

This aerial imagery shows conditions of the site just before the Japanese attack on Pearl Harbor. The dredge filling of the crater is clearly underway with fill entering the crater from the northwest as evidenced by the solids settling out and forming a distinctive dendritic drainage pattern (**1**). The water levels in the crater extend to the widest lateral extent (blue polygon annotation) of available imagery. The majority of the western portion of the FUDS (green polygon annotation) is covered by water (**2**). On the northeast side of the crater, there is an unvegetated band approximately 150 feet wide, possibly associated with exposed rock (**3**). There are dirt trails to and through the eastern area (**4**), within the naval installation (red annotation represents boundary). Within the area there are stockpiles of manufactured items in open storage (**5**). Outside the naval boundary, east of the Honolulu Plantation Company Railroad that defines the southeast boundary of the FUDS, the fields appear to be in production (**6**).

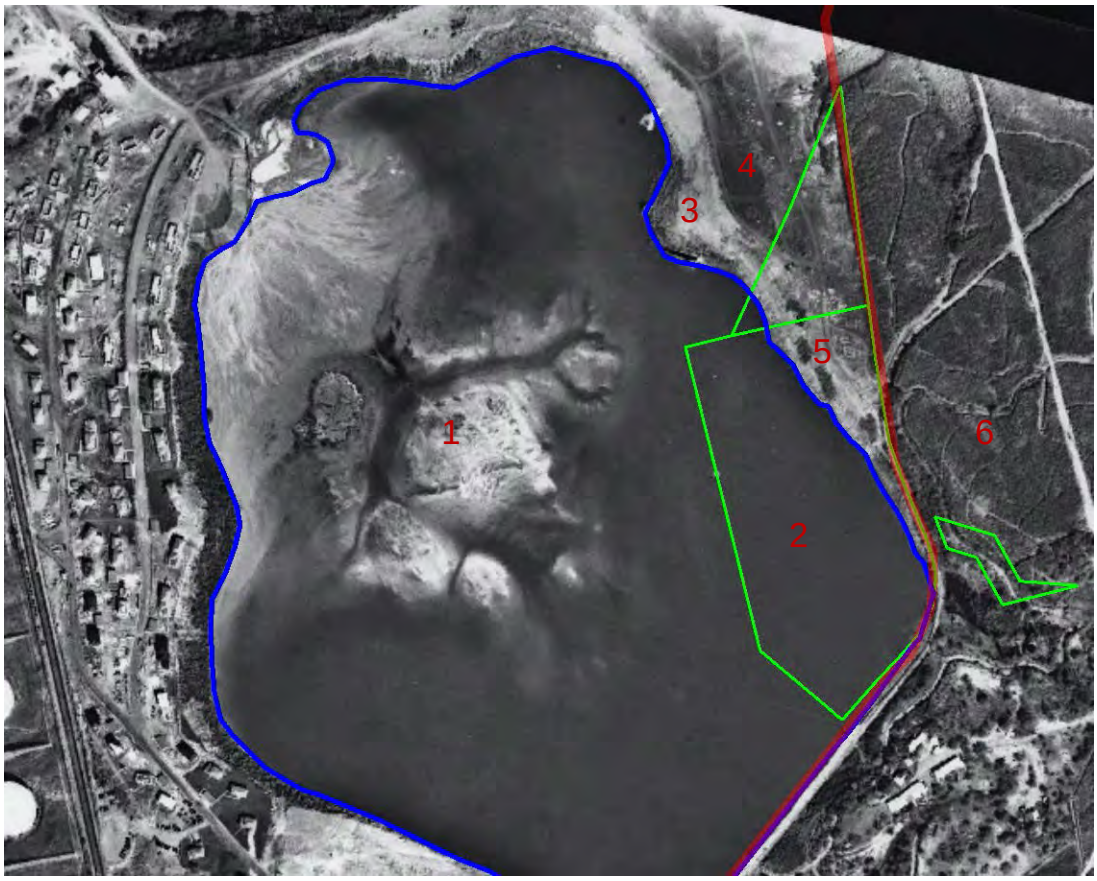


Figure 39 *– Aerial Imagery 26 November 1941*

Legend

- Confirmed FUDS Property boundary
- Naval Yard Pearl Harbor boundary 1941
- Crater water levels 26 November 1941

4.4.2 24 September 1943

This imagery is just under two years after the previous image. There are only a few areas of pooled water in the crater (**1**) with dredge spoils (**2**) appearing to fill the rest. Along the northeast perimeter, the Navy has constructed buildings on areas formerly covered by water (**3**) and prepared another rectangular area for construction (**4**) (blue polygon annotation equates to November 1941 water level extent). The stockpiles of material (**5**) in the Navy salvage yard, established approximately nine months earlier, are readily visible on the northeast side of the crater, with a road network between them. A few buildings exist in the area (**6**) on the eastern edge of the property near the road entrance just north of the rail line (**7**). There is not a clear delineation between the salvage yard and burning ground dump. Evidence of active burning (**8**) is visible with a dark shadow smoke to the west (**9**)[v]. On the eastern edge of the crater, there is evidence of a shelf above the lower dredge fill (**10**) that had apparently been covered by water in the 1941 imagery. It is unclear if this is a natural shelf or evidence of dumped fill. There is clear evidence of recent material dumping occurring at the southeast end (**11**) of this area. Outside the naval boundary (FUDS), east of the railroad, a portion of the field has been cleared with some signs of activity at the location of the possible gun emplacement, though the features are indistinct, possibly camouflaged (**12**) .

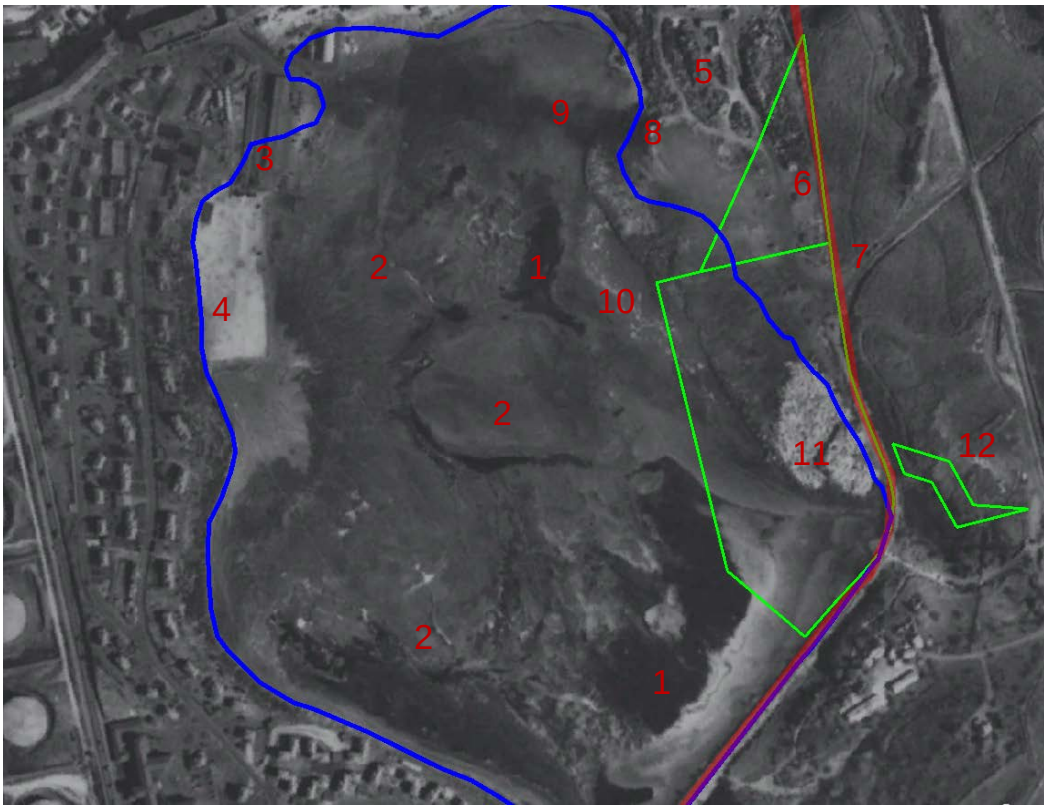


Figure 40 *– Aerial Imagery 24 September 1943*

[v] This is approximately 200 yards north of the later 1946 fence separating salvage and dump operations.

4.4.3 30 June 1944 Site Plan

For comparison the Navy site plan does not delineate the features or land use evident on the aerial imagery.

Figure 41 *– Site Plan Pearl Harbor Naval Yard Makalapa Crater– 30 June 1944*

4.4.4 14 July 1945

The July 1945 image is a single overhead frame, as opposed to imagery taken for stereo viewing and mapping (note print framing). As in the 1943 imagery, there are only a few clear areas of pooled water in the crater (**1**) but the middle appears to be a mix of dredge spoils and water. The west side of the crater fill (**2**) appears more solid but the building construction has not expanded beyond those previously visible (**3**) or where a pad had been prepared for construction in 1943 (**4**). There are piles of material (**5**) in the Navy salvage yard area but they are less distinct and organized than before, with less distinction between the dump and burning ground to the south. A few buildings remain on the eastern perimeter (**6**). There is no evidence of active burning but there is recent material dumping visible (**7**), some of the fill extending beyond (i.e. east) of the 1941 water level. Most of the eastern perimeter of the crater exhibits a mottled pattern indicative of dumping, as does the southeast side of the crater just interior from the railroad (**8**) of this area. Outside the naval boundary (FUDS), east of the railroad, there is no evidence of activities and the fields have apparently revegetated (**9**).

Figure 42 *– Aerial Imagery 14 July 1945*

4.4.5 2 January 1946 Site Plan

A Navy site plan from January 1946 shows the location of a fence (pink annotation) installed to separate the *"Salvage Recovery Area"* from the *"Trash Disposal Area"*, though that distinction was not clear on previous aerial imagery.

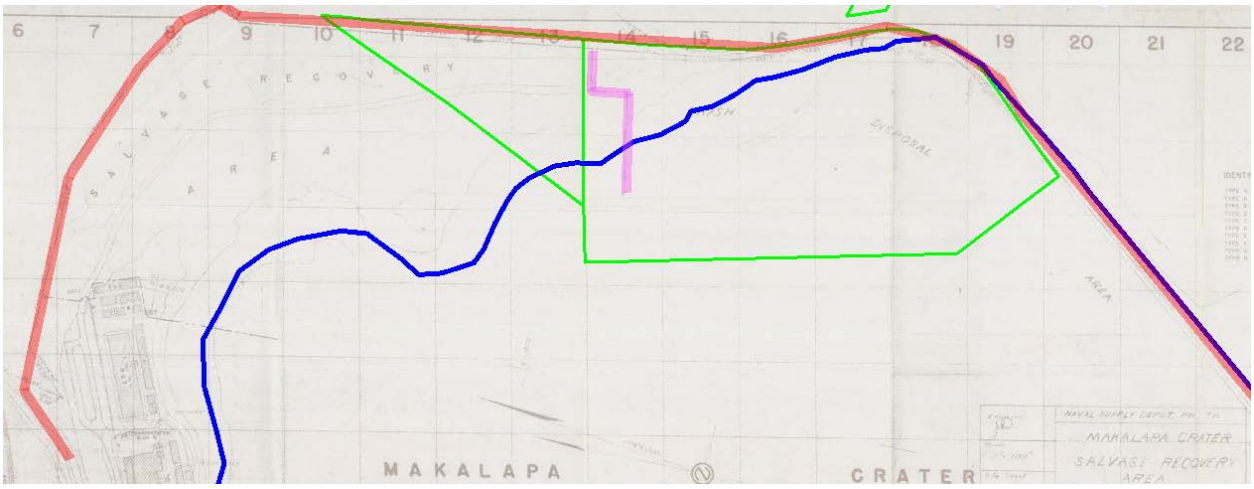


Figure 43 *– Site Plan Makalapa Salvage Recovery Area – 2 January 1946*
Note: Figure rotated 90º counterclockwise

4.4.6 29 November 1949

In November 1949, the war had been over for over four years and Makalapa Crater dump had been closed for 3 ½ years. The center of the crater has standing water (**1**). The western and eastern sides of the crater are significantly filled in from what they had been before the war. There are no material stockpiles visible in the former salvage yard (**2**), although there is active earth moving occurring on fill along the northeast perimeter of the crater (**3**). Areas of the dump have vegetated (**4**) though patches remain bare (**5**). A well-traveled perimeter road has been added to the west of the railroad right-of-way (**6**) on the FUDS parcel. A bare earth area is visible on the former salvage yard (**7**) with a few dark toned north-south lineations, possibly rills or berms.

Figure 44 *– Aerial Imagery 29 November 1949*

4.4.7 21 June 1950

Seven months later in June 1950, conditions remain similar to the 1949 imagery in this single overhead frame. The shadow of the plane is visible on the surface water in center of the crater (**1**) (purple annotation added to clarify limit). The western and eastern sides of the crater have been filled in. As in 1949, active earth moving is occurring on fill along the northeast perimeter of the crater (**2**). Areas of the dump have vegetation but non-vegetated patches appear larger, indicative of some activities occurring (**3**). The bare earth area on the former salvage yard (**4**) remains similar to 1949.

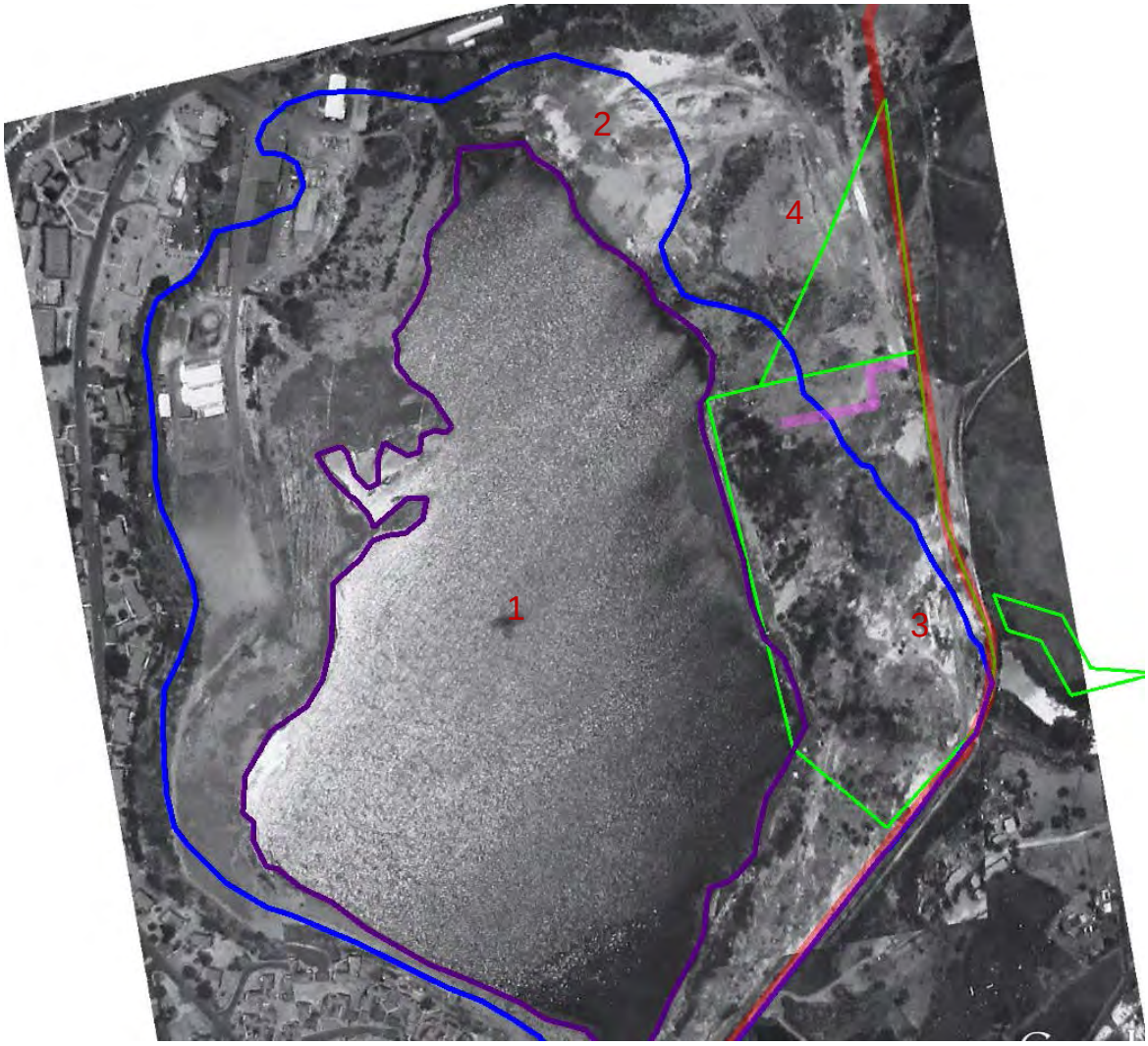


Figure 45 *– Aerial Imagery 21 June 1950*

4.4.8 3 April 1952

A year later in 1952, there is less standing water (**1**) within the crater and the fill on the north, east and southeast perimeters are vegetating (**2**). A straight road (**3**) from a parking lot north of the crater leads to a road along the railroad right-of-way and an eastern entrance to the site (**4**). There is a devegetated lineation (**5**) along the west side of the FUDS extending between the north and south end of the navy boundary that is possibly related to a pipeline emplacement. There is some evidence of earth moving (**6**) on the northeast side of the crater but it is unclear if this is active. The bare earth area on the former salvage yard (**7**) remains and has vegetation growing on one of the lineations.

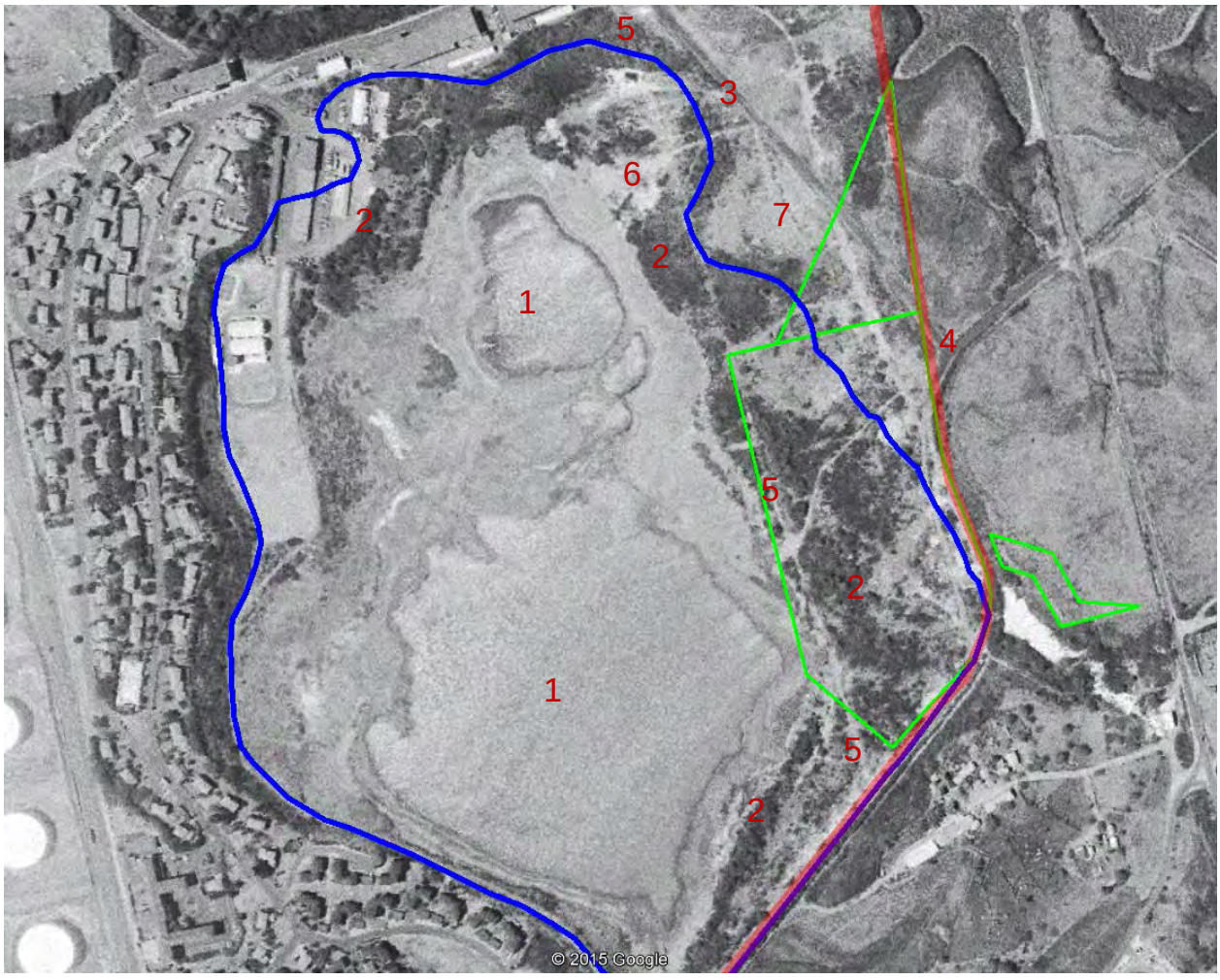


Figure 46 *– Aerial Imagery 3 April 1952*

4.4.9 April 1957

The Navy annotated this single overhead frame image with land use descriptions. Of particular interest is the newly constructed Radford High School (RHS) building complex (**1**) to the east of the crater and outside the Navy property boundary. The April 1957 imagery is about a month after the Navy officially leased the 15 acres immediately to the west (RHS FUDS) for use of the school (although the lease was back dated to take effect in August 1956). Some of this area has been cleared (**2**) but its active redevelopment is unclear. There are possible debris piles (**3**) present although this is uncertain with the poor image resolution. The crater appears filled and much of the center is covered by vegetation (**4**), though there are few open clearings or areas of ponded water (**5**). There are probably additional fill operations occurring on the northeast perimeter (**6**). The bare earth area on the former salvage yard (**7**) remains as before with vegetation on one of the lineations.

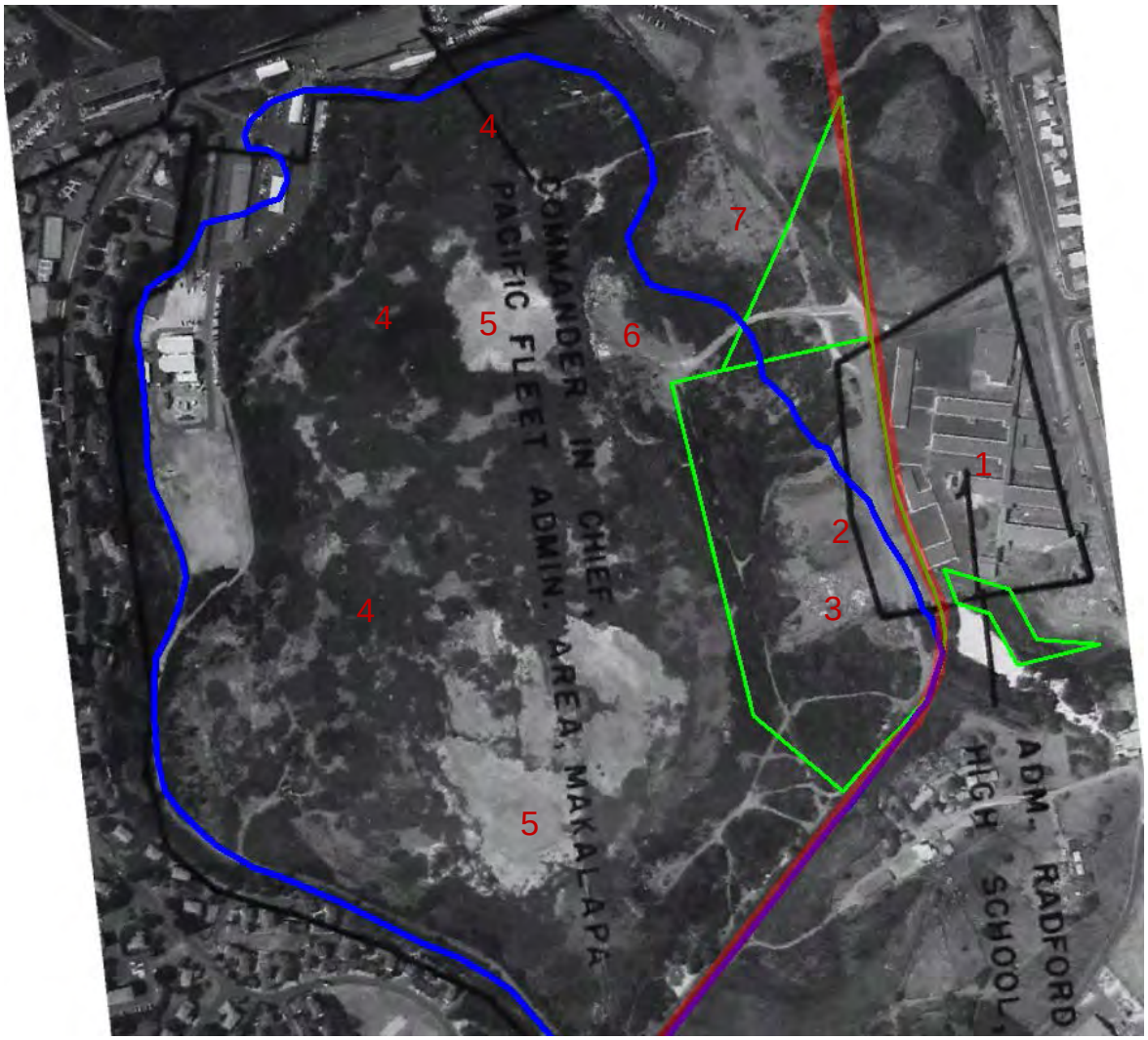


Figure 47 *– Aerial Imagery 10 April 1957*
Note: black labels & annotation are on a contemporary overlay and are approximations

4.4.10 19 January 1959

In 1959, the RHS building complex (**1**) is clearly visible and the 15 acre leased area has a been cleared of vegetation and developed to include a running track with a probable football field (**2**) within it and a baseball field (**3**) to the south. Parts of the perimeter of the crater have leafy vegetation (**4**) growing but the majority of it appears to be open clearing covered with grasses (**5**). The probable fill operations noted in 1957 appear to be lightly vegetated or bare ground (**6**) with no clear active operations. The area on the former salvage yard (**7**) remains mostly bare but is vegetating besides the lineation. At the southern end of the crater, an approximately 700 foot straight linear elevated road has been added (**8**).

Figure 48 *– Aerial Imagery 19 January 1959*

4.4.11 4 December 1962

Nearly four years after the 1959 imagery, the RHS building complex (**1**) is clearly visible, as is the running track and football field (**2**) within it and a fence surrounding it. There is a probable baseball field (**3**) to the south. Leafy vegetation at the perimeter of the crater (**4**) continues to grow but the majority of the crater appears to be open clearing covered with grasses (**5**), though a couple areas may be bare (**6**). The probable fill operations noted in 1957 appear to be lightly vegetated or bare ground (**7**) and are not clearly active. The area on the former salvage yard (**8**) continues to vegetate but the lineations remain discernable.

Figure 49 *– Aerial Imagery 4 December 1962*

4.4.12 15 February 1965

Just over two years later, the RHS building complex remains similar; however an additional 270 by 50 foot building has been added to the southwest of the complex (**1**). The running track around the football field appears similar (**2**), with the field to the south definitely configured for baseball (**3**). The crater perimeter leafy vegetation continues to grow (**4**) with the center generally being open clearing covered with grasses (**5**). A couple areas continue to be bare or less vegetated (**6**) at the end of the north-south road into the crater from the south rim (**7**). Fill operations on the northwest side of the crater have reactivated (**8**) if stopped in 1962. The area on the former salvage yard is mostly revegetated (**9**) except for the area around the lineations.

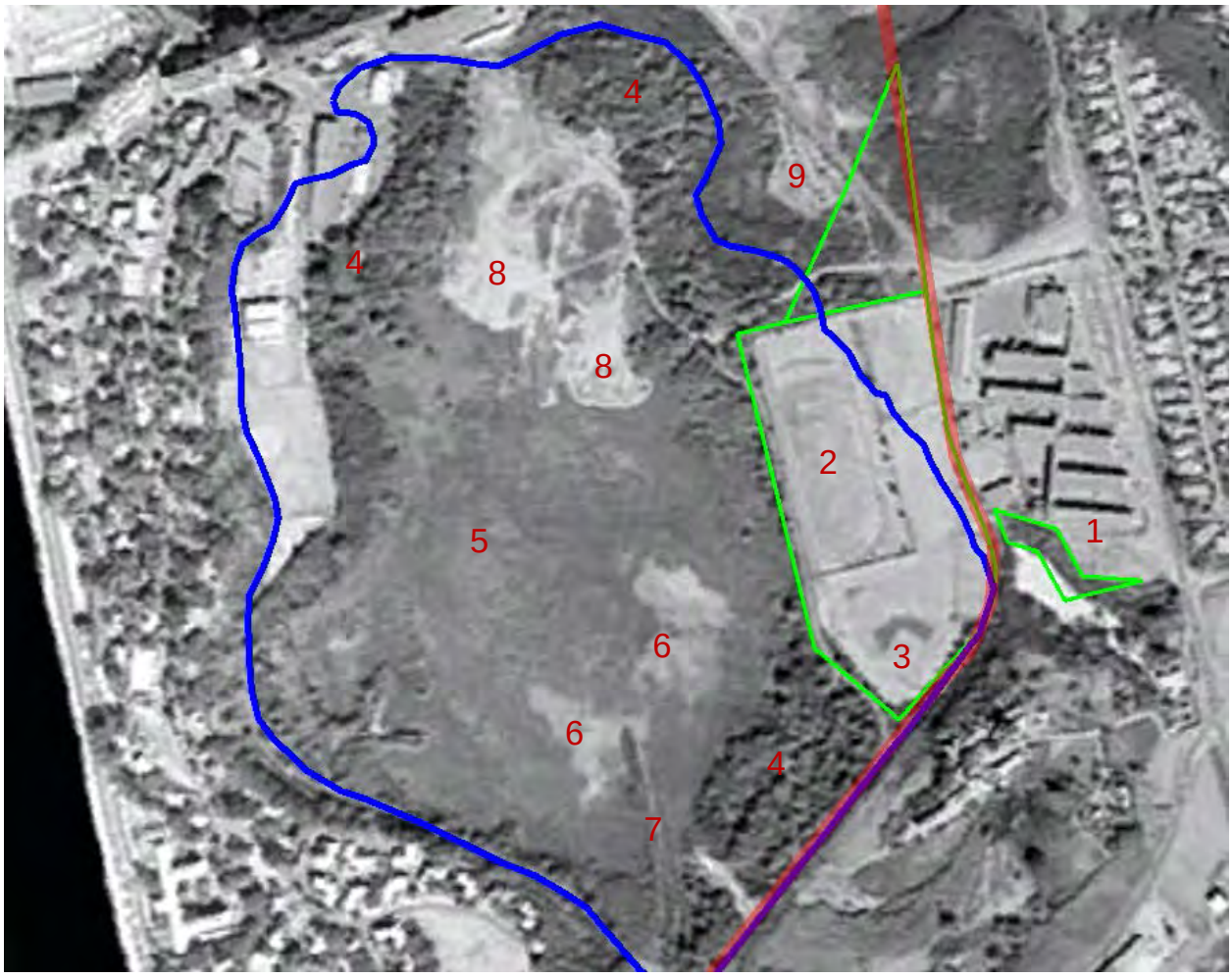


Figure 50 *– Aerial Imagery 15 February 1965*

4.4.13 26 February 1968

Three years later conditions appear essentially the same at RHS, although a dozen approximately 30 by 30 foot structures have been added at the southeast end (**1**). The athletic fields appear the same (**2**) though it is clear there are lights for the field by this point. The lineations at the former salvage yard area remain visible (**3**). The leafy vegetation around the crater perimeter continues to grow (**4**). The vegetation in the center appears thicker and brushier (**5**) with less or different vegetated areas (**6**) remaining. Fill operations on the northwest side of the crater have ebbed (**7**) but others have begun more toward the center of the crater (**8**) as material mounds are readily apparent.

Figure 51 *– Aerial Imagery 26 February 1968*

4.4.14 30 October 1969

A year and a half later, at RHS, another half dozen approximately 30 by 30 foot structures, only with white roofs, have been added at the southeast end (**1**). North of the football field, an approximately 40 by 95 foot building has been added. The lineations at the former salvage yard area remain visible (**3**). The vegetation around the crater continues to grow with leafy trees on the sides (**4**), with more brush like vegetation in the center of the crater (**5**), though the two areas of lesser vegetation persist (**6**) as noted as before. Although material piles remain readily visible, the fill operations in the center of the crater appear to have ceased (**7**). On the north end of the crater, fill operations area appear active (**8**) as evidenced by numerous material mounds.

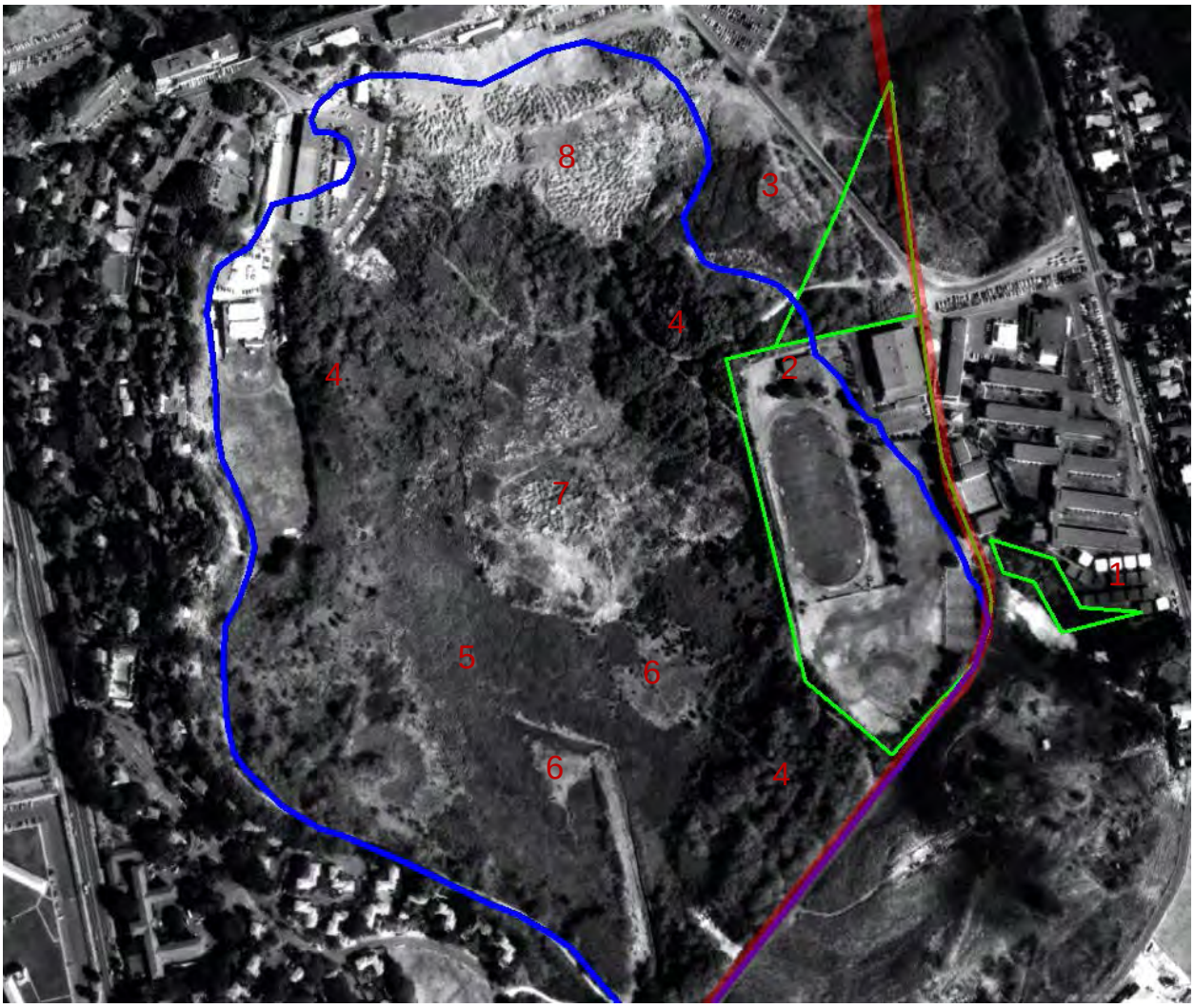


***Figure 52** – Aerial Imagery 30 October 1969*

4.4.15 24 March 1972

The image quality in 1972 limits detailed analysis but some changes are clear in the 2 ½ years since the 1969 imagery. Construction of the Makalapa Elementary School (MES) (**1**) has occurred (students began attending in January 1972) and roadway paths to the west on the 3.577 acres (FUDS, lease beginning in August 1971) appear well traveled (**2**). Equipment or material (**3**) is staged at the southwest most corner of the MES FUDS parcel. On the north end of the crater, a parking lot (**4**), roadway and vegetated lot (**5**) are evident at the location of the 1969 fill operations with no clear material mounds remaining. To the south are large clearings (**6**), possibly indicative of active fill operations or earth work. The rest of the crater fill area in the center appears vegetated with leafy growth (**7**) but the image resolution does not provide clarity. The lineations at the former salvage yard area remain visible (**8**).

Figure 53 *– Aerial Imagery 24 March 1972*

4.4.16 5 January 1978

The big change in the mid-1970s is construction of Interstate Highway H-1 (**1**) through Makalapa Crater, with a right-of-way immediately adjacent to the MES FUDS parcel (**2**) and including the northwest corner of the RHS FUDS (**3**). A pedestrian overpass (**4**) and sidewalk connects the installation to the west with MES and RHS to the east side of the highway. There appears to be some trenching work parallel to the northeast-southwest leg of the MES FUDS (**5**) that continues to the northeast but is not clearly related to highway work. To the southwest of the RHS FUDS, an area has been cleared and the Navy Hale Keiki School (**6**) has been constructed. On the west side of the highway, the Navy has constructed a number of structures (**7**) and possibly a tennis court (**8**) on previous fill areas. Aligning the highway to the west are two approximately 125 foot wide grassy areas, possibly berms. The rest of the former crater is covered in leafy vegetation.

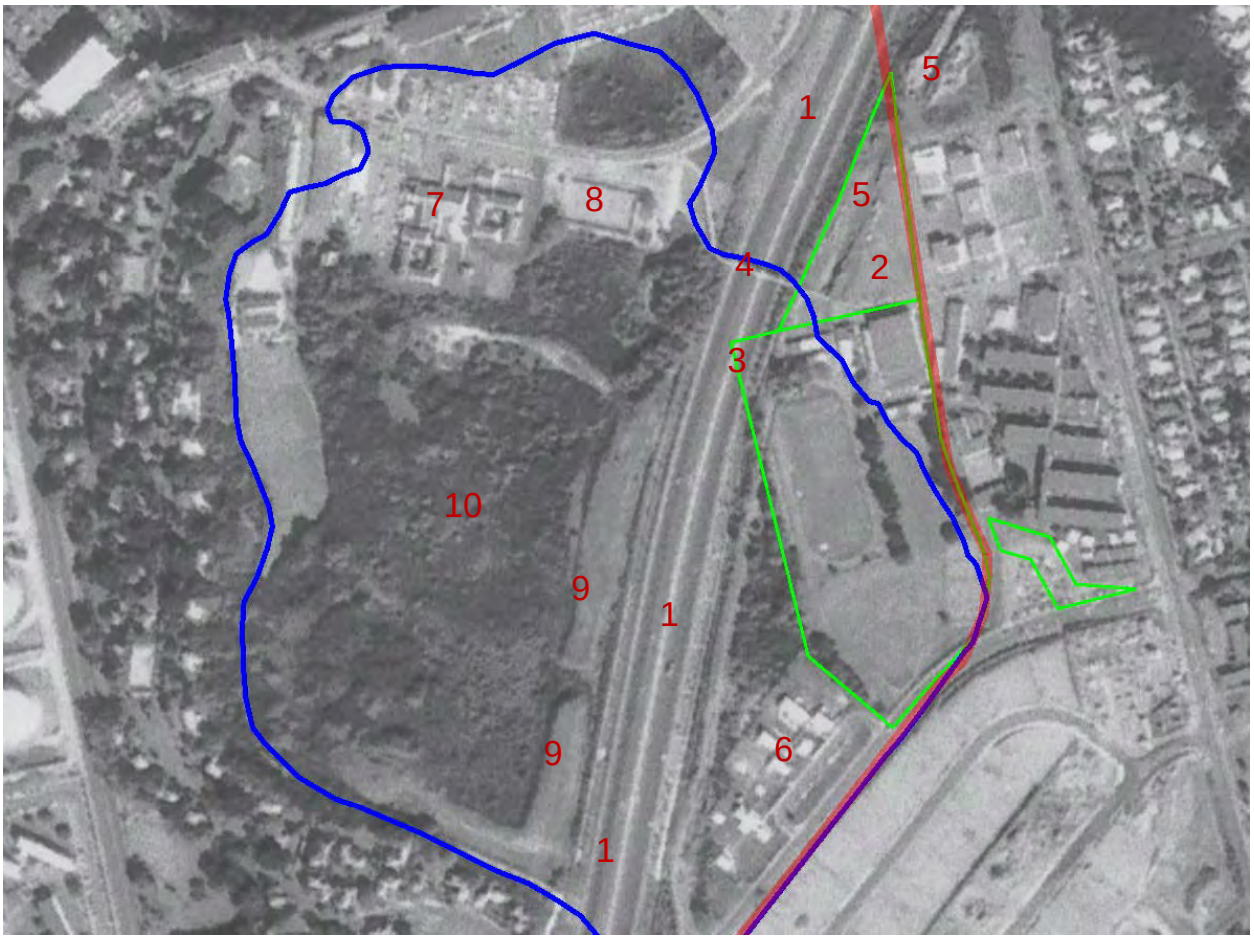


Figure 54 *– Aerial Imagery 5 January 1978*

4.4.17 2 May 1985

The 1985 imagery occurs over seven years after the 1978 imagery but changes or further development appear minimal, though poor photo resolution restricts detailed analysis. The imagery is only a month after the third FUDS parcel has transferred from NAVFAC to RHS and the area appears to be cleared and unvegetated (**1**). At the MES FUDS, the area appears grassy with a few trees (**2**). Other features appear similar to those previously discussed.

Figure 55 *– Aerial Imagery 2 May 1985*

4.4.18 25 September 1993

About 8 ½ years later, noted additional development includes a new approximately 60 by 200 foot building on the third FUDS parcel transferred to RHS in 1985 (**1**). At the MES FUDS, the area appears grassy with a few trees and a parking lot is at the northern tip (**2**). On the west side of the highway, the Navy has further developed the former northwest portion of the crater with a building and parking lot (**3**). The color imagery provides a clearer sense of the height and health of the vegetation within the undeveloped center of the crater (**4**).

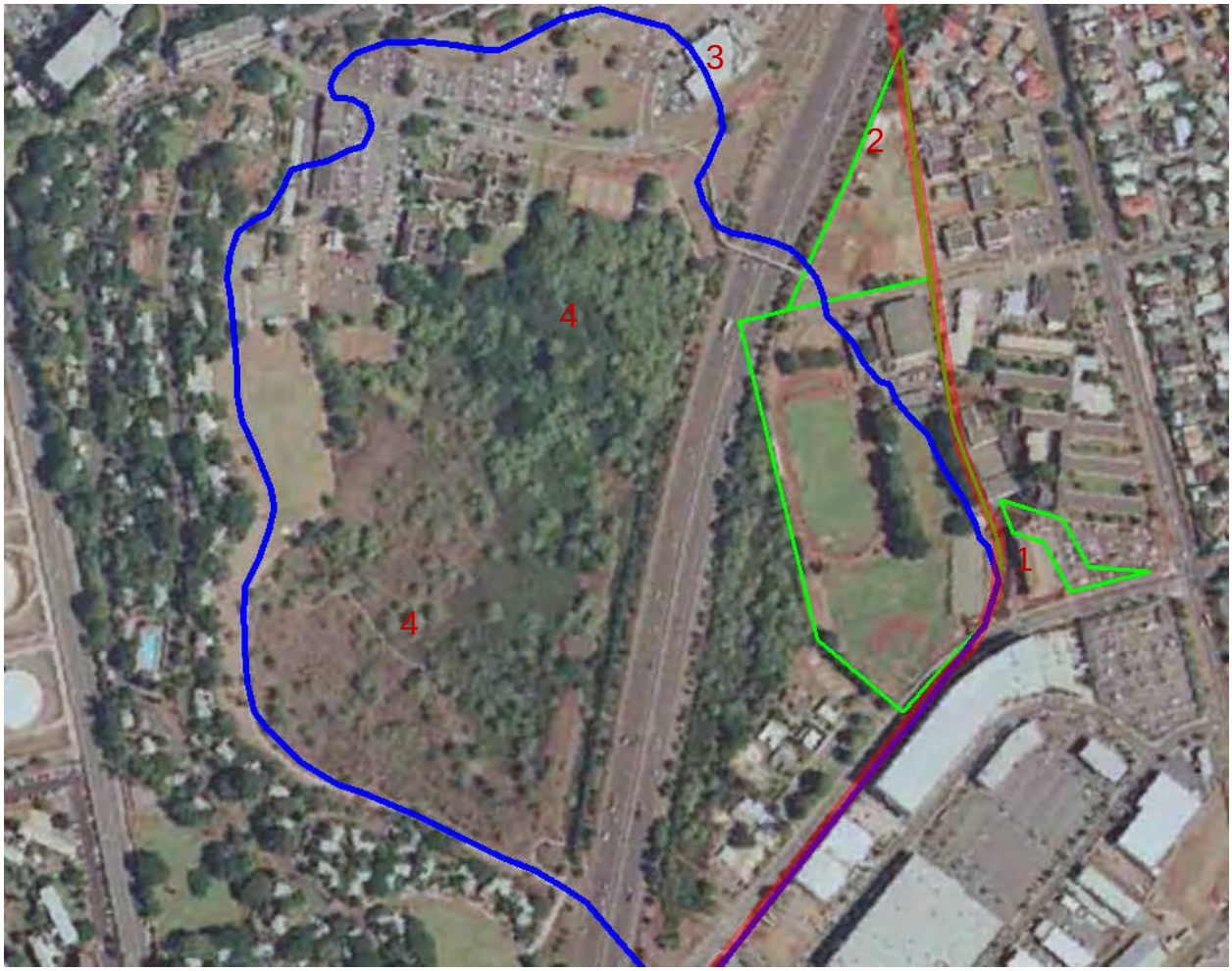


Figure 56 *– Aerial Imagery 25 September 1993*

4.4.19 18 April 2013

The 2013 imagery shows conditions on the site eight months prior to the start of the RHS replacement of the running track and subsequent remedial efforts by the Navy. The imagery resolution allows for detailed review of site conditions. Most of the site conditions have been discussed; however it may be worth noting that a few buildings have been added to the southeast corner of the MES FUDS parcel (**1**).

Figure 57 *– Aerial Imagery 1 January 2013*

5 EVALUATION OF MILITARY MUNITIONS PRESENCE

5.1 GENERAL EVALUATION OF MEC PRESENCE

5.1.1 Evaluation of MEC Presence

5.1.1.1 General

Munitions activities at the former Makalapa Crater FUDS property included the disposal of munitions debris and scrap during operations at the Navy salvage yard and dump on the east side of Makalapa Crater that inadvertently included MEC on occasion. In addition, the Navy operated a pistol range immediately adjacent to the south end of Makalapa Crater. While the pistol range firing lines and target berm were not on the subject FUDS property, the range fan did extend onto the Makalapa Crater Navy Salvage Yard FUDS property.

5.1.1.2 Munitions-Related Areas of Interest

Analysis of the information gathered during this investigation identified potential munitions-related Areas of Interest (AOI) at the FUDS property. Munitions-related AOIs are locations where there is a potential for UXO, Discarded Military Munitions (DMM), or Munitions Constituents (MC) based on past use. Table 5.1 lists the identified munitions-related AOIs.

TABLE 5.1 - Munitions-Related Areas of Interest

Potential AOIs	Munitions-Related Function	MC / MEC Potential
Salvage Yard / Dump	Disposal of munitions debris and scrap	**Confirmed (Physical Evidence)** TCRA investigation at RHS identified over 800 pieces of MPPEH from past disposal operations.
Makalapa Crater Pistol Range	Small arms weapons training	**MEC- None; MC - Confirmed (Physical Evidence)** Historical text, maps and aerial images document the use and location. Firing lines and target berm not on subject FUDS but range fan extends onto FUDS. TCRA found a number of small arms projectiles.

5.1.2 Munitions Technical Data

A final, comprehensive list of the munition debris/scrap found during the TCRA was not available to the FUDS PA investigation. Preliminary data showed it included an extensive and wide variety of WWII era munition items including but not limited to cartridges, cartridge cases, fuzes, igniter/flash tubes, practice bombs, practice grenades, small arms projectiles and packaging. The items found were primarily determined to be expended, empty or inert. Without the final TCRA report and final list of TCRA munition debris/scrap found, the PA investigation chose not to include munition technical data based on preliminary data.

5.2 GENERAL EVALUATION OF CWM PRESENCE

The investigation team uncovered no evidence of chemical warfare materials storage, usage or disposal at the FUDS. The mission of the former Makalapa Crater Navy Salvage Yard does not indicate that CWM would have been present and the research team discovered no historical records associating CWM with the property. In addition, the property visit team did not uncover any evidence of CWM hazards.

5.3 GENERAL EVALUATION OF MC PRESENCE

5.3.1 Conventional Munitions Constituents

Munitions may exist at the former Makalapa Crater Navy Salvage Yard that are no longer intact or did not completely function (e.g., low order detonation, ruptured dud round). This investigation did not attempt to determine all the potential breakdown or daughter products of the constituents identified that may currently exist on site.

5.3.2 CWM Constituents

The investigation team did not identify any CWM associated with the former Makalapa Crater Navy Salvage Yard; therefore, there are no CWM constituents to discuss.

5.4 PROPERTY-SPECIFIC LOCATIONS

5.4.1 Makalapa Crater Dump (and Salvage Yard)

The subject FUDS included a material scrap salvage yard, open burning trash disposal area and solid waste land fill. The salvage and disposal operations occurred on adjacent areas on the northeast and east side of the crater, though the separation between the areas was somewhat ambiguous, shifting and overlapping at times. These activities included the disposal of munitions debris scrap during solid waste disposal that inadvertently including MEC on occasion.

During 1943, the Navy noted that on occasion live loads and explosives ended up in material at the salvage lot.[162] More recently, excavation work to replace the running track at RHS in December 2013 revealed munition debris. The Navy contractor recovered 844 pieces of munition related items / MPPEH during TCRA field efforts in September and November 2014. Recovered munitions included but were not limited to cartridges, cartridge cases, fuzes, igniter/flash tubes, practice bombs, practice grenades, small arms projectiles and packaging. The items found were primarily determined to be expended, empty or inert. Of the 844 items, the contractor considered two items as containing explosives (i.e. MEC / MPPEH): one M100 series bomb fuze and one Type 89 Japanese Powder Time fuze. The contractor turned both items over to Navy EOD personnel.[163] Analysis by Navy EOD confirmed that neither item contained explosives.[164]

The lateral extent of the solid waste landfill on the subject FUDS, comes from analysis of historical aerial photography (see section 4.4). The water levels visible on the 26 November 1941 imagery delineate the approximate horizontal extent of subsequent fill operations within the crater, which equates to 11.9 acres (see following figures).

***Figure 58** – Approximate Lateral Extent of Fill based on 1941 Aerial Imagery*

This is an approximation based on the fill equaling the 1941 water level, which may not be the case (i.e. fill height could be higher or lower). Aerial imagery from July 1945

(section 4.4.4) depicts probable fill piles extending beyond the 1941 water level, indicating a wider lateral extent of fill is probable but the extent is unclear. An approximate fill volume was not determined (see additional landfill discussion in section 6.2.1).

There remains potential for additional munition debris and scrap in the fill material on the subject FUDS property that was not excavated. The MEC potential within that munition scrap appears to be very small. Based on the preliminary TCRA material evaluated, items found during the TCRA field efforts had *"no explosive hazard"*, including two items turned over to Navy EOD for confirmation. In July 2015 the Navy reported there was *"no explosive hazard"* found during the TCRA field efforts.

5.4.2 Makalapa Crater Pistol Range

The Navy established a small arms pistol range in near proximity but not on the subject FUDS. A 1944 Navy site plan depicts firing lines and target line / berm approximately 25 yards apart with a "*Target Range Gallery*" building (Building 256) 50 yards from the target line. The pistol range is immediately adjacent to the southern end of Makalapa Crater, just to the south. The direction of fire is the northeast (see following figure).[165]

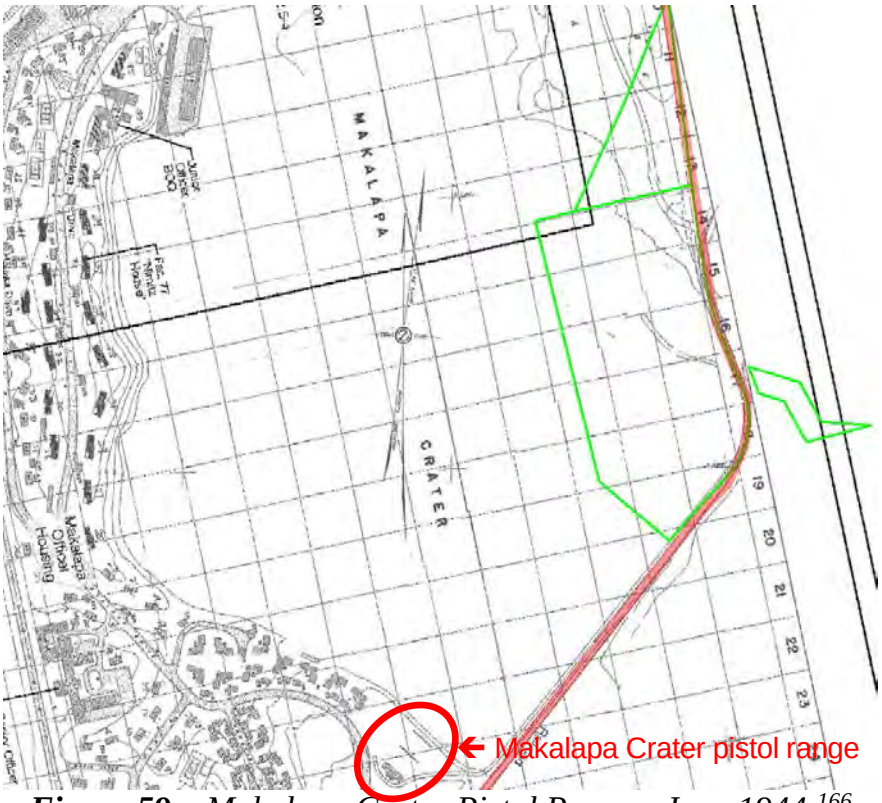
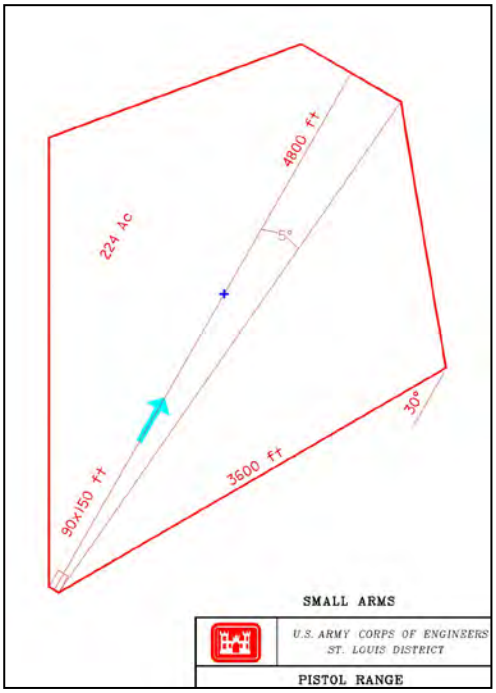


Figure 59 *– Makalapa Crater Pistol Range - June 1944* [166]
Note: FUDS Boundary (green) and Naval historic boundary (orange) annotations added for clarity.

Although, the range is not on the subject FUDS property, the range fan for pistol firing (1600 yards) would extend onto the Makalapa Crater Navy Salvage Yard FUDS property.[167] A typical Pistol Range might accommodate 25 firing positions and be approximately 30 yards wide by 50 yards deep. A pistol range is comprised of a salvage wall (earthen berm), the targets, the firing line(s), safety fan, and an area behind the firing lines, which typically included the ready line, ammunition issue point, and administrative area. The salvage wall (earthen berm) would have been constructed along the backside of the range approximately 5' to the rear of the target line. A five-foot opening typically separated each target. Firing lines would have been positioned at various distances, including 5, 10, 15, and 25 yards in front of the targets. A 5° angle of fire extended from each end of the firing line down range a distance of 1,600 yards; and an additional 25° safety fan, which originated from the same points as the angle of fire, extended down range a distance of 1,200 yards.[168]



The pistol range would have only been used for small arms munitions firing; thus, no MEC hazards would remain from historical range activities at the subject FUDS. It is possible that an MC concern would remain (i.e. lead) from military range use. Any residual MC hazards from the small arms range use at the FUDS would likely be negligible with the amount of earthwork activities and development in the area.

6 EVALUATION OF HTRW PRESENCE

6.1 GENERAL EVALUATION OF HTRW PRESENCE

Operations and activities conducted at the former Makalapa Crater Navy Salvage Yard during DoD jurisdiction of the property may have caused the release of hazardous substances, pollutants, or contaminants to the environment. These operations included solid waste disposal and probable pest control activities. Details of potential HTRW related to military operations on the FUDS are discussed in Section 4.2.2.

A number of previous environmental studies have been completed to identify potential hazards remaining immediately adjacent to the subject FUDS property (see Section 2.2) and include a TCRA initiated by the Navy in 2014 on the current site of RHS athletic fields (i.e. a portion of the subject FUDS). The final TCRA report was not completed at the time of this PA investigation. The water, soil and air pathways for those chemicals to reach human and environmental receptors are assessed in Section 8 of this PA.

6.2 PROPERTY SPECIFIC LOCATIONS

6.2.1 Waste Disposal Areas / Landfills

By 1943, activities at the former Makalapa Crater Navy Salvage Yard included a material scrap salvage yard, open burning trash disposal, and solid waste landfill. The salvage and disposal operations occurred on adjacent areas on the northeast and east side of the crater. The scrap and salvage yard was located on the northeast portion of the Makalapa Crater. At the salvage yard, materials were segregated into like piles, including cast iron, brass, copper, lead, and aluminum during salvage and scrap operations.[169]

The Navy established an open burning area immediately south of the salvage yard on the east side of Makalapa Crater. The open burn area was for burning refuse collected and brought there by activities in and around Pearl Harbor. In the 1940s, standard practice on military installations dictated establishing a garbage collection system that allowed the segregation of salvageable materials (i.e., grease, paper, cardboard, glass, tin cans, wood, metal, ash) with the remaining materials further segregated into burnable and non-burnable waste. The burnable waste was burned and the remainder was sent to a landfill. On 28 October 1944, the Commandant approved moving the "*Present Site of Dump"* to an alternate location *"around the rim of the Makalapa Crater to an area on the southeast side…as a temporary trial expedient"* (see following figure).[170]

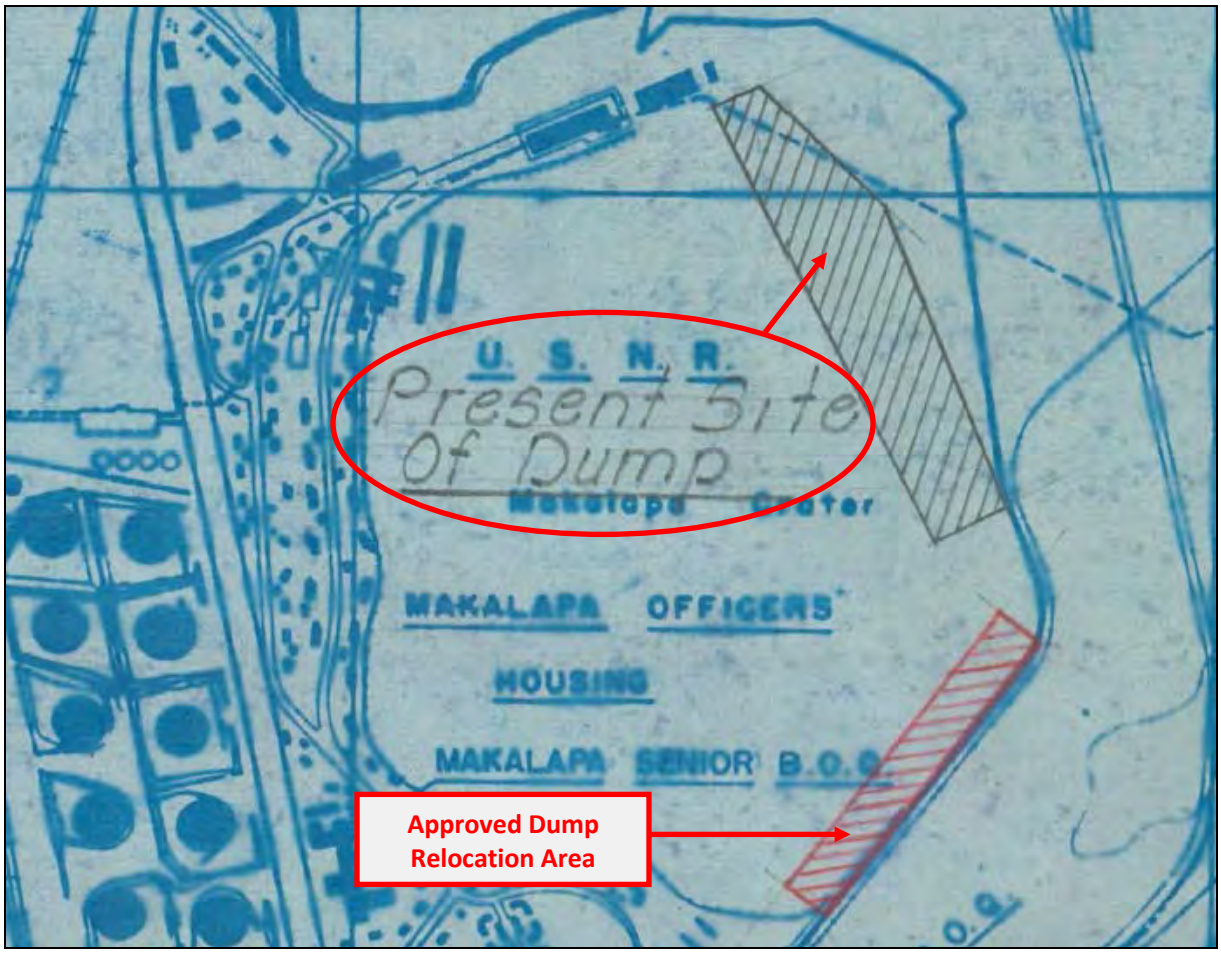


Figure 60 *– "Present Site of Dump" and Approved Relocation – 28 October 1944*[171]

Available documentation does not explicitly state what the Navy did with the non-combustible material left after burning or non-burnable material brought to the dump. Analysis of the historic aerial imagery clearly shows the expansion of land along the eastern perimeter of the crater in 1943 and 1945 as compared to 1941. The "new" land includes areas of piled material or fill.

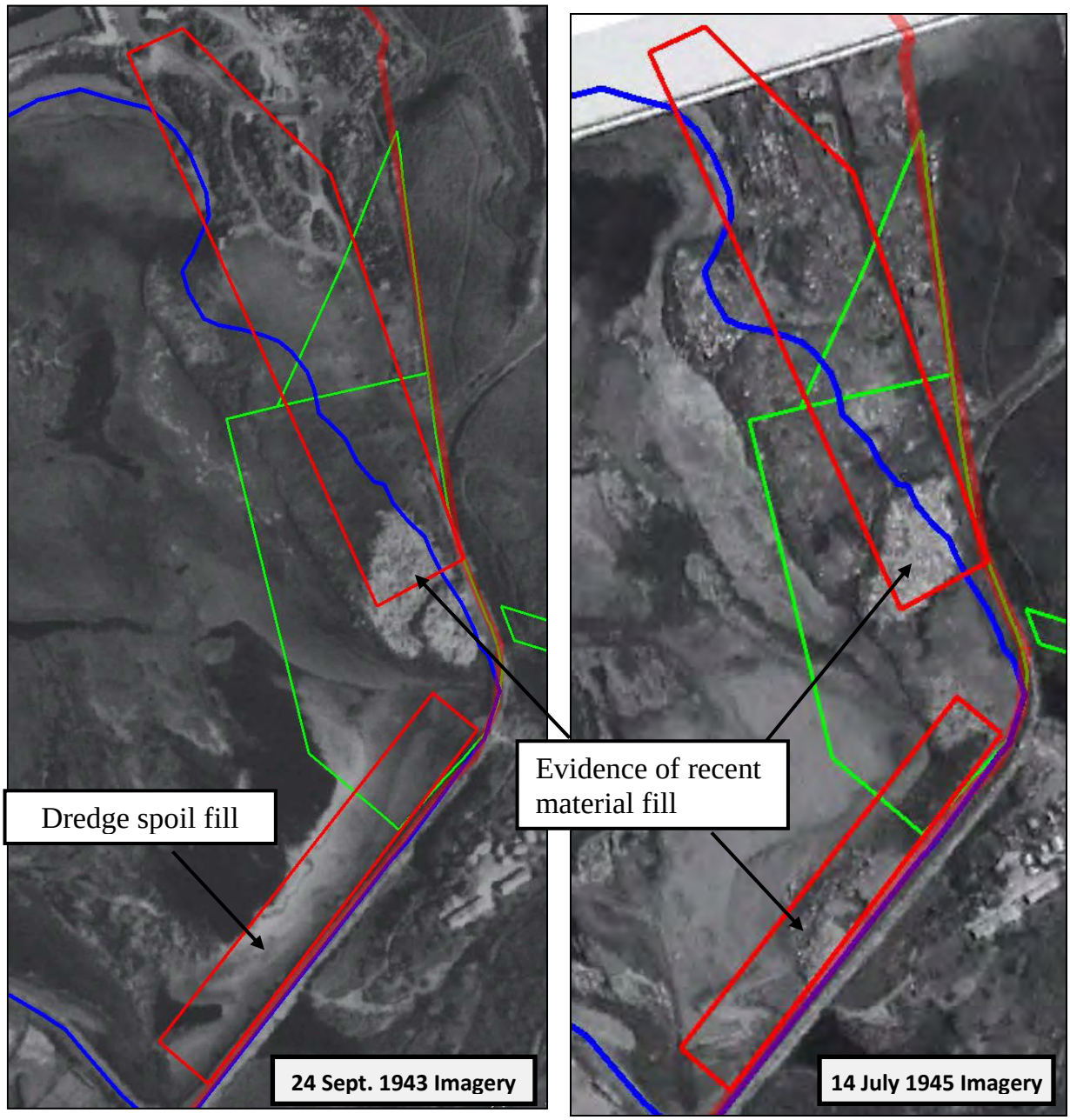


Figure 61 *– 1943 and 1945 Aerial Imagery Comparison "Site of Dump" and Approved Relocation*

In July 1943 imagery, prior to the dump relocation to southeast side of crater, the area exhibits the murky solids of dredge spoils settling out. By 1945, about two thirds of the relocation area is higher ground and exhibits evidence of fill material that is connected to other ground to the north that was the "*Present Site of Dump"* in October 1944. Much of these areas were under water on 26 November 1941 as represented by the blue line annotation.

As discussed in Section 5.4.1, the lateral extent of the solid waste landfill on the subject FUDS, can be estimated from the water levels visible on the 26 November 1941 imagery.

The horizontal extent of that water level equates to approximately 11.9 acres (see figure in section 5.4.1). This approximation of the lateral extent of fill would appear to be on the low side based on aerial imagery from July 1945 which depicts light toned material, which is evidence of more recent dumping beyond the 1941 blue water line (section previous figure). Preliminary results from the TCRA delineation sampling indicate debris was found at depths less than 6 inches on the subject FUDS beyond the 1941 water levels.[172] This implies that fill might be found in much of the FUDS that the Navy owned and operated at the time of the dump and salvage yard operations (i.e. 18.577 acres). Final results of the NAVFAC TCRA sampling were not available for this PA.

Analytical data from soil sampling conducted in February 2014 in and around the RHS field indicated that the soils contained arsenic, barium, cadmium, lead, mercury, benzo(a)pyrene, polychlorinated biphenyls (PCBs), and dioxins/furans at concentrations exceeding DOH Tier 1 Environmental Action Levels (EALs).[173] Additional sampling data from the NAVFAC TCRA were not available for this PA.

As discussed in section 5.4.1, there remains potential for munition debris and scrap in the fill material on the subject FUDS property that was not excavated beyond what was found and evaluated for the TCRA. Based on the preliminary TCRA material evaluated, all the recovered items found during the TCRA field efforts had *"no explosive hazard"*, including two items turned over to Navy EOD for confirmation..

6.2.2 Pesticides

There is clear indication that solid waste disposal operations at the Makalapa Dump resulted in a pest infestation (i.e. flies, mosquitoes, and rodents) on the FUDS property. It is probable that the Navy utilized pest control chemicals (e.g. herbicides, insecticides and rodenticides) during solid waste operations on the subject FUDS, however, comprehensive list of pesticides used on the FUDS has not been found. Specific details concerning the pest control activities remain undetermined.

As the suspected pesticide use included only the normal application of registered pesticides in ways that are consistent with the pesticides' purpose, it meets the U.S. EPA's interpretation of the pesticide exemption in CERCLA section 103. CERCLA section 101(10) defines federally permitted releases in terms of releases permitted under a number of other environmental statutes. Releases that are federally permitted are exempt not only from CERCLA section 103 and EPCRA section 304 notification requirements, but from CERCLA liability as well.[174]

7 EVALUATION OF CON/HTRW AND BD/DR PRESENCE

7.1 EVALUATION OF CON/HTRW PRESENCE

Based on the findings of this assessment, there is not a CON/HTRW potential on the former Makalapa Crater Navy Salvage Yard FUDS as a result of the military's previous use. Historical documents did not indicate that the Navy placed aboveground storage tanks (ASTs) or underground storage tanks (USTs) for Petroleum, Oil and Lubricants (POL) on the FUDS property. Furthermore, there is no indication that other containers that might have stored hazardous, toxic or radioactive materials were present on the property. Therefore, there no further action is recommended in regards to CON/HTRW at this property

7.2 EVALUATION OF BD/DR PRESENCE

No structures have been identified as remaining on the former Makalapa Crater Navy Salvage Yard during its use by the DoD (See Section 3.3.3-Condition of Facilities Constructed for the Military). Therefore, there no further action is recommended in regards to BD/DR at this property.

8 PATHWAY AND ENVIRONMENTAL HAZARD ASSESSMENT

8.1 GROUNDWATER PATHWAY

8.1.1 Hydrogeologic Setting

Makalapa Crater is the westernmost of six tuff and ash cones that compose the Salt Lake group of volcanic craters, which generally feature low cones with broad rims and wide craters that have filled with lake and pond sediments. Tuff deposits are formed by the rapid cementation of hot volcanic ash. The tuffs were deposited by explosive eruptions centered on the Aliamanu, Salt Lake, and Makalapa Craters. The oldest crater, Aliamanu, erupted during a period of high sea level, while the Salt Lake and Makalapa craters are younger and erupted during periods of low sea level. The volcanic tuffs generally have relatively low hydraulic conductivity, typically ranging from about 1 to 100 ft/day. [175]

The soils identified at the Makalapa Crater are classified as Makalapa Clay and are dark grayish-brown, sticky, and very plastic soils formed in volcanic tuff. These soils are typically level to moderately sloping, well drained, with a very slow soils permeability and runoff. Soils surrounding and on the outer slopes of the crater also include the Kokokahi clay series with a slow to moderately slow permeability and a medium runoff. Environmental investigations reveled the maximum thickness of the dredge-spoil fill material in the center of the crater is estimated at 45 feet; the native ash, tuff, and soil are overlain throughout most of the area by recent fill deposits. [176]

Makalapa Crater is situated in the Waimalu system of the Pearl Harbor aquifer. Shallow groundwater occurs under unconfined conditions in the volcanic tuff and sediment deposits at approximately 35 to 45 feet bgs. The caprock confines a deep basal aquifer under artesian conditions at depths beginning at approximately 75 feet bgs. Migration of groundwater from the shallow caprock aquifer to the deeper basal aquifer is unlikely due to artesian pressure in the saturated zone within fractured basalts. The shallow (caprock) groundwater within the Makalapa Crater is not considered a potential source of drinking water due to high salinity. Environmental investigations indicate that groundwater does not migrate to surface water outside of the Makalapa crater.[177]

8.1.2 Groundwater Receptors

The U.S. EPA's Safe Drinking Water Information System (SDWIS), the national regulatory compliance database for the drinking water program, and the the U.S. Geological Survey (USGS) National Water Information System (NWIS) Mapper were searched for groundwater data in the vicinity of the Makalapa Crater FUDS property. The USGS NWIS search results indicate that there are multiple groundwater drinking wells within 4 miles of the FUDS; however, the wells listed in NWIS are established in the deep aquifer at depths greater than 100 feet bgs.[178]

There are no known shallow groundwater drinking wells within the vicinity of the Makalapa FUDS property due to groundwater conditions (i.e. high salinity); therefore, there are no primary or secondary target populations. However, the State of Hawaii Department of Land and Natural Resources (DLNR) indicates that there is one sealed water supply well located within the Makalapa Crater (Well Number 2156-03). The well was reportedly screened in the deeper basal aquifer and is registered to the Navy. No records documenting the historical use of the well or the methods used to seal and abandon the well were identified during the FUDS PA investigation.[179]

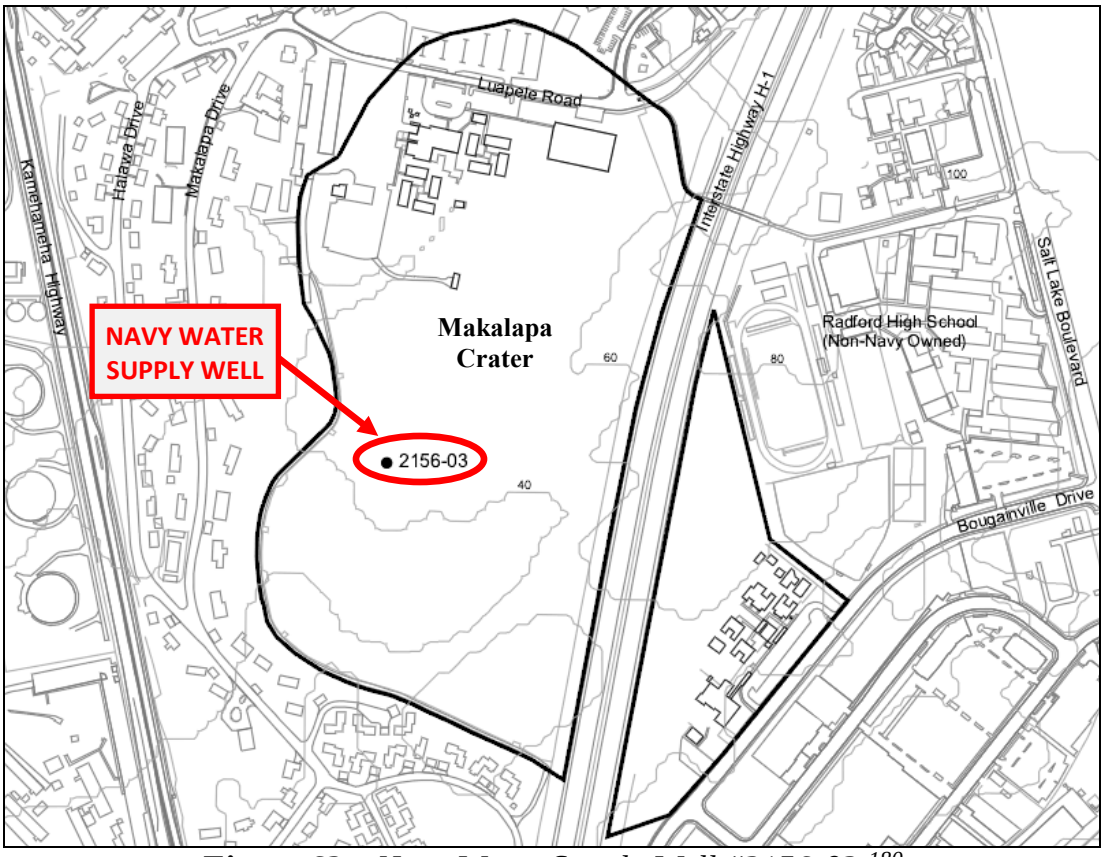


***Figure 62** – Navy Water Supply Well #2156-03* [180]

It is possible there are additional wells in the area used for agricultural purposes, such as irrigation; however, the presence of agricultural wells remains unconfirmed. Groundwater wells used for agricultural purposes would indicate a resource target.

8.1.3 Groundwater Conclusions

Previous investigations on the FUDS property have shown the presence of contaminants in several locations in the vicinity of Makalapa Crater. However, groundwater in the area is not considered a suitable source of drinking water due to high salinity. Thus, it is not feasible that contaminants would migrate to a drinking water supply.

8.2 SURFACE WATER PATHWAY

8.2.1 Hydrologic Setting

The lake within Makalapa Crater was originally formed by a combination of rain runoff and discharge from artesian irrigation wells and used as a commercial fish pond. Two overflow tunnels were established near the north rim of the crater that led north to Halawa Stream. However, the overflow tunnels are believed to have been sealed and buried prior to filling activities during the late-1930s and early-1940s. When the tunnels were in operation, surface water runoff near the crater would drain through the tunnels into Halawa Stream and eventually to Pearl Harbor. Two drains were installed in the 1940s to allow the water to be drained and the crater to be filled. [181]

During construction of Interstate H-1, fill was placed along the highway corridor to reduce the potential for roadway flooding and alter flow patterns within the crater. To facilitate the flow of water within the crater from one side of Interstate Highway H-1 to the other, a large culvert was placed beneath the highway. Presently, surface water flow is from northwest to southeast within the crater, where it enters a culvert and ditch system and eventually empties into Quarry Loch. [182] On the east side of H-1 where the subject FUDS sits, topography dictates that surface water would typically flow to the west or southwest to a drainage channel along the Interstate and the relative low spot of the wooded area immediately to the west of the RHS athletic fields.

The existing surface topography, soil conditions, and subsurface geology of Makalapa crater suggest that surface water generated by rainfall would remain within the crater, infiltrate through the permeable surface soils, and flow towards the center of the crater as it encounters low-permeability clay and volcanic tuff in the subsurface. Drainage channels on both sides of H-1 Freeway receive storm water runoff from the roadway and direct the runoff southeast, out of the crater, without contacting soil in Makalapa Crater. The large storm water runoff culvert under Interstate H-1 near the southeast end of the crater connects the drainage channels on both sides of the highway. Furthermore, drainage conditions indicate that surface water runoff generated within Makalapa Crater would not naturally flow out of the crater, and that runoff generated outside of the crater would not flow into the crater. [183]

8.2.2 Surface Water Receptors

Surface water within the Makalapa Crater generally flows northwest to southeast where it enters a culvert and ditch system that empties into Quarry Loch and eventually to the Pacific Ocean; property drainage generated outside of the crater typically flows to the southwest to the Pacific Ocean.

Current Navy policy (5510.21B) authorizes recreational fishing in and around Pearl Harbor from sunrise to sunset, subject to the fish and game laws of the State of Hawaii.

The fishing from Navy lands is restricted to military personnel and permits "*recreational fishing from the shores of privately owned property bordering the waters of Pearl Harbor…subject to the Control by State Fish and Game Wardens."* The current regulations have been in place since 1987, predating the Hawaii Department of Health advisory, which warns of potential *"contaminated fish and shellfish"* in Pearl Harbor. [184]

The Pacific Ocean represents a number of significant fisheries, with over 90 different fish and shellfish species identified in Pearl Harbor alone. However, since there is not a suspected release to surface water, these are considered a secondary target. [185]

Although wetlands exist in the vicinity of the subject FUDS within and adjacent to the Pearl Harbor area, there are no wetlands specifically within the Makalapa Crater Navy Salvage Yard FUDS according to the USFWS National Wetland Inventory (see following figure). The wetlands along the surface water migration path from the property should be considered a secondary target. [186]

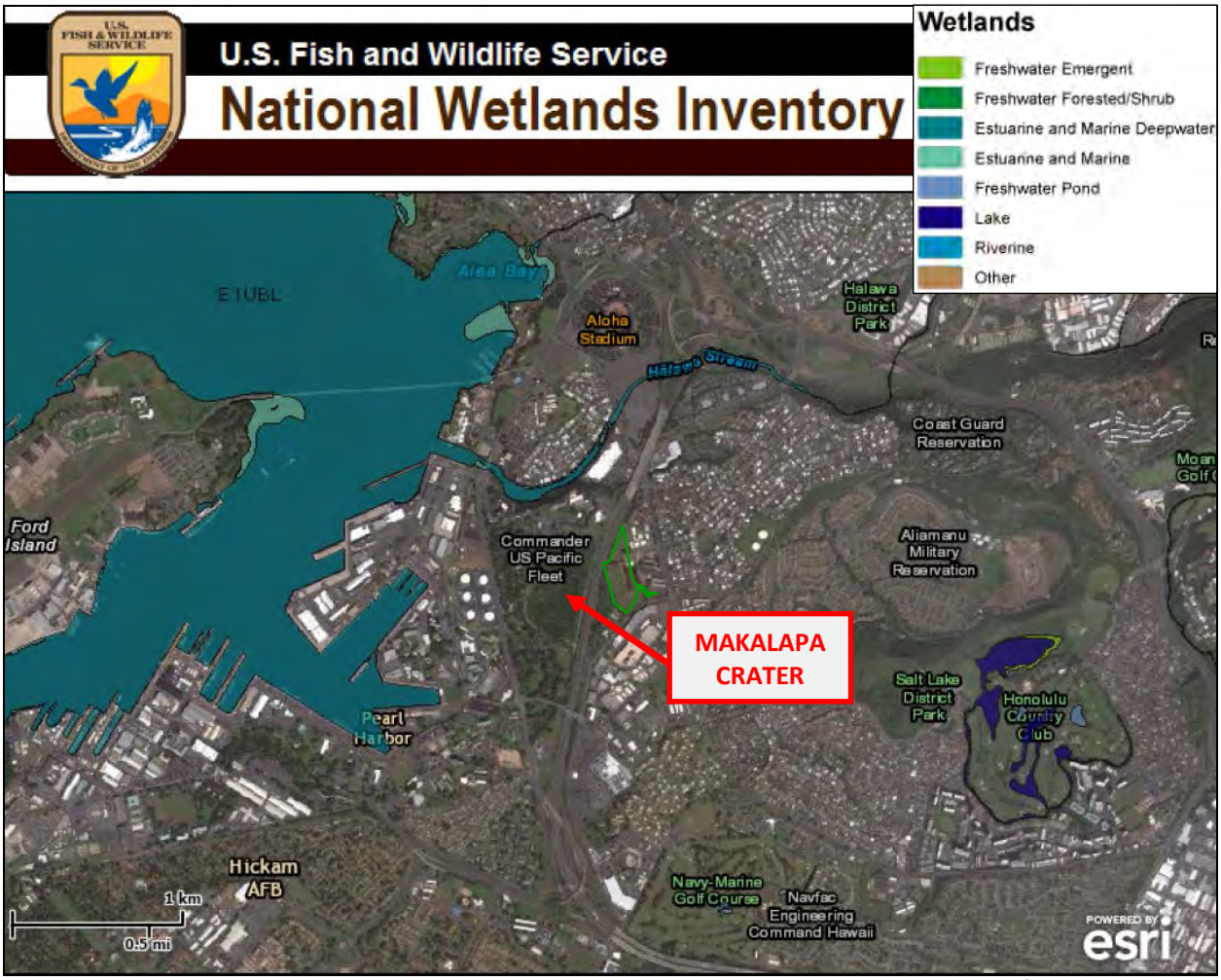


Figure 63 *– USFWS Wetland Map of Makalapa Crater Area* [187]

8.2.3 Surface Water Conclusions

Previous environmental investigations have confirmed contaminants within the soils on the FUDS property. However, the investigation team did not see clear indications, such as stressed vegetation or discolored water indicating a contaminant release to area surface water. In addition, the local hydrogeology coupled with a shallow aquifer unsuitable for drinking water suggests an incomplete pathway from surface water to groundwater.

8.3 SOIL EXPOSURE AND AIR PATHWAYS

8.3.1 Physical Conditions

As discussed previously in Section 3.3.2, the public has unrestricted access to the former Makalapa Crater Navy Salvage Yard. In general, the subject FUDS has been redeveloped for schools and education facilities (Makalapa Elementary School and Radford High School). It is anticipated that the future land use will remain the same. There are no known land use restrictions or restrictive covenants limiting property development, except for subsurface pipeline easements.

The interior portions of Makalapa Crater are relatively flat, although landfill activities with construction and demolition debris have affected local relief in some areas. Slopes, are generally gentle to nearly flat within the crater; on the north side of the crater the slopes become steeper and terminate at Halawa Stream. The undeveloped portions of Makalapa Crater are heavily vegetated dominated by introduced and alien species such as kiawe, koa haole, and buffelgrass. Kiawe trees form a closed-canopy forest on the north and east portions of the crater; on the south and west portions, the kiawe forest is open. Along the southern boundary, opiuma trees are locally abundant and form large stands.[188]

The FUDS property is occupied by Makalapa Elementary School and Radford High School. The property has been redeveloped with buildings, parking lots, athletic facilities (i.e. football and baseball fields, track, and tennis courts), and associated landscaping. The introduced weed Sida ciliaris was observed along the road that parallels Interstate Highway H-1. [189]

Previous environmental investigations (see Section 2.2) located buried solid waste, including munitions debris, on the Makalapa Crater Navy Salvage Yard FUDS clearly indicating past use. Prior Navy use of the property was also confirmed through textual documentation, historical maps, and aerial imagery. This confirmed past use indicates the possible release of contaminants and the potential for latent HTRW and MC contamination on site, along with other solid wastes deposited in the landfill areas.

8.3.2 Soil and Air Receptors

Students and educators working at or attending Makalapa Elementary School and Radford High School in the immediate vicinity of potential contamination. Potential Terrestrial Sensitive Environments consisting of the habitats of Federal and State listed rare, threatened or endangered animal and plant species (see Section 3.4.7) may be present in the vicinity of Makalapa Crater. As discussed above in surface water pathway, there is an abundance of wetlands located within 4 miles of the property within and adjacent to the Pearl Harbor area. However, this assessment did not positively establish these habitats to be present on the subject FUDS.

8.3.3 Soil Exposure and Air Pathway Conclusions

Buried solid waste, including munitions scrap and debris, was identified on the FUDS resultant from past Navy activities on the property. These activities indicate a possible release of contaminants and the potential for latent HTRW and MC contamination in soils on site. Any release to the atmosphere, which would have been detectable at the time, has long since dispersed; there is not a recent suspected release to the air. Measurable releases of contaminants from the property via wind erosion of soil are not suspected.

Buried solid wastes and munitions debris at the property generally lie beneath a layer of cover soil that varies in depth across the FUDS indicates the potential release of MC to surface soil when erosion or excavation of that cover occurs. Direct contact of contaminants remaining in surface soil by persons residing on site is possible. Although the potential exposure is lessened by the development of the property with schools and education facilities, roads, parking lots, and lawns/landscaping, redevelopment or landscaping of the property provide an exposure pathway.

9 SUMMARY AND CONCLUSIONS

9.1 AREAS THAT MAY WARRANT NO FURTHER ACTION BY DOD

The PA investigation team identified potential hazards remaining at the former Makalapa Crater Navy Salvage Yard associated with the former salvage yard and dump, equating to approximately 18.577 acres as discussed in Section 9.2 below. This assessment did not identify any hazard potential as a result of the military's previous use of the third tract (0.6935 acres). Therefore, No Further Action (NFA) is the recommendation at that portion of the property.

9.2 POTENTIAL HAZARDS THAT MAY WARRANT FUDS PROJECTS

9.2.1 MMRP

There is clear potential for additional munition debris scrap to be found in the fill material on the subject FUDS property. The Navy operated a material scrap salvage yard, open burning trash disposal area and solid waste land fill on 18.577 acres of the subject FUDS (Makalapa Crater Dump and Salvage Yard). These activities included the disposal of munitions debris scrap during solid waste disposal that inadvertently including MEC on occasion. Excavation at the athletic fields at Radford High School in 2013 and 2014 recovered over 800 pieces of munition related items / MPPEH including cartridges, cartridge cases, fuzes, igniter/flash tubes, practice bombs, practice grenades, small arms projectiles and packaging. The items found were primarily determined to be expended, empty or inert. All the recovered items found during the TCRA field efforts had *"no explosive hazard"*, including two items turned over to Navy EOD for confirmation. Additionally, there is negligible MC potential from the subject FUDS being within the range fan of the former Makalapa Crater Pistol Range (target berm and firing lines under the current Interstate Highway H-1).

Any potential MEC from munition scrap and potential MC would be comingled with the fill material located on site. To date, there is very limited evidence available to support potential for MEC at the two munitions related AOIs reviewed during this PA.

9.2.2 PRP/MMRP Considerations

This assessment did not identify any previous or subsequent use of the property relating to munitions or explosives. Therefore, there are no Potential Responsible Party (PRP) considerations regarding MMRP at the former Makalapa Crater Navy Salvage Yard.

9.2.3 HTRW

As noted in Section 2.1 of this PA, concurrent to this assessment, the USACE Honolulu

District prepared an INPR for the former Makalapa Crater Navy Salvage Yard (H09HI0484) property in support of the DERP for FUDS, which approved a HTRW project (H09HI048401). The HTRW potential at the subject FUDS relates to the Navy's operations of a material scrap salvage yard, open burning trash disposal area and solid waste land fill on 18.577 acres from approximately 1943 to 1946. Analytical data from soil sampling conducted in February 2014 in and around the RHS field indicated that the soils contained arsenic, barium, cadmium, lead, mercury, benzo(a)pyrene, polychlorinated biphenyls (PCBs), and dioxins/furans at concentrations exceeding DOH Tier 1 Environmental Action Levels (EALs). As noted in 9.2.1, there is limited potential MEC from munition scrap and potential MC comingled with the fill material located on site. Additional sampling data and the final results of the NAVFAC TCRA were not available for this PA. When complete, the TCRA would meet the intent and purpose of a CERCLA Site Inspection (SI).

Further consideration and action on the HTRW project will originate from the Honolulu District and could include the next step in the CERCLA process, a Remedial Investigation/Feasibility Study (RI/FS) to delineate the nature and extent of HTRW contaminate potential.

9.2.4 CON/HTRW

This investigation found no evidence or indication that the Navy placed aboveground storage tanks (ASTs) or underground storage tanks (USTs) on the FUDS property or that other containers that might have stored hazardous, toxic or radioactive materials were present on the property. Therefore, No Further Action (NFA) is the recommendation in regards to CON/HTRW at this property.

9.2.5 PRP/HTRW Considerations

This assessment did not identify any previous or subsequent use of the property relating to hazardous, toxic or radioactive waste. Therefore, there are no PRP considerations regarding HTRW at the former Makalapa Crater Navy Salvage Yard.

9.2.6 BD/DR

This assessment did not identify any unsafe structures or debris remaining as a result of the military's previous use of the former Makalapa Crater Navy Salvage Yard. Therefore, there is NFA recommended in regards to BD/DR at this property.

APPENDIX A

REFERENCE SOURCES AND RECORDS REVIEWED

APPENDIX A

A REFERENCE SOURCES AND RECORDS REVIEWED

The research team searched at the following locations for records relating to munitions, chemical warfare, and HTRW activities at the former Makalapa Crater Navy Salvage Yard. At these repositories, the research team used finding aids and records managers to assist in locating documents relevant to the research topic. The investigation team also accumulated complementary documents reviewed on the former Makalapa Crater Navy Salvage Yard, but not specifically used. These complementary documents are stored with the original PA back-up documents. Appendix B contains the References of all in text endnote citations. All back-up references gathered for this investigation whether directly cited in this report or not have been digitized and are available with the digital files. The following subparagraphs described the research team's efforts at the noted archival repositories:

A.1 TEXTUAL AND CARTOGRAPHIC REPOSITORIES

The following repositories were consulted primarily for textual and cartographic information regarding the former Makalapa Crater Navy Salvage Yard.

A.1.1 AECOM Technical Services, Inc.

1001 Bishop Street, Suite 1600
Honolulu, HI 96813-3698
808-521-3051
Tom Hanneman, Senior Environmental Engineer / Project Manager
Frank Cioffi

The research team contacted this firm which completed the May 2011 for "*Preliminary Assessment for Munitions, Makalapa Crater, JBPHH"* regarding receiving copies of the historical material gathered for the PA. AECOM provided copies of their back-up material ((1365 files, 4.57GB), allowing the FUDS research team to concentrate on repositories and material not previous reviewed for the JBPHH effort.

A.1.2 Bishop Museum Library and Archives

1525 Bernice Street
Honolulu, Hawaii 96817
808.847.3511
http://www.bishopmuseum.org/

The Navy's contractor for the May 2011 for the "*Preliminary Assessment for Munitions, Makalapa Crater, JBPHH"*, AECOM, conducted research at this repository including the Dillingham Collection. As the FUDS PA research team received copies of the historical

support material from the 2011 PA effort, it was determined that additional research at this repository was not warranted.

A.1.3 Critical Past LLC
12100 Sunrise Valley Drive
Box E-230-16
Reston, Virginia 20191
800-249-4430/ 302-724-4153
http://www.criticalpast.com/

The research team used the online research search engine to identify potentially relevant films and photo images that this company has gathered royalty-free from various sources including the National Archives. This repository has no references for "Makalapa" or "pearl +harbor +dump" and eight strips of film on "pearl +harbor +salvage" but none that appear to include imagery of the operations at Makalapa Crater Salvage Yard or dump:

A.1.4 Defense Technical Information Center (DTIC)
8725 John J. Kingman Road Ste. 0944
Ft. Belvoir, VA 22060-6218
1-800-CAL-DTIC (1-800-225-3842)
Mary Jones, Research
703-767-9603
Registration Office
703-767-8673
http://www.dtic.mil/dtic/

The Defense Technical Information Center (DTIC) is the largest central resource for DoD and government-funded scientific, technical, engineering, and business related information. It is a DoD Field Activity within the Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L), reporting to the Director, Defense Research & Engineering (DDR&E). DTIC provides ready access to relevant information formerly contained in their various Technical Information Centers or libraries located throughout the DoD (e.g. scanned PDFs of reports). DTIC's origins date back to WWII and a shared Air Corps and Navy document center (i.e. library) to collect process and distribute scientific and technical reports. DTIC sponsors a number of additional Information Analysis Centers (IACs). A DTIC information query accesses not only the information catalogue / database within the DTIC holdings but also within the IACs as well, allowing a search for a report in multiple different repositories. The unclassified material is available on-line, though much of the material has distribution restrictions limiting it with DoD. Classified documents are available as well but are distributed in hard copy form. The research team queried the DTIC database for the following key words: "Makalapa dump" – 0, "Makalapa salvage" – 0, and "Makalapa crater" – 7 but did not finad any relevant material no acquired from another source (specifically NAVFAC).

A.1.5 Environmental Data Resources, Inc.
6 Armstrong Rd, 4th Floor
Shelton, CT 06484
800-352-0050
http://www.edrnet.com/

Founded in 1990, EDP is a leading provider of environmental risk information in the United States with an extensive database of environmental land records (e.g. Federal, State and Tribal NPL, CERCLIS, RCRA, landfill, solid waste disposal, leaky tanks, brownfields, spills and releases, etc.) and historical land use records (historic USGS topographic Maps, Sanborn fire insurance maps, aerial imagery, Flood Zone Data, USDA Soil Conservation Service (SCS) soil surveys) and familiarity with local / regional hydrologic hydrogeologic and geologic information and water agency records.

The research team tasked EDR with providing a standard package of their environmental and historic land use records for the subject site, which were used in preparation of this PA.

A.1.6 Federal Records Center, - Northwest (FRC Seattle)
6125 Sand Point Way NE
Seattle, WA 98115-7999
206-336-5115
Roy Lower
Mary Olson

The research team reviewed the Standard Form 135 (SF135s) for accession relating to POH real estate. After determining appropriate accessions Mr. Lower verified if it was physically located at the records center. All accessions had been pulled back to POH on 2013.

A.1.7 Federal Records Center (FRC) – Pacific Region (FRC-San Bruno)

Leo J. Ryan Memorial Federal Building
1000 Commodore Dr.
San Bruno, CA 94066-2350
650-238-3500
Kenneth Thomas, Chief Transfer and Disposition Branch
Cynthia Mitchell, Archives Technician
Michael C. Frush, Archives Technician
650-238-3472
Open 7:30 A.M. to 4:00 P.M.
http://www.archives.gov/frc/san-francisco/

The research team requested and received permission to review the SF135s "*Records Transmittal and Receipt*" form and the Army's *"Records Shipment List" (*AR345-222) that the FRC maintains for Record Group 77. The active FRC accession files are kept in file drawers within the archivist work room. The research team reviewed the transmittal records from the 1960s (oldest) through the 1990s looking for instances where Honolulu District records had been sent to this FRC (or its predecessors in the San Francisco area) as opposed to the currently designated FRC for Hawaii, Seattle. While there were times in the 1960s when material did get transferred, none of it appeared relevant to the FUDS program. The team skipped the more recent accessions as the guidance for sending Hawaii records to the Seattle FRC has been in place for decades and the material of interest would have be sent before that. The FRC-San Bruno also maintains copies of obsolete record transfers relating to material no longer held in storage (i.e. transferred to the archives, destroyed or pulled back by the agency) in the basement. The team reviewed these for records from the 1960s and 1970s along with a list denoting source of records and final dispositions. They do not appear to be any relevant records relating to Hawaii FUDS remaining.

A.1.8 Hawaii Department of Education (DOE)

Facilities Development Branch
Construction Management Section
P.O. Box 2360
Honolulu Hawaii 96804
Jadine Urasaki, P.E., LEED AP, Public Works Manager
808.586.0397
Cell: 808.265.5400
http://www.hawaiipublicschools.org/Pages/home.aspx

The research team did not coordinate with the Hawaiian DOE during the preparation of this PA.

A.1.9 Hawaii State Archives

Kekāuluohi Building
Iolani Palace Grounds
364 S. King Street
Honolulu, Hawai'i 96813
808-586-0329
http://ags.hawaii.gov/archives/

The research team reviewed the Hawai'i State Archives finding aids for the records of the Board of Commissioners of Agriculture and Forestry 1903 – 1959 and identified the following boxes for review as potentially dealing with FUDS (Army, Navy, Range Target, permit, real):

COM2-13
President and Executive Officer
Frank H. Locey:
Permits Issued to Army and Navy, 1941
Target Range, Kauai, 1941
U.S. Navy, 1941
Water Permit, Molokai, 1940 - 1941
COM2-16
Executive Secretary
Hawaiian Department (U.S. Army), 1929 – 1939
COM2-17
Board of Agriculture and Forestry
Action Memos, Division of Forestry, 1949 - 1961
COM2-19
General Administrative Records:
Land and Real Property 1942-53
COM2-25
U.S. Government:
U.S. Army, 1943 - 1950
U.S. Army, 1950 - 1959

U.S. Navy, 1943 - 1950
U.S. Navy, 1950 - 1959
COM2-28
Division of Entomology
Army and Navy, 1943 - 1952
COM2-35
Records of the Division of Forestry
Charles S. Judd
U. S. Army, 1919 – 1933

The research team copied relevant real estate documentation skipping material dealing with game warden and hunting violations, animal quarantine and mascots (e.g. dogs). The reference archivist stated that later material, post-statehood, was not within the archives and the current agency should be checked with for relevant material.

A research team from AECOM Technical Services, Inc. of Honolulu AECOM, a NAVFAC contractor, conducted research at this repository for the 2011 NAVFAC PA on Makalapa Crater. [190] NAVFAC provided the FUDS PA research team copies of the material gathered by that effort from the following collections:

- U.S. Army Air Corps Aerial, Flight 39, Photos M-58.39 through M-58.42, 28 January 1940.
- Admiral Furlong Photograph Collection. 1930-1946
- Map Catalogue

A.1.10 Honolulu Land Information System (HoLIS)

City and County of Honolulu, HI
http://publicrecords.onlinesearches.com/view/lid/20436/

The research team used the HoLIS interactive GIS mapping to access geographically referenced tax assessment designations parcel data including Hawaii Tax Maps for the subject FUDS..

A.1.11 John D. Bennett, Military Historian

45-340 Mokulele Dr.
Kaneohe, HI 96744-2245
808- 247-0326
jbennett@hawaiiantel.net

The research contacted Mr. Bennett, a local military historian who has conducted research and written extensively on coast artillery and harbor defense facilities on Oahu. Mr. Bennett provided an index to the paper and journals articles he's produced, primarily for the Coast Defense Study Group (CDSG) along with some unpublished accounts.

A.1.12 JBPHH – 647th Civil Engineer Squadron (647 CES)

Building 1200, Hickam Field
JBPHH , Oahu, HI
808-449-3101
Senior Airman Nazzro
808-448-2832

The research team visited the engineering plans, maps and drawings vault at Hickam Field at JBPHH being currently being maintained by the 647 CES. The drawing vault

facility currently contains approximately 450 drawers and has been at the same location for at least two decades and reflect the Air Force material (i.e. not consolidated or comingled with Navy records after establishment of JBPHH). The research team reviewed the contents of several drawers making a cursory finding aide related to the contents of the following drawers:

- Drawer 121 Canton, Christmas, Midway and Palmyra islands
- Drawer 144 – American Samoa, Baker, Beito, Gilbert, Guan, Kwajalein, Makin, Marshall and Tutuila
- Drawer 146 Big Island, Lanai, Maui and Molokai (includes pre-war CAA plans)
- Drawer 152 Nike Sites Bellows, Dillingham and Palehua
- Drawer 215 Real Estate Audit Maps
- Drawer 216 Basic Layout Maps (for Real Estate)
- Drawer 217 & 218 Utilization Maps (for Real Estate) – Master Plan and some audit maps
- Drawer 248 All Other Misc. Bases Master Plans
- Drawer 249 Airfield and Explosive Wavier Plans All bases
- Drawer 250 Army Navy Master Plans
- Drawer 253 State Land Use Maps, Topographic Maps (includes maps of large landholders in the state)
- Drawer 254 Zoning Maps
- Drawers 255-256 Aerial Photos (not old ones)

The facility does not currently have a map copy or scanner and one would need to take any desired drawing elsewhere for reproduction.

A.1.13 JBPHH – 647th Civil Engineer Squadron CES/CED (EOD)
Hickam AFB, HI 96853
POC: MSgt Mark Gostomski Jr.
808-449-7112

The research team contacted MSgt Gostomski regarding USAF EOD Incident Reports pertaining to munitions recovered at Makalapa/Radford High School (RHS). MSgt Gostomski forwarded an EOD Incident Report for a fuze recovered at RHS.

A.1.14 Library of Congress (LOC)
101 Independence Ave, SE
Washington, DC 20540
http://www.loc.gov/
http://www.loc.gov/pictures/collection/hh/

The Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey (HABS/HAER/HALS) collection at the LOC includes numerous documents, drawings, large-format photographs, and written histories for more than 38,600 historic structures and sites. The NPS HABS, HAER and HALS programs is on-going and new documentation is added continually and online digitization is occurring in phases. The research team queried the HABS/HAER/HALS collection of the LOC for "makalapa crater", "makalapa dump", "makalapa salvage" "Pearl Harbor salvage" "Pearl Harbor dump" but found no relevant material (Makalapa by itself had 181 images but none that appeared relevant).

The Navy's contractor for the May 2011 for the "*Preliminary Assessment for Munitions, Makalapa Crater, JBPHH",* AECOM, conducted research at the LOC Furlong Papers Collection and they reviewed the following material t

BOX 7 Salvage and repair
General reports, 1940-1944 (3 folders)
New York Times article, 1943
Officers and crew of salvage section, 1942, n.d.
BOX 8 Status of work reports, 1941-1942 (3 folders)
BOX 8 Scrap drive, 1942-1943
BOX 8 War diaries, 1941-1943 (possibly)
BOX 17 Scrapbooks, 1941-1945

As the FUDS PA research team received copies of the historical support material from the 2011 PA effort, it was determined that additional research of this collection was not warranted.

A.1.15 National Archives at College Park (NARA-CP), Textual Records
8601 Adelphi Road
College Park, MD 20740-6001
301-837-6800
http://www.archives.gov/dc-metro/college-park/index.html

For each of the Record Groups (RG) of potential interest at this repository, the research team reviewed the Master Location Register (MLR) and Finding Aids available in the public research rooms to help locate potential Entries / Series / Accessions of records of relevance and if possible refined to specific boxes. The team also consulted with staff archivists and the NARA Online Public Access

(http://www.archives.gov/research/search/) search engine (formerly the Archival Research Catalog or ARC) for additional suggested material. The following is a detailed list records researched at this repository.

Record Group 38 (Records of Office of the Chief of Naval Operations)

Entry 25 Naval History and Heritage Command, Base Maintenance Division, Field Liaison and Records Section, Subject Files; 1930 -1965
Boxes 90-91

Record Group 51 (Records of the Bureau of Budget)

Entry 149B Inspection Reports, 1940-1945
Boxes 605-608

Record Group 71 (Records of the Bureau of Yards and Docks)

Entry 1001 Naval Property Case Files 1941- 1958
Boxes 357-404

Entry 1006, Purchase Files Regarding Perimeter Acquisition, Pearl Harbor, Hawaii, {Ca.} 1934-46
Boxes 1-16

Entry 1020 Bureau of Yards and Docks Circular Letters, 1940-45
Box 1

Entry 1032, Records Regarding Inactivation of Foreign Bases, 1945-46
Boxes 1-2

Entry 1033, Records Regarding Lease Renewals And Cancellations, Hawaii, 1946
Boxes 1-3

Record Group 77 (Records of the Office of the Chief of Engineers)

Entry 262 Real Property Files 1944-1955
Box 16

Entry 415 Real Estate Branch Surplus Disposal Unit, 1917-1944
Box 76

Entry 508 Military Construction Army Program Files, 1943-1961
Boxes 16-19

Entry 440 Central Decimal Files, 1951-1952

Box 61-69

Entry 508 Military Construction Army Program Files, 1943-1961
Boxes 16-19

Entry 539 Real Property Historical Files, 1955 (55A-0448)
Boxes 13-17

Entry 568 Realty, 1948 (52A-0088)
Boxes 15-55

Entry 1007, War Department, Office of the Chief of Engineers, Formerly Classified Harbor Defense Files, Geographic File, 1918 - 1945

Boxes 79-80, 87-98 and 107-108

Entry 1009, War Department; Office of the Chief of Engineers; Unclassified Harbor Defense Files, Geographic File, 1918 - 1945

Boxes 57-60, 94-99 & 108-110

Record Group 80 (Records of the Department of the Navy 1804-1944)

This research team reviewed the MLR and available finding aids and did not identify entries or accessions of records of clear relevance to the subject site.

Record Group 121 (Records of the Public Building Service)

Entry 1, Real Property Disposal Case Files, 1970 (Accession 121-76-0003)
Box 25

Record Group 125 (Records of the Office of the Judge Advocate General (Navy))

Entry 1, Office of the Judge Advocate General; Correspondence Relating to Pearl Harbor, November 26, 1943-May 24, 1949
Box 1

Record Group 126 (Records of the Office of the Territories 1885-1976)

Entry 3, Department of the Interior, Office of Territories, Central Files; 1950 - 1971
Boxed 210, 226-228, 279-292 322-337 & 396-404

Record Group 143 (Records of the Bureau of Supplies and Accounts (Navy))

Entry 14 (A1): Field Activity Standard Organization Files, 1947-1959
Boxes 1-24

Record Group 181 (Records of the Naval Districts and Shore Establishments)

This research team reviewed the MLR and available finding aids which did not identify entries or accessions of records of clear relevance to the 14th Naval District and the subject site at NARA-CP textual but there is lots of material at the Regional archives at NARA-San Bruno.

Record Group 291 (Records of the Federal Property Resources Service)

Entry 5 Real Property Disposal Case Files 1949-1962 (66a-2712)
Box 60

Record Group 313 (Records of the Records of Naval Operating Forces, 1849 – 1997)

Entry P88 Secret and Top Secret General Administrative Files, 1941-1944
Boxes 21 & 54

Entry 89 Commander-In-Chief Pacific Fleet (CINCPAC); (Red 107); Confidential and Secret General Administrative Files; 1943 – 1945 (formerly Entries UD 1031-1039)

8 Box 103

9 Box 319

10 Box 354

Box 381

Record Group 428 (General Records of the Department of the Navy 1947-)

This research team reviewed the MLR and available finding aids and did not identify entries or accessions of records of clear relevance to the subject site.

Record Group 494 (Records of U.S. Army Forces in the Middle Pacific (WWII))

Entry 10, Historical Section; History of the Army Port and Service Commands; 1943-47
Boxes 28 (Old box G-26)

Entry 44, Western Pacific Base Command; Adjutant General Section; General Correspondence; 1917 – 1944 (ARC ID#: 7321587)
Boxes 413-432

Entry 51, Western Pacific Base Command; Adjutant General Section; Formerly Restricted General Correspondence; 1944 - 1946
Boxes 456-460, 556-560

Entry75, Adjutant General; Bulletins, 1940-41

Box 863

Entry 76, Adjutant General; Artillery Bulletins, 1944
Box 864

Entry 105, Adjutant General Reports of Operations, 1943-45
Box 904 (Old Box G-41)

Entry 116, Chemical Section, Numbered Letters, 1943-45
Box 944 (Old Box G-269)

Entry 117, Chemical Section; History of the Chemical Warfare Service in the Middle Pacific, 1941-46 (Old Boxes G-43 - G-45)
Boxes 945-947

Entry 118 Engineer Division, General Correspondence, 1920-1946
Box 948 (Old Box G-287)
Box 950-951 (Old Box G-289-290)
Box 960 (Old Box G-299)
Box 971 (Old Box G-310)
Box 972 (Old Box G-311)
Box 1003 (Old Box G-342)
Box 1007 (Old Box G-346)
Box 1015 (Old Box G-354)
Box 1016-1024 (Old Boxes G-355-G-363)
Box 1025-1032 (Old Boxes G-364-G-371)
Box 1040 (Old Box G-379)
Box 1057 (Old Box G-396)
Box 1074 (Old Box G-413)
Box 1075 (Old Box G-414)
Box 1076 (Old Box G-415)
Box1082-1084 (Old Box G-421 thru G-431)
Box 1089 (Old Box G-428)
Box 1092 (Old Box G-431)
Box 1123 (Old Box G-462)
Box 1139-1144 (Old Box G-478 thru G-483)
Box 1147 (Old Box G-488)

Entry 119 Engineer Division, General Correspondence, 1942-45
Boxes 1156-1158

Entry 125 (UD-UP): History of Engineering Activities in the Pacific Ocean Area, 1941-1946
Box 1165-1166 (Old boxes G-285-G-286)

Entry 126, War Department, Hawaiian Department, General Correspondence, 1940 - 1944
Box 1203 (Old Box G-619)
Box 1211-1213 (Old Box G-627 thru G-629)

Entry 142, Engineer/District Engineer, Correspondence Relating To Ammunition Storage, 1939-43
Box 1242 (Old Box G-577)

Entry 145, Engineer/District Engineer; Memorandums, Receipts for Classified Documents, & Other Records Received From The 6th Field Area, 1941-44
Box 1247 (Old Box G-578) Waterborne Bombing Targets

Entry 150, District Engineer; Blueprints, Specifications, Reports & Other Records Relating To Construction Projects, 1936-43
Boxes 1259-1263 (Old Boxes G-666 - G-670)

Entry 151, District Engineer; Correspondence Relating To Construction Projects, 1937-43
Box 1264-1265

Entry 151A, Engineer Division; District Engineer; Construction Reports, 1945
Boxes 1265A-1265C, &1265D-1265F

Entry 152, Engineer Division/District Engineer; Completion Reports, 1942-43
Boxes 1266-1268

Entry 186, Inspector General Reports, 1942-1945
Box 1329-1329A

Entry 191 Provost Marshall; Weekly Strength Reports of Bases, 1945
Box 1321

Entry 199, Ordnance Section; Maps, Overlays, and Planning Documents Relating To the Defense of Oahu, 1939-42
Box 1379

Entry 213, Western Pacific Base Command; Signal Service; General Correspondence; 1945 – 1946
Boxes 1421-1423

Entry 245, Central Pacific Base Command; Engineer Formerly Classified General Correspondence, 1938-45

Box 1476-1477 (Old Box G-984-985)
Box 1478 (Old Box G-986)
Box 1489 (Old Box G-997)
Box 1492 (Old Box G-1000)

Entry 251, Western Pacific Base Command; Adjutant General Section; General Correspondence; 1941 – 1945
Boxes 1530-1533

Entry 338, Military Government of Hawaii; Office of the Military Governor; Statistical and Engineering Section; Decimal File, 1942-43
Boxes 895-897

Entry 407, Hawaiian Department; Adjutant General's Office; Revision Sheets for a Supplement to the "Digest of Information", 1940-41
Box 5

Entry 408, Hawaiian Department; Adjutant General's Office; Maps of Hawaii, 1940-41
Box 5

Entry 415, Hawaiian Department; Adjutant General's Office; Publications Section; Memorandums, 1939-43
Box 1 (aka box 13)

Entry 416, Hawaiian Department; Adjutant General's Section; Publications Section; Training Memorandums, 1938-43
Box 1

Entry 418 Hawaiian Department Adjutant General Section, Publications Section, Staff Memorandums, 1940-1943
Box 14

Entry 440 Hawaiian Department; Combat Training Command, Pacific Combat Training Center Unit History, 1943-1945
Box 26

Entry 442 Hawaiian Department Army Ground Forces Pacific
Boxes 1536-1541

Record Group 550 (Records of U.S. Army, Pacific)

Entry 48, Administrative, Program, And Publications Files of Hawaiian Department, 1942-1945

Boxes 409-421

Entry 55, Administrative, Program, And Publications Files of U.S. Army Pacific and Predecessor Commands, 1944-1951
Boxes 576-598

Entry 180, Army Ground Forces, Pacific, 1947
Boxes 6302, 6304- 6315, 6322-, 6330-6339

Entry 181 Army Ground Forces Pacific, 1947
Box 6067-6068 & 6072

Entry 182 Army Ground Forces Pacific 1947-1948
Box 26

Entry 183 Army Garrison Forces Pacific, 1944-1945
Box 1

Entry 194 U.S. Army Pacific, 1949-1950
Boxes 105-111

Entry 198 Hawaiian Defense Command, 1947-1960
Box 91

Entry 199 Hawaiian Defense Command, 1949-1950
Box 36

A.1.16 National Archives, Cartographic and Architectural Branch
8601 Adelphi Road
College Park, MD 20740
301-837-3200

The research team reviewed the Military, Forts, Posts and Installations Finding Aid notebooks in the cartographic research room and located the following items:

Record Group 23/370/237 (Records of the Federal Aviation Administration)

Entry Sectional Aeronautical Charts
Folder Hawaii

Record Group 71 (Records of the Bureau of Yards and Docks)

Entry Series I Microfilm
No reels for "1434"

Reels 1128-1130 – 1400-2 thru 1400-4
1142 -1400-16
1159 1400-42

Entry Series II Index Cards
Box 243 – thru 1400-7
Box 259 – 1434

Entry Series II Microfilm
Reel 1042 Frames 1 thru 91
Reel 1046 Frame 276-277
Reel 11332, Fr367, 1434-16-1
Reel 1493, fr 361

Entry Flat Map Files (paper copies)
Folder 1400-3
Folder 1434

A.1.17 National Archives at College Park, Still Pictures Branch
8601 Adelphi Road
College Park, MD 20740
Reference Desk
301-837-0561

The research team reviewed the file card and album indexes available for the following for relevant material:

Record Group 80 (General Records of the Department of the Navy)
Entry 80G, 1941-1945 and Entry 80G 1946-1958
Boxes 204, 277-278, 290, 918-919, 926, 1089, 1983, 1697, 2856-57

The research team consulted the RG 80G Subject card catalogues for the WWII and prior and post WWII for the following key words (with the number of applicable prints noted):

- Makalapa (0)
- Salvage (301501 thru 301503)
- Dump (0)
- Burn (0)
- Garbage (0)
- Pearl Harbor (lots, only pulled aerials)

The research team also consulted the RG 80G Subject card catalogues for the WWII and prior and post WWII for the following key words (with the number of applicable prints noted):

- Makalapa (lots)

Record Group 111 (Records of the Office of the Chief of the Signal Corps)

Entry 111-SCA Signal Corps Albums

Albums 1115-1118, 1778-1780, 1786-1825, 1826A-1826H and 1827; 3058, 3301, 4337, 5426E, 5913, 6020A, 6072, 6312E

A.1.18 National Archives at College Park - Motion Picture, Sound and Video Reference

8601 Adelphi Road
College Park, MD 20740
301-837-0526
http://www.archives.gov/dc-metro/college-park/visit-motion-picture-room.html

The research team queried the NARA Online Public Access search engine for suggested material but found no relevant material.

A.1.19 National Archives and Records Administration –Pacific Region (NARA-San Bruno)

Leo J. Ryan Memorial Federal Building
1000 Commodore Dr.
San Bruno, CA 94066-2350
POC: William (Bill) Greene, Archivist
650-238-3482
Open 7:30 A.M. to 4:00 P.M.
http://www.archives.gov/pacific/san-francisco/index.html

Record Group 21 (Records of the U.S. District Court)

Entry US District Court of Hawaii, Civil Case Files, 1900-1995, Screened Case Files

Box 74

Entry US District Court of Hawaii, Civil Case Files, 1900-1995, Civil and Admiralty Case Exhibits, 1900-52

Boxes 1-8 (aka 30-38)

Entry US District Court of Hawaii, Civil Dockets, 1900-1959

Boxes 4-5

Record Group 121 (Records of the Public Building Service)

Entry Real Property Disposal Project Files, 1950-59 (Accession 121-85 -009/ ARC ID 616603)

Box 14

Record Group 126 (Records of the Office of the Territories)

The research team copied six pages of finding aids but did not pull any records.

Record Group 181 (Records of the Naval Districts and Shore Establishments)

Entry 14th Naval District, Staff Headquarters, Pearl Harbor (FRC Accession 181-58A-3405)
Boxes V9523, V9530 and V9538

Entry 14th Naval District, Staff Headquarters, Pearl Harbor (FRC Accession 181-58B-3405)
Box V9544 Enclosures

Entry 14th Naval District, Staff Headquarters, General Correspondence, 1923-1946 (FRC Accession 181-58-3079)
Box 31 of 54 (318921)
Box 34 of 54 (318924)
Box 37 of 54 (318927)
Box 41 of 54 (318931)
Box 42 of 54 (318932)

Entry 14th Naval District, Staff Headquarters, General Correspondence, 1923-1946 (FRC Accession 181-58-3405)
Box V9522

Entry 14th Naval District, Staff Headquarters, General Correspondence, 1925-57 (FRC Accession 181-58-3112)
Boxes 6 and 13 of 45 (51893 and 51900)

Entry 14th Naval District, Staff Headquarters, General Correspondence, 1946 (FRC accession 181-58-3122)
Box 19 (71803)

Entry 14th Naval District, Office of the Commandant, General Correspondence, 1925-1957 (FRC Container No.181-60-0165)
Boxes 5-8 of 18

Entry 14th Naval District, Office of the Commandant, General Correspondence, 1925-57 (FRC accession 181-58-3062)
Boxes 1-9 (318877-318844)

Entry 14th Naval District, Office of the Commandant, General Correspondence, 1925-57 (FRC accession 181-58B-3022)
Boxes 13 of 29 (319495)

Entry 14th Naval District, District Logistical Officer, General Correspondence, 1942-46 (FRC accession 181-58-3171)
Box 13 of 16 (aka 319444 or V8159)

Entry 14th Naval District, Legal Officer, General Correspondence, 1946-47 (FRC Accession 181-58-3430)
Box 1 (V9563, 85411, 319183)

- *L4-3 Contracts, Leases*
- *L6 Receipts*

Entry 14th Naval District, Office of the Inspector General Investigation and Inspection Case Records, 1946-52 (FRC Accession 181-58-3068)
Box 1 (319512)

Entry 14th Naval District, Office of the Public Works Officer, Drawings for Projects in the Hawaiian and Marshall Islands, 1950-59 (FRC accession 181-59-0172)
Folders 1-26

Entry Naval Facilities Engineering Command, Design and Planning Records and Construction and Contract Drawings (Originals) 1908 – 1957 (FRC accession 181-84-23 and 181-84A-56)
Tubes 12-14, 53-62

Entry Naval Facilities Engineering Command (NAVFAC), Western Division, Land Acquisitions, 1944-61 (accession 181-92-001, former 181-76A-2177)
Boxes 1-12

Entry Naval Facilities Engineering Command (NAVFAC), Pacific Division, Land Acquisitions, 1944-61 (accession 181-92-002, FRC Accession 181-77-0023); Pearl Harbor Perimeter Acquisition Project Files
Boxes 1-9

Entry Pearl Harbor Naval Base, Hawaii, Office of the Commander, General Correspondence 1940-46, (Formerly Classified), Accession 181-58-3404A
Box 128-130

Entry Pearl Harbor Naval Base, Hawaii, Office of the Commander, General Correspondence 1941-46 (FRC Accession 181-58-3113)

Box 1-4 (52627-52630)

Entry Naval Base Pearl Harbor, Oahu, Hawaii General Correspondence 1945-46
(FRC Container No. – 181-58-3117)
Box 3 of 7

Record Group 313 (Records of Naval Operating Forces, 1849 – 1997)

The research team copied selected finding aids for this record group for potential future FUDS research efforts relating to other facilities in the Pacific but did not identify material that appeared to be directly relevant to the subject FUDS research.

A.1.20 Naval Facilities Engineering Command (NAVFAC), Hawaii

400 Marshall Road
JBPHH, HI 96860-3139
808-471-3926
https://www.navfac.navy.mil/navfac_worldwide/pacific/fecs/hawaii.html
Denise Emsley, Public Affairs Officer
808-471-7300
Environmental Restoration
Jan Kotoshirodo, Remedial Project Manager
808-471-1171 x 341
Janice Fukumoto, Environmental Restoration Program Manager
808-471-1171 x 229
Janea Jackson, AM4 & GRC Manager
808-471-5396 x356

The research team coordinated with this office about the Navy's investigation at Makalapa Crater Geographic Study Area of the Pearl Harbor Naval Complex Superfund site, Environmental Protection Agency (EPA) Facility Number: HI4170090076. They received the following material:

- May 2011 "*Preliminary Assessment for Munitions, Makalapa Crater, JBPHH*", by AECOM

NAVFAC Hawaii provided the team the roughly 5 GB of historical records data that AECOM located used for the 2011 PA.

They also inquired about acquiring real estate records for the subject facility was redirected to the NAVFAC Pacific that handles that role for Hawaii.

The research team also received current installation shape files from NAVFAC - Hawaii.

A.1.21 Naval Facilities Engineering Command (NAVFAC), Pacific Division

Building 258, Makalapa Drive
Pearl Harbor, HI 96860-3134
NAVFAC Asset Management
Building 499, 180Main Street
Real Estate Office
Ron Darlington, Asset Management, Real Estate, Cadastral Surveying and Mapping
808-473-0598

The research team discussed the news of the FUDS group relating to documentation to support eligibility and received the following material from NAVFAC Pacific:

- 1913 to 1930 1:62500 topographic quadrangles for Hawaii
- 1941-07-02 Makalapa Lands Adjacent to Pearl Harbor To Be Acquired NAVFAC OA-N1-310.pdf
- 2005-09-28 Makalapa Complex Real Estate Summary Map NAVFAC SHT02.pdf
- 2005-09-28 Makalapa Complex Real Estate Summary Map NAVFAC SHT02-A.pdf
- 2005-09-28 Makalapa Complex Real Estate Summary Map NAVFAC SHT02-B.pdf
- C416-DT.pdf, divided up as follows:

PDF Page	Filename
1	1939-10-19 Letter Extension NY_PH 369 acres NAVFAC C416-DT.pdf
2	1939-11-30 Letter Extension NY_PH 369 acres NAVFAC C416-DT.pdf
3	1942-01-22 Letter Revocable permit to WD for PH NAVFAC C416-DT.pdf
4-24	1939-10-30 Declaration of Taking Civil 416 NAVFAC C416-DT.pdf
25-42	1941-08-05 Amendment DT Civil 416 NAVFAC C416-DT.pdf
43-44	1941-04-09 Amendment DT Civil 416 NAVFAC C416-DT.pdf
45-60	1944-11-02 Amendment DT Civil 416 NAVFAC C416-DT.pdf
61-65	1943-06-05 Stipulation Order DT Civil 416 NAVFAC C416-DT.pdf
66-71	1939-10-30 Declaration of Taking Civil 416 NAVFAC C416-DT.pdf
72-77	1944-10-30 Stipulation Order DT Civil 416 NAVFAC C416-DT.pdf
78-79	1941-04-02 Amendment DT Civil 416 NAVFAC C416-DT.pdf
80-88	1939-10-19 Declaration of Taking Civil 416 NAVFAC C416-DT.pdf

A.1.22 Pacific Historic Parks

Formerly Arizona Memorial Museum Association (AMMA)
94-1187 Ka Uka Blvd.
Waipahu, HI 96797
808.954.8759
php@pacifichistoricparks.org
http://www.pacifichistoricparks.org/

A research team from AECOM Technical Services, Inc. of Honolulu AECOM, a NAVFAC contractor, conducted research at this repository for the 2011 NAVFAC PA on Makalapa Crater. [191] NAVFAC provided the FUDS PA research team copies of the material gathered by that effort from the following collections:

- World War II Valor in the Pacific National Monument
- 14th Naval District Photo Collection
- Photographs 13308, 13309, 13396-B

The FUDS PA research team did not identify material at this repository that warranted additional research.

A.1.23 University of Hawaii at Manoa Hamilton Library

Social Science Research Institute
2550 McCarthy Mall
Honolulu, HI 96822
808-956-7203
Ted Kwok
http://library.manoa.hawaii.edu/index.php

The research team queried the eVols digital repository of the UH (http://evols.library.manoa.hawaii.edu/) and downloaded the complete 21 sheet collection of 1:20,000 scale Topographical Quadrangles Terrain Maps for Oahu, completed in 1943 and printed by the U.S. Army Corp of Engineers Engineer Reproduction Plant (ERP).

A research team from AECOM Technical Services, Inc. of Honolulu AECOM, a NAVFAC contractor, conducted research at this repository for the 2011 NAVFAC PA on Makalapa Crater. [192] NAVFAC provided the FUDS PA research team copies of the material gathered by that effort from the following collections:

- Archives & Manuscripts Department
- Hawaii War Records Depository,

The research team also consulted the Maps, Aerial Photographs, and GIS (MAGIS) collection (http://guides.library.manoa.hawaii.edu/magis/mapcoll#hist) for relevant maps

and aerial images of the site. According to one of their archivist, they've scanned in most of their aerial photo collection but have not completed processing them. The USGS imagery for Hawaii and the Pacific is selective and available directly online. There is no metadata and unfortunately they do not have index maps to any of the sets. They are in the process of creating 300dpi scans for the WWII-Pacific collection. The Trust Territory collection has been scanned at 300dpi, but having been hosted yet. The Trust Territory aerials are heavily damaged from a flood we had in 2004. Upon request, they can prioritize some work based on USACE needs, including creating higher resolution images (though a request using their service forms would be needed). He thinks their WWII-Pacific aerials were acquired from UCLA which is perhaps part of the Fairchild Aerial Surveys that had been at UC Santa Barbara (http://www.library.ucsb.edu/map-imagery-lab/fairchild-aerial-surveys-fas).

A.1.24 U.S. Air Force AFCEC AFCEC/CXD
139 Barnes Dr, Suite 1
Tyndall AFB, FL 32403-5319
POC: James Prater Jr.
850-283-6306

The research team contacted Mr. Prater requesting contact information for the 647th CES AF EOD Flight, Hickam AFB HI to request EOD Incident Reports for Makalapa. Mr. Prater emailed contact information for the 647th CES AF EOD Flight and a request for USAF EOD Incident Reports was provided.

A.1.25 U.S. Army Corps of Engineers, Honolulu District (CEPOH)
Building 230
Fort Shafter, HI 96858-5440
Programs & Project Management Division, CEPOH-PP
Stephen Cayetano, Deputy Chief, Programs and Project Management Division
808-835-4100
Environmental Programs Branch (CEPOH-PP-E)
Building 230
Dan Nakamura, Chief, Environmental Programs Branch
808-835-4079
Gary Shirakata, Chief Restoration Section
808-835-4087
Helene Takemoto, FUDS Program Manager
808-438-6931
Lori Wong, Project Manager CEPOH-PP-E
808-835-4090
Jacqueline (Jackie) Conant, Project Manager CEPOH-PP-E
808-835-4033
Kevin Pien, Project Manager
808-835-4091
Walter Nagai, Environmental Engineer
808-835-4089
Michael Mullen Safe & Occupational Health Specialist (former Navy EOD)
808-835-4092
Tom Maruyama, Construction Inspection Tech
808-835-4095
Real Estate Branch (CEPOH-PP-R)
Building 230
Mike Sakai, Lead Realty Specialist (Team Leader)
808-438-0449
Sarah J. Watts, Realty Specialist
808-835-4060
Ann Loo, Realty Specialist
808-835-4058
Programs Branch (CEPOH-PP-P)
Roxane Iseri, Chief, Programs Management Branch
808-835-4045
Wendy Mow, Program Analyst
808-835-4049
Information & Technology
Pamela Branch, Records Manager (ACE-IT)
808-835-4464

The research team closely coordinated with the FUDS Project Manager (PM) during all aspects of this PA. The FUDS PM coordinated interacting with other elements of the District, Division and the Navy as required.

The research team contacted the Real Estate Branch regarding any applicable historical audited real estate of realty files for the subject FUDS. As most of the subject FUDS was originally a naval acquisition and disposal, the Corps of Engineers does not maintain historical realty files for those tracts. The realty specialist reviewed the files for the Aliamanu Military Reservation that additional tracts of the subject FUDS. The realty specialists also reviewed the similarly named Makalapa Military Reservation, determining that it did not include lands for the subject FUDS. The realty specialists also in assisted in evaluation of the subject FDE. The realty specialists also recounted that back when they were located in Building 127 of Tripler Amy Medical Center, they stored historic realty files in the basement and many were destroyed during flooding. It was also confirmed that short term Schofield Records Holding Area did not currently have any real estate records, as reconfirmed by the Records Manager.

A.1.26 U.S. Army Corps of Engineers, Pacific Ocean Division (CEPOD)
Building 525, Room A314
Fort Shafter, HI 96858-5440
Civil Works & Military Integration Division (CEPOD-PDM)
Hudson Kekaula, Civil Engineer
808-438-4632
Lindsey Kasperowicz, Assistant Division Counsel
808-835-4753

The research team consulted with the POD on the subject FUDS from an overall programmatic sense of the POH FUDS program.

A.1.27 US Army Garrison Hawaii (USGH-HI), Directorate of Public Works (DPW)
Building 104, Wheeler Field
947 Wainwright Avenue
Schofield Barracks, HI 96857-5013
808-656-1275, Service Order Desk
808-656-2371, Administration DPW
Rod Oshiro, Chief Programs Directorate
808-656-7561
Dawn Sakai, GIS/CADD Operations-contractor
808-656-3051

The research team coordinated with various Division and Branch elements of the DPW office locating information of potential relevance to the FUDS program as elaborated below. The GIS/CADD contact had a key to the map and drawing vault.

A.1.28 US Army Garrison Hawaii (USGH-HI), DPW Planning and Environmental Divisions

Building 105, Wheeler Field
948 Santos Dumont Avenue
Schofield Barracks, HI 96857-5013
David Pollack, Chief Master Planner
808-656-2448
Sheri Evans, Admin
808-656-2522
Allen Armstrong, GIS
808-656-3082
Horace Purifoy, Chief Real Estate Branch and Real Property Accountable Officer
808-656-8300
Ginger Sagum, Reality Specialist- retired
Bobbie Puahala, Real Property Technician
808-656-3259

The DPW engineering plans, maps and drawings vault is located in the basement of Building 102 (1129 Wright, exterior door on south side east of Barber Shop.) This material was moved from an earlier location on the east side of Hanger 113 in two rooms. Based on 2007 review and analysis of the material in the hanger, this collection represents the circa late 1970s merger of the Fort Shafter map drawers and an earlier collection of Schofield Barracks located in a vault in a building that has subsequently been razed. Unlike many other installation drawing collections, this collection indexed most of the drawings in sequential order of construction or maintenance contract and not by specific building number (roughly 70% of total drawings). By being the merger of two map collections, there were at least two drawing numbering systems in place, in addition to a large number of maps and drawings that didn't include index numbering. The DPW had scanned in an estimated 70-90% of the drawings into a ProjectWise database, with the bulk of those being from the indexed drawings. Unfortunately, ProjectWise wasn't maintained and the material isn't readily copied from that system. The research team did not review material but acquired the current inventory of material, Excel database (Schofield Barracks DPW Building 102 Plan Files Inventory 2015-08-18.xls). The inventory covers some 63,000 items. The research team conducted a key word search of the inventory (i.e., Makakilo, Makalapa, Pali, Koko, Bombing, Jungle, Kihewamoku, Pulemoku, Mokualai, Mokuauia, Heeia, Saipan, Guam, Training Area, Barrette, Real estate). Based on the keyword search, there did not appear to be any clearly relevant maps to FUDS of current interest but certainly could have material of use for future FUDS. Drawer R21-A-1, General Sites, Various Posts appear to be worth a visual review.

The research team met with the new DPW GIS coordinator, who had recently been assigned responsibility for the DPW map and drawing vault in Building 102. The GIS coordinator agreed to provide the current inventory of the holdings. The research team contacted personnel familiar with the holdings of the DPW Real Estate Branch. They provided the team with a circa 1970 listing of Inactive Army Installations Hawaii but the team did not locate any directly relevant real estate material for the FUDS program.

A.1.29 U.S. Army Garrison Hawaii (USGH-HI), DPW Conservation and Restoration Branch, Cultural Resources Section (IMPC-HI-PWE)

1513 Kolekole, Building 494 Schofield Barracks
Schofield Barracks, HI 96857-5013
Richard Davis, Cultural Resources Program Manager
808-655-9709
David Cox, Senior Cultural Resources Specialist
808-655-9735
Jill Sommer, Curator of Cultural Resources, RCUH/PCSU Contractor
808-655-9697
Linda Hee, Archivist
808-655-9703
808-656-2878 – Lillian Mills, Administration Environmental Division

The research team met with the DPW Cultural Resources staff and reviewed the inventory database of their gathered maps and engineering drawing collection, primarily retrieved from the main DPW collection housed in Building 102. The research team selected the following items and received digital copies of them:

- 1943-08 Battery E 95th Kokokahi Fort Hase area SB-DPW-CR 0243.pdf
- 1943-08 Battery E 95th CA Fort Hase SB-DPW-CR 0244.pdf
- 1941 Hawaiian Defense Project Oahu AA Positions SB-DPW-CR 0839.pdf
- 1942 Modified Road and Trail Program Oahu SB-DPW-CR 2845.tif
- 1944-07-05 HSAC Fire Control Base End Stations Oahu SB-DPW-CR 0837.pdf
- 1944 -06 Oahu Training Areas Camps and Centers SB-DPW-CR 0810.tif
- 1945-06 30 Oahu Training Areas Camps and Centers SB-DPW-CR 0653.pdf
- 1954-08 Makua TA Kaena Point MR Mokuleia TA SB-DPW-CR 0821.jpg
- 1971-11 Military Installations and Facilities Hawaii SB-DPW-CR 0801.tif
- 1941circa Operations Fixed Installations AA AWS OP Oahu SB-DPW-CR 0654.pdf
- 1970circa Installations Oahu SB-DPW-CR 0825.pdf
- 1944-06 Oahu Training Areas Camps and Centers SB-DPW-CR 0851.pdf
- 1933 Incl 2 Oahu Roads and Gun Emplacements SB-DPW-CR 3736.tif
- 1933 Incl 1 Oahu Installations SB-DPW-CR 3737.tif

The Cultural Resource group had begun an inventory of the DPW collection, completing approximately 65% before that effort was halted in spring 2014 and shifted to others within DPW (Master Planning GIS). They did not have authority to release the inventory completed to date to the research team without DPW Master Planning GIS approval which was received and they provide an excel database of the inventory (Schofield Barracks DPW Building 102 Plan Files Inventory 2015-08-18.xls).

A.1.30 Navy Mobile Diving and Salvage Unit One
Detachment Explosive Ordnance Disposal, UIC: 32082
1025 Quincy Ave. Ste. 800
Pearl Harbor, HI 96860-4512

The research team received two Navy EOD incident reports related to potential MEC finds as part of the TCRA from NAVFAC.

A.2 AERIAL PHOTOGRAPHY REPOSITORIES

The following repositories were consulted for aerial imagery of the property. Note historical imagery that exceeded 1:40,000 scale was not considered for acquisition. The light gray shading indicates historical imagery that is planned for purchase. Also, additional aerial imagery acquired from sources noted in as noted in section A.1, such as National Archives at College Park, Still Pictures Branch and University of Hawaii at Manoa Hamilton Library.

A.2.1 National Archives at College Park, Cartographic & Architectural Branch
8601 Adelphi Road
College Park, MD 20740
866-272-6272
http://www.archives.gov/research/formats/cartographic.html

The research team consulted the aerial photo coverage overlays in Record Group 373 (Records of the U.S. Defense Intelligence Agency) for imagery at a scale of 1:40,000 or better covering the area. The contractor pulled the index sheets for Makalapa Crater Landfill (A04MS0142) and identified the following imagery that covers the site:

Date	Scale	Record Group	Can Number	Frames	Total Frames
24 Sept 1943	NA	373	ON 26549 (A-9349)	Exp 959 AB4 M11-3-110 Exp 959 AB4 M11-3-111	2
27 July 1943	1:20,000	373	ON 2914 (A-9368)	Exp M83-37-917 Exp M83-38-917 Exp M83-39-917	3

The research team also consulted *Aerial Photographs in the National Archives-Special List 25*, dated 1990, for available imagery from:

Record Group 57 (Records of the U.S. Geological Survey)
Record Group 95 (Records of the U.S. Forest Service)
Record Group 114 (Records of the Soil Conservation Service)
Record Group 145 (Records of the Agriculture Stabilization and Conservation Service)

The team located the following imagery in these Record Groups:

Date	Scale	Record Group	Can Number	Frames	Total Frames

Note: *There was no imagery available from this record group.*

A.2.2 U.S. Geological Survey - EROS Data Center
47914 252nd Street
Sioux Falls, South Dakota 57198
800-252-4547 ext. 2074
http://edcwww.cr.usgs.gov/

CEMVS-EC-SG tasked a contractor to perform an initial search of available imagery for Makalapa Crater Landfill (A04MS0142) at this repository. The contractor identified the following imagery that covers the site.

Aerial Photo Mosaics

Acquisition Date	Scale	Entity ID	Image Type	Project	Frame Nbr	# Frames
5/14/1951	28000	ARDE1MFO000790267	BW	MFO00	See Below	See Below
3/24/1972	40000	ARDDC150400800378	BW	15040	See Below	See Below
3/31/1972	40000	ARDDC150700800372	BW	15070	See Below	See Below

Aerial Photography Single Frame

Acquisition Date	Scale	Entity ID (*See Note)*	Image Type	Project	Roll Nbr	Frame Nbr	# Prints
5/14/1951 (note: acquisition date and date printed on aerial photo do differ)	1:27,000	AR1MFY00002XXXX	BW	MFY00	2	23 thru 26 56 thru 58 65 thru 69	12
6/4/1951	1:8,000	AR1MFO00001XXXX	BW	MFO00	1	8 thru 10	3
2/6/1968	1:24,000	AR1VXJS0002XXXX	BW	VXJ50	2	11 thru 15	5
2/6/1968	1:24,000	AR1VXJS0002XXXX	BW	VXJ50	3	9 thru 12	4
3/24/1972	1:40,000	ARC15070001XXXX	BW	15040	1	36 & 37	2
3/31/1972	1:40,000	ARC15070001XXXX	BW	15070	1	60 thru 62	3
10/9/1974	1:31,000	AR574001935XXXX	CLR	74000	1935 1934 1936	26 196 194	3
10/16/1974	1:33,000	AR5740019439999	CLR	74000	1943	9999	1

Acquisition Date	Scale	Entity ID (*See Note)*	Image Type	Project	Roll Nbr	Frame Nbr	# Prints
10/16/1974	1:33,000	AR5740019420003	CIR	74000	1942	3	1
10/16/1974	1:33,000	AR5740019440002	BW	74000	1944	2	1
10/16/1974	1:33,000	AR5740019440003	BW	74000	1944	3	1
10/16/1974	1:33,000	AR5740019420004	CIR	74000	1942	4	1
10/16/1974	1:32000	AR5740019430000	CLR	74000	1943	0	1
7/28/1975	32000	AR575002160XXXX	Color	75000	2160	24 thru 27	4
4/29/1985	24000	AR585003455XXXX	Color	85000	3455	15 thru17 87 thru 89	6
5/2/1985	11000	AR585003457XXXX	Color	85000	3457	214 thru 216	3
5/2/1985	27250	AR585003457XXXX	Color	85000	3457	301 thru 303 288 thru 290	6
9/19/1992	30000	AR592004462XXXX	Color	92000	4462	96 thru 98	3
9/19/1992	30000	AR592004461XXXX	Color	92000	4461	96 thru 98	3
9/23/1992	29000	AR592004473XXXX	Color	92000	4473	31 thru 33 233 thru 235	6
9/23/1992	30000	AR592004474XXXX	Color	92000	4474	31 thru 33 229	4
9/25/1992	30000	AR592004477XXXX	Color	92000	4477	45 & 46	2
9/25/1992	30000	AR592004478XXXX	Color	92000	4478	45 & 46	2
5/19/2004	19200	ARUHNL00003XXXX	Color	HNL00	3	42 thru 45	4
5/22/2004	19200	ARUHNL00003XXXX	Color	HNL00	3	121 thru 124	4
4/9/2005	19200	ARUHNL00006XXXX	Color	HNL00	6	268 & 269	2
4/9/2005	19200	ARUHNL00006XXXX	Color	HNL00	6	128 thru 131 267, 270 & 271	7
7/22/2006	21600	ARUHNL06001XXXX	Color	HNL06	1	62 thru 65 80 thru 83	8

Note: *Last 4 digits of the Entity ID are the frame number (replace XXXX with frame number – include leading zeros).*

DOQ

Acquisition Date	Resolution (meters)	Entity ID	Map Name	Quadrant	Band Type
1/30/2000	1	DI00000100234868	PEARL HARBOR	NE	RGB

High Resolution Orthophotography

Beginning Date	Ending Date	Resolution (meters)	Dataset Name	# Tile
2/1/2004	2/1/2004	0.3	200402_honolulu_hi_0x3000m_utm_clr	2
7/18/2006	1/17/2009	0.3	200607_honolulu_hi_0x3000m_utm_clr	2
5/13/2010	5/28/2011	0.15	201005_honolulu_hi_0x1500m_utm_clr	1

NAIP Compressed

Acquisition Date	Resolution (meters)	Dataset Name	# Tile

Note: *There was no imagery found for this group.*

NAPP

Acquisition Date	Entity ID (*See Note*)	Project	Roll Nbr	Frame Nbr	Film Type	Project Number	# Frames

Note: *Last 3 digits of the Entity ID are the frame number (replace XXX with frame number – include leading zeros).*
Note 2: *There was no imagery found for this group.*

NHAP

Acquisition Date	Scale	Entity ID (*See Note)*	Project	Roll Nbr	Frame Nbr	Film Type	# Frames

Note: *Last 3 digits of the Entity ID are the frame number (replace XXX with frame number – include leading zeros).*
Note2 : *There was no imagery found for this group.*

A.2.3 U.S. Department of Agriculture – Farm Service Agency (USDA-FSA) Aerial Photography Field Office (APFO)

2222 West 2300 South
Salt Lake City, UT 84119-2020
801-975-3653
http://www.fsa.usda.gov

CEMVS-EC-SG tasked a contractor to perform an initial search of available imagery for Makalapa Crater Landfill (A04MS0142) at this repository. The contractor identified the following imagery that covers the site:

Makalapa Crater Landfill (A04MS0142) – Honolulu County, Hawaii

YEAR	RES/SCL	PROG	%COV *	BND/FLM	FMT	QTY *	REMARKS
1965	24000	FSA	100	BW	PI	4	2116
2001	1	NDOP	100	CIR	MR	1	CCM
2001	1000	USDA	81	BIP		46	DOQQ FORMAT

* %COV and QTY represents amounts for entire county and not necessarily the site

A.2.4 R. M. Towill Corporation (RMTC)

2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819-3494
808- 842-1133
Edgar Gamiao, aerial photography
http://www.rmtowill.com/order-historical-photos

The research team contacted RMTC which maintains a library of aerial photographs taken throughout Hawaii dating back to 1948. Research to conduct availability of imagery in their collection is $150 with acquisition costing $150 per frame if available. The research team acquired the following imagery: 1949-11-22_Makalapa_Crater_Frame_217-5

APPENDIX B

REFERENCES AND REFERENCE MATERIAL

B REFERENCES AND REFERENCE MATERIAL

The reference numbers below refer to the endnote citations in the main text of the document. The citations refer to file names of digital scans of the source material backup documents. On the digital version of this report, the references are scanned images of the source material, typically saved as Adobe PDF files for textual material or as a TIF or JPG file for map or photo references. The file name or the last page of the PDF file indicates the location where the source material was located. The listing and scope of repositories searched for the gathered documents are listed in Appendix A - Reference Sources and Records Reviewed. The following list of endnote references only represents the items directly cited in preparation of this report, and do not illustrate all the documents reviewed or copied for the reference material.

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APPENDIX C

ABBREVIATIONS, ACRONYMS, AND BREVITY CODES

ABBREVIATIONS, ACRONYMS AND BREVITY CODES

The following list contains abbreviations, acronyms and brevity codes within this Preliminary Assessment, as well as typical others.

AA	Anti-Aircraft
AAA	Anti-Aircraft Artillery
ACM	Asbestos-Containing Materials
AOI	Area of Interest
ASR	Archives Search Report
ASSHP	Abbreviated Site Safety and Health Plan
AST	Aboveground Storage Tank
AT&L	Acquisition, Technology, and Logistics
BD/DR	Building Demolition/Debris Removal
BRAC	Base Realignment and Closure
CDC	Child Development Center
CEMVS	Corps of Engineers, Mississippi Valley Division, St. Louis District
CEMVS-EC-E	Environmental and Munitions Branch of the U.S. Army Corps of Engineers, St. Louis District
CEPOH	U.S. Army Corps of Engineers – Honolulu District
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CON/HTRW	Containerized/Hazardous, Toxic, and Radioactive Waste
CONUS	Continental U.S.
COPC	Constituents of Potential Concern
CW	Chemical Warfare
CWM	Chemical Warfare Materials
DDR&E	Director, Defense Research & Engineering
DERP	Defense Environmental Restoration Program
DLNR	Department of Land and Natural Resources
DMM	Discarded Military Munitions
DoD	Department of Defense
DOE	Department of Education
DOH	Department of Health
DTIC	Defense Technical Information Center
DU	Decision Unit
EAL	Environmental Action Level
EMCX	Environmental & Munitions Center of Expertise
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
FA	Feasibility Assessment
FDE	Findings and Determination of Eligibility

FI	Facility Investigation
FRC	Federal Records Center
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
G-RAM	General Radioactive Material
GSA	Geographic Study Area
HAAC	Hawaiian Antiaircraft Artillery Command
HDOH	Hawaii Department of Health
HEER	Hazard Evaluation and Emergency Response
HEW	Health, Education and Welfare
HRA	Historical Radiological Assessment
HTRW	Hazardous Toxic and Radioactive Waste
IAS	Initial Assessment Study
INPR	Inventory Project Report
INRMP	Integrated Natural Resource Management Plan
JBPHH	Joint Base Pearl Harbor-Hickam
MBTA	Migratory Bird Treaty Act
MC	Munitions Constituents
MD	Munitions Debris
MEC	Munitions and explosives of concern
MES	Makalapa Elementary School
mdg	million gallons per day
MLR	Master Location Register
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Military Reservation
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
msl	mean sea level
NARA	National Archives and Records Administration
NAVFAC	Naval Facilities Engineering Command
NCP	National Contingency Plan
n.d.	No Date
NDAI	No DoD Action Indicated
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NHKS	Navy Hale Keiki School
NHL	National Historic Landmark
NOAA	National Oceanic and Atmospheric Administration
NOSSA	Naval Ordnance Safety and Security Activity
NPL	National Priorities List
NWIS	National Water Information System
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons

PAL	Protection Action Level
PHNB	Pearl Harbor Naval Base
PHNC	Pearl Harbor Naval Complex
POC	Point of Contact
POL	Petroleum, Oils and Lubricants
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act of 1976
RG	Record Group
RHS	Radford High School
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SDWIS	Safe Drinking Water Information System
SSR	Site Summary Report
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Units
TCRA	Time Critical Removal Action
TEQ	Toxicity Equivalent
TFH	Total Fuel Hydrocarbons
TPH	Total Petroleum Hydrocarbons
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WW II	World War II

* designates an historic acronym

APPENDIX D

GLOSSARY

GLOSSARY

The following list contains a glossary of selected terms associated with the FUDS program; however, inclusion of these terms does not indicate they are specifically applicable to this Abbreviated Preliminary Assessment. Source references for the definitions are provided in the endnotes that follow.

Active Range[i]

A military range that is currently in service and is being regularly used for range activities

Anomaly Avoidance[ii]

Techniques employed on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to avoid contact with potential surface or subsurface explosive or CA hazards, to allow entry to the area for the performance of required operations.

Chain of Custody[iii]

The activities and procedures taken throughout the inspection, re-inspection and documentation process to maintain positive control of MPPEH to ensure the veracity of the process used to determine the status of material as to its explosive hazard. This includes all such activities from the time of collection through final disposition.

Chemical Agent (CA)[iv]

A chemical compound (to include experimental compounds) that, through its chemical properties produces lethal or other damaging effects on human beings, in intended for use in military operations to kill, seriously injure, or incapacitate a person through its physiological effects. Excluded are research, development, testing and evaluation (RDTE) solutions, riot control agents, chemical defoliants and herbicides, smoke and other obscuration materials; flame and incendiary materials; and industrial chemicals.

Chemical Agent (CA) Hazard[v]

A condition where danger exists because CA is present in a concentration high enough to present potential unacceptable effects (e.g., death, injury, damage) to people, operational capability, or the environment.

Chemical Agent Identification Sets (CAIS)[vi]

CAIS are military training aids containing small quantities of various chemical warfare agents and other chemicals.

Chemical Agent (CA) Safety[vii]

A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks of a mishap involving chemical warfare material (CWM) and CA in other than munitions configurations.

Chemical Warfare Agents (CWA)

Are the V- and G-series nerve agents, H-series (i.e., "mustard" agents) and L-series (i.e., lewisite) blister agents, and certain industrial chemicals used by the military as weapons, including hydrogen cyanide (AC), cyanogens chloride (CK), or carbonyl dichloride (called phosgene or CGI00. CWA do not include riot control agents (e.g., w-chloroacetophenone (CN) and ochlorobenzylidenemalononitrile (CS) tear gas), chemical herbicides, smoke or incendiary compounds, and industrial chemicals that are not configured as a military munition.

Chemical Warfare Material (CWM)

Items generally configured as a munition containing a chemical compound that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM includes V- and G- series nerve agents or H-series (mustard) and L-series (lewisite) blister agents in other-than-munition configurations; and certain industrial chemicals (e.g., hydrogen cyanide (AC), cyanogen chloride (CK), or carbonyl dichloride (called phosgene or CG)) configured as a military munition. Due to their hazards, prevalence and military-unique application, chemical agent identifications sets (CAIS) are also considered CWM. CWM does not include: riot control devices; chemical defoliants and herbicides; industrial chemicals (e.g., AC, CK, or CG) not configured as a munition; smoke and other obscuration producing items; flame and incendiary producing items; or soil, water, debris or other media contaminated with low concentrations of chemical agents where no CA hazards exist.[viii]

Chemical Warfare Material (CWM) *is a general term that includes four subcategories of specific materials:*

- *CWM, explosively configured are all munitions that contain a CWA fill and any explosive component. Examples include M55 rockets with CWA, the M23 VX mine, and the M360 105-millimeter GB artillery cartridge.*
- *CWM, nonexplosively configured are all munitions that contain a CWA fill but that do not include any explosive components. Examples include any chemical munition that does not contain an explosive component and VX or mustard agent spray canisters.*
- *CWM, bulk container are all non-munitions-configured containers of CWA (e.g., a tone container).*

- *Chemical Agent Identification Sets (CAIS). All forms of CAIS are scored the same except for CAIS K941, toxic gas set M-1; and K942, toxic gas set M-2/E-11, which are scored higher due to the relatively large quantities of agent they contain.* [ix1]

Chemical Warfare Material (CWM) Response[x]

Munitions responses and other responses to address the chemical safety; explosives safety, when applicable; human health; or environmental risks presented by CA-filled munitions and CA in other than munitions configurations. (See munitions response.)

Closed Range[xi]

A military range that has been taken out of service as a range and that either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a DoD component.

Construction Support[xii]

Assistance provided by DoD EOD or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards.

Cultural Debris[xiii]

Debris found on operational ranges or munitions response sites, which may be removed to facilitate a range clearance or munitions response, that is not related to munitions or range operations. Such debris includes, but is not limited to: rebar, household items (refrigerators, washing machines, etc.), automobile parts and automobiles that were not associated with range targets, fence posts, and fence wire.

Defense Site[xiv]

Locations that are or were owned by, leased to, or otherwise possessed or used by the Department of Defense. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used for or was permitted for the treatment or disposal of military munitions.

[1] On 23 April 2007, the Department of the Army changed the 5 September 1997 Interim Guidance for Biological Warfare Material (BWM) and Non-Stockpiled Chemical Warfare Material (CWM) Response Activities to state that CAIS that do not contain dilute amounts of nerve agent or neat Chemical Agent (i.e., CAIS K941 and K942) are no longer considered CWM.

Discarded Military Munitions (DMM)[xv]

Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations.

Disposal[xvi]

End of life tasks or actions for residual materials resulting from demilitarization or disposition operations.

Disposition[xvii]

The process of reusing, recycling, converting, redistributing, transferring, donating, selling, demilitarizing, treating, destroying, or fulfilling other life-cycle guidance, for DoD property.

Documentation of the Explosives Safety Status of Material[xviii]

Documentation attesting that material:
(1) does not present an explosive hazard and is consequently safe for unrestricted transfer within or release from DoD control, or
(2) is MPPEH, with the known or suspected explosive hazards stated, that is only transferable or releasable to a qualified receiver.
This documentation must be signed by a technically qualified individual with direct knowledge of:
(1) the results of both the material's 100 percent inspection and 100 percent re-inspection or of the approved process used and the appropriate level of re-inspection, and
(2) the veracity of the chain-of-custody for the material. This signature is followed by the signature of another technically qualified individual who inspects the material on a sampling basis (sampling procedures are determined by DoD entity that is inspecting the material).

Environmental Regulators and Safety Officials[xix]

Include, but may not be limited to environmental regulators, environmental coordinators or hazardous material coordinators, law enforcement officers, and safety personnel of the U.S. Environmental Protection Agency (USEPA), American Indians and Alaska Natives, other Federal Land Managers, and/or the States. When appropriate, public health officials of various agencies may also be involved.

Explosive Hazard[xx]

A condition where danger exists because explosives are present that may react (e.g., detonate, deflagrate) in a mishap with potential unacceptable effects (e.g., death, injury, damage) to people, property, operational capability, or the environment.

Explosive Ordnance Disposal (EOD)[xxi]

The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration.

Explosive Ordnance Disposal (EOD) Personnel[xxii]

Military personnel who have graduated from the Naval School, Explosive Ordnance Disposal; are assigned to a military unit with a Service-defined EOD mission; and meet Service and assigned unit requirements to perform EOD duties. EOD personnel have received specialized training to address explosive and certain CA hazards during both peacetime and wartime. EOD personnel are trained and equipped to perform Render Safe Procedures (RSP) on nuclear, biological, chemical, and conventional munitions, and on improvised explosive devices.

Explosive Ordnance Disposal (EOD) Unit[xxiii]

A military organization constituted by proper authority; manned with EOD personnel; outfitted with equipment required to perform EOD functions; and assigned an EOD mission.

Explosives or Munitions Emergency Response[xxiv]

All immediate response activities by an explosives and munitions emergency response specialist to control, mitigate, or eliminate the actual or potential threat encountered during an explosives or munitions emergency. An explosives or munitions emergency response may include in-place render-safe procedures, treatment or destruction of the explosives or munitions, and/or transporting those items to another location to be rendered safe, treated, or destroyed. Any reasonable delay in the completion of an explosives or munitions emergency response caused by a necessary, unforeseen, or uncontrollable circumstance will not terminate the explosives or munitions emergency. Explosives and munitions emergency responses can occur on either public or private lands and are not limited to responses at RCRA facilities.

Explosives Safety[xxv]

A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks or potential mishaps involving military munitions.

Former Range[xxvi]

Former range means the munitions response site is a location that was:
(1) Closed by a formal decision made by the DoD Component with administrative control over the location, or
(2) *Put to a use incompatible with the presence of UXO, DMM, or MC.*

Formerly Used Defense Sites (FUDS)[xxvii]

A FUDS is defined as a facility or site (property) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. By the Department of Defense Environmental Restoration Program (DERP) policy, the FUDS program is limited to those real properties that were transferred from DoD control prior to 17 October 1986. FUDS properties can be located within the 50 States, District of Columbia, Territories, Commonwealths, and possessions of the United States.

Historical Evidence[xxviii]

Historical evidence means that the investigation:
(1) Found written documents or records, or
(2) Documented interviews of persons with knowledge of site conditions, or
(3) *Found and verified other forms of information.*

Inactive Range[xxix]

A military range that is not currently being used, but that is still under military control and considered by the military to be a potential range area, and that has not been put to a new use that is incompatible with range activities.

Interim Holding Facility (IHF)[xxx]

A temporary storage facility designed to hold recovered chemical warfare material (RCWM).

Land Use Controls (LUC)[xxxi]

LUC are physical, legal, or administrative mechanisms that restrict the use of, or limit access to, real property, to manage risks to human health and the environment. Physical Mechanisms encompass a variety of engineered remedies to contain or reduce contamination and/or physical barriers to limit access to real property, such as fences or signs.

Long-Term Management (LTM)[xxxii]

The period of site management (including maintenance, monitoring, record keeping, 5-year reviews, etc.) initiated after response (removal or remedial) objectives have been met (i.e., after Response Complete).

Material Potentially Presenting an Explosive Hazard (MPPEH)[xxxiii]

Material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially contaminating a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

Military Munitions[xxxiv]

Military munitions means all ammunition products and components produced or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes: confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof.

The term does not include wholly inert items; improvised explosive devices; and nuclear weapons, nuclear devices, and nuclear components, other than nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) have been completed.

Military Munitions Burial Site[xxxv]

A site, regardless of location, where military munitions or CA, regardless of configuration, were intentionally buried, with the intent to abandon or discard. This term includes burial sites used to dispose of military munitions or CA, regardless of configuration, in a manner consistent with applicable environmental laws and regulations or the national practice at the time of burial. It does not include sites where munitions were intentionally covered with earth during authorized destruction by detonation, or where in-situ capping is implemented as an engineered remedy under an authorized response action.

Military Munitions Response Program (MMRP) Site[xxxvi]

A discrete location within a Munitions response Area (MRA) that may or may not require a munitions response.

Military Range[xxxvii]

Designated land and water areas set aside, managed, and used to conduct research on, develop, test, and evaluate military munitions and explosives, other ordnance, or weapon systems, or to train military personnel in their use and handling. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas.

Military Separation Distance (MSD)[xxxviii]

MSD is the distance at which personnel in the open must be from an intentional or unintentional detonation.

Munition Response Area (MRA)[xxxix]

Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites.

Munition Response Site (MRS)[xl]

A discrete location within a MRA that is known to require a munitions response.

Munition with the Greatest Fragmentation Distance (MGFD)[xli]

The munition with the greatest fragment distance that is reasonably expected (based on research or characterization) to be encountered in any particular area.

Munitions Constituents (MC) [xlii]

Any materials originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris[xliii]

Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions and Explosives of Concern (MEC)[xliv]

This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means:

(a) Unexploded Ordnance (UXO), as defined in 10 U.S.C. 1(e)(5);

(b) Discarded military munitions (DMM), as defined in 10 U.S.C. 2710 (e)(2); or

(c) Munitions constituents (e.g., TNT, RDX) as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Response[xlv]

Response actions, including investigation, removal actions and remedial actions to address the explosives safety, human health, or environmental risks presented by unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC), or to support a determination that no removal or remedial action is required.

Mutual Agreement[xlvi]

A meeting of the minds on a specific subject, and a manifestation of intent of the parties to do or refrain from doing some specific act or acts. Inherent in any mutual agreement or collaborative process are the acknowledgement of each member's role in the process and their differing views of their authorities. The mutual agreement process will provide a means of resolving differences without denying the parties an opportunity to exercise their respective authorities should mutual agreement fail to be achieved.

One Percent Lethality Distance[xlvii]

A distance calculated from a given CA Maximum Credible Event (MCE) and meteorological conditions (temperature, wind speed, Pasquill stability factor) and established as the distance at which dosage from that MCE agent release would be 150 mg-min/m^3 for H and HD agents, 75 mg-min/m^3 for HT agent, 150 mg-min/m^3 for Lewisite, 10 mg-min/m^3 for GB agent, 4.3 mg-min/m^3 for VX vapor, and 0.1 mg-min/m^3 for inhalation and deposition of liquid VX.

On-call Construction Support[xlviii]

Construction support provided, on an as needed basis, where the probability of encountering UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, has been determined to be low. This support can respond from off-site when called, or be on-site and available to provide required construction support.

On-Site Construction Support[xlix]

Dedicated construction support, where the probability of encountering UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, has been determined to be moderate to high.

On-the-Surface[l]

A situation in which UXO, DMM or CA, regardless of configuration, are: (A) entirely or partially exposed above the ground surface (i.e., the top of the soil layer); or (B) entirely or partially exposed above the surface of a water body (e.g., because of tidal activity).

Open Burn (OB)[li]

An open-air combustion process by which excess, unserviceable, or obsolete munitions are destroyed to eliminate their inherent explosive hazards.

Open Detonation (OD)[lii]

An open-air process used for the treatment of excess, unserviceable or obsolete munitions whereby an explosive donor charge initiates the munitions being treated.

Operational Range[liii]

A range that is under the jurisdiction, custody, or control of the Secretary of Defense and that is used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. (10 U.S.C. 101(e)(3)(A) and (B)). Also includes "military range," "active range," and "inactive range" as those terms are defined in 40 CFR 266.201.

Ordnance and Explosives (OE) [liv]

Anything related to munitions designed to cause damage to personnel or material through explosive force, incendiary action or toxic effects. OE is: bombs and warheads, missiles; artillery, mortar and rocket ammunition, small arms ammunition; antipersonnel and antitank mines; demolition charges; high explosives and propellants; depleted uranium rounds; military chemical warfare materials as defined [below]; and all similar and related items or components, explosive in nature or otherwise designed to cause damage to personnel or material (e.g., fuze, boosters/propellants or soils/media contaminated with explosives if the concentration is sufficient to be reactive.) . . .Unexploded Ordnance (UXO) is an item of explosive ordnance which has failed to function as designed or has been abandoned, discarded or improperly disposed of and is still capable of functioning, causing damage to personnel or material.

Other Than Operational Range

Replaces the previous definitions for Closed, Transferring, or Transferred ranges

Physical Evidence[lv]

Physical evidence means:

(1) *Recorded observations from on-site investigations, such as finding intact UXO or DMM, or components, fragments, or other pieces of military munitions, or*

(2) *The results of field or laboratory sampling and analysis procedures, or*

(3) *The results of geophysical investigations.*

Primary Explosives[lvi]

Primary explosives are highly sensitive compounds that are typically used in detonators and primers. A reaction is easily triggered by heat, spark, impact or friction. Examples of primary explosives are lead azide and mercury fulminate.

Public Access Exclusion Distance (PAED)[lvii]

The PAED is defined as longest distance of the hazardous fragment distance, inhabited building distance (IBD) for overpressure, or the One Percent Lethality Distance. For siting purposes, the PAED is analogous to the IBD for explosives; therefore, personnel not directly associated with the chemical operations are not to be allowed within the PAED.

Qualified Receiver[lviii]

Entities that have personnel who are, or individuals who are, trained and experienced in the identification and safe handling of used and unused military munitions, and any known or potential explosive hazards that may be associated with the MPPEH they receive; and are licensed and permitted or otherwise qualified to receive, manage, and process MPPEH.

Range[lix]

A designated land or water area that is set aside, managed, and used for range activities of the Department of Defense. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration.

Range Activities[lx]

Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems.

Range Clearance[lxi]

The destruction, or removal and proper disposition of used military munitions (e.g., unexploded ordnance (UXO) and munitions debris) and other range-related debris (e.g., target debris, military munitions packaging and crating material) to maintain or enhance operational range safety or prevent the accumulation of such material from impairing or preventing operational range use. "Range clearance" does not include removal, treatment, or remediation of chemical residues or munitions constituents from environmental media, nor actions to address discarded military munitions (e.g., burial pits) on operational ranges.

Range Related Debris[lxii]

Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g., target debris, military munitions packaging and crating material).

Recovered Chemical Warfare Materiel (RCWM)[lxiii]

CWM used for its intended purpose or previously disposed of as waste, which has been discovered during a CWM response or by chance (e.g., accidental discovery by a member of the public), that DoD has either secured in place or placed under DoD control, normally in a DDESB-approved storage location or interim holding facility, pending final disposition.

Render Safe Procedures (RSP)[lxiv]

The portion of EOD procedures that involves the application of special disposal methods or tools to interrupt the functioning or otherwise defeat the firing train of UXO from triggering an unacceptable detonation.

Secondary Explosives[lxv]

Secondary explosives are generally less sensitive to initiation than primary explosives and are typically used in booster and main charge applications. A severe shock is usually required to trigger a reaction. Examples are TNT, cyclo-1,3,5-trimethylene-2,4,6-trinitramine (RDX or cyclonite), HMX, and tetryl.

Small Arms Ammunition[lxvi]

Ammunition, without projectiles that contain explosives (other than tracers) that is .50 caliber or smaller, or for shotguns.

Team Separation Distance (TSD)[lxvii]

The distance that munitions response teams must be separated from each other during munitions response activities involving intrusive operations.

Technical Escort Unit (TEU)[lxviii]

A DoD organization manned with specially trained personnel that provide verification, sampling, detection, mitigation, render safe, decontamination, packaging, escort and remediation of chemical, biological and industrial devices or hazardous material.

Technology-aided Surface Removal[lxix]

A removal of UXO, DMM or CWM on the surface (i.e., the top of the soil layer) only, in which the detection process is primarily performed visually, but is augmented by technology aids (e.g., hand-held magnetometers or metal detectors) because vegetation, the weathering of UXO, DMM or CWM, or other factors make visual detection difficult.

Time Critical Removal Action (TCRA) [lxx]

Removal actions where, based on the site evaluation, a determination is made that a removal is appropriate, and that less than 6 months exists before on-site removal activity must begin.

Transferred range[lxxi]

A military range that is no longer under military control and has been leased, transferred, or returned to another entity, including Federal entities. This includes a military range that is no longer under military control but was used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the Federal land manager.

Transferring Range[lxxii]

A military range that is proposed to be leased, transferred, or returned from the Department of Defense to another entity, including Federal entities. This includes a military range that is used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the Federal land manager. An active range will not be considered a ``transferring range'' until the transfer is imminent.

Unexploded Ordnance (UXO) [lxxiii]

Military munitions that:

(a) Have been primed, fuzed, armed, or otherwise prepared for actions;

(b) Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and

(c) *Remain unexploded whether by malfunction, design, or any other cause.*

UXO Technicians[lxxiv]

Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

UXO-Qualified Personnel[lxxv]

Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

Venting[lxxvi]

Exposing any internal cavities of MPPEH, to include training or practice munitions (e.g., concrete bombs), using DDESB- or DoD Component-approved procedures, to confirm that an explosive hazard is not present.

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[i] Environmental Protection Agency, Military Munitions Rule, published 12 February 1997 (62 FR 6622)

[ii] Department of the Army Office of the Assistant Secretary Installations and Environment, Memorandum for the Assistant Chief of Staff For Installation Management, Subject: Munitions Response Terminology, 21 April 2005. (Hereafter Memorandum, Subject: Munitions Response Terminology, 21 April 2005.)

[iii] *Ibid.*

[iv] Corps of Engineers Safety Office (CESO), *ER 385-1-92, Safety - Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities*, 1 September 2000

[v] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[vi] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[vii] *Ibid.*

[viii] Corps of Engineers Safety Office (CESO), *ER 385-1-92, Safety - Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities*, 1 September 2000

[ix] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[x] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xi] Originally defined in the 26 September 1997 DOD proposed range rule, *Closed, Transferred, and Transferring Ranges Containing Military Munitions*, Title 32 Code of Federal Regulations (CFR) Part 178, which the DoD withdrew on 13 November 2000.

[xii] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xiii] *Ibid.*

[xiv] 10 U.S.C. 2710(e)(1)

[xv] 10 U.S.C. 2710(e)(2)

[xvi] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xvii] *Ibid.*

[xviii] *Ibid.*

[xix] *Ibid.*

[xx] *Ibid.*

[xxi] *Ibid.*

[xxii]*Ibid.*

[xxiii] *Ibid.*

[xxiv] Military Munitions Rule, 40 CFR 260.10

[xxv] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xxvi] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[xxvii] Department of the Army, U.S. Army Corps of Engineers, Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy, ER 200-3-1, dated 20May2004.

[xxviii] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[xxix] Environmental Protection Agency, Military Munitions Rule, published 12 February 1997 (62 FR 6622)

[xxx] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xxxi] *Ibid.*

[xxxii] *Ibid*.

[xxxiii] Department of the Army Office of the Assistant Secretary Installations and Environment, Memorandum for the Assistant Chief of Staff For Installation Management, Subject: Definition Related to Munitions Response Action, 28 October 2003:

[xxxiv] 10 U.S.C. 101(e)(4)(A) through (C)

[xxxv] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xxxvi] U.S. Army Corps of Engineers-St. Louis District, Ordnance and Technical Services Branch CEMVS-ED-P developed this term in lieu of using Munitions Response Site (MRS)

[xxxvii] Military Munitions Rule, 40 CFR 266.201

[xxxviii] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xxxix] *Ibid.*

[xl] *Ibid.*

[xli] *Ibid*.

[xlii] 10 U.S.C. 2710(e)(3)

[xliii] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[xliv] *Ibid.*

[xlv] *Ibid.*

[xlvi] *Ibid.*

[xlvii] *Ibid.*

[xlviii] *Ibid.*

[xlix] *Ibid.*

[l] *Ibid.*

[li] *Ibid.*

[lii] *Ibid.*

[liii] *Ibid.*

[liv] Corps of Engineers Safety Office (CESO), *ER 385-1-92, Safety - Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities*, 1 September 2000

[lv] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[lvi] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[lvii] *Ibid.*

[lviii] *Ibid.*

[lix] 10 U.S.C. 101(e)(1)(A) and (B)

[lx] 10 U.S.C. 101(e)(2)(A) and (B)

[lxi] Department of the Army Office of the Assistant Secretary Installations and Environment, Memorandum for the Assistant Chief of Staff For Installation Management, Subject: Definition Related to Munitions Response Action, 28 October 2003:

[lxii] *Ibid.*

[lxiii] U. S. Army Corps of Engineers (CESO-I)
2003 *ER 385-1-95, Safety - Safety and Health Requirements for Ordnance and Explosives (OE) Operations*, 16 June 2003

[lxiv] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[lxv] *Ibid.*

[lxvi] Department of Defense, Munitions Response Site Prioritization Protocol; Proposed Rule, 22 August 2003; 32 CFR Part 179

[lxvii] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[lxviii] *Ibid.*

[lxix] *Ibid.*

[lxx] *40 CFR 300.5*

[lxxi] Originally defined in the 26 September 1997 DOD proposed range rule, *Closed, Transferred, and Transferring Ranges Containing Military Munitions*, Title 32 Code of Federal Regulations (CFR) Part 178, which the DoD withdrew on 13 November 2000.

[lxxii] *Ibid.*

[lxxiii] 10 U.S.C. 101(e)(5)(A) through (C)

[lxxiv] Memorandum, Subject: Munitions Response Terminology, 21 April 2005.

[lxxv] *Ibid.*

[lxxvi] *Ibid.*

APPENDIX E

PA (PRELIMINARY ASSESSMENT) DATA AND SITE CHARACTERISTICS FORM

Reference: U. S. Environmental Protection Agency, *Guidance for Performing Preliminary Assessments Under CERCLA, EPA/540/G-91/013, Publication 9345.0-01A*, September 1991; Appendix D.

OMB Approval Number: 2050-0095
Approved for Use Through: 1/92

EPA Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: ***Hawaii***
CERCLIS Number: ***Not Applicable***
CERCLIS Discovery Date: ***Not Applicable***

1. General Site Information

Name:	Street Address:				
Makalapa Crater Navy Salvage Yard (H09HI048400)	***Not Applicable***				
City:	State:	Zip Code:	County:	Co. Code:	Cong. Dist:[ii]
Halawa, District of Ewa	***HI***	***96818***	***Island of Oahu***	***(HI) (003)[i]***	***1***
Latitude: Longitude:	Approximate Area of Site:		Status of Site:		
N21° 21' 34", W157° 55' 46"	***19.2705*** Acres		☐ Active ☐ Not Specified ■ Inactive ☐ NA (GW plume, etc.)		

2. Owner/Operator Information

Owner:	Operator:
The former Makalapa Crater Navy Salvage Yard is currently owned by the City (Honolulu), County (Honolulu), and State (Hawaii).	***The former Makalapa Crater Navy Salvage Yard has subsequently been redeveloped and is currently used by the Makalapa Elementary School, Radford High School, and State Highway H-1.***
Street Address: ***N/A***	Street Address: ***N/A***
City: ***Halawa, District of Ewa***	City: ***Halawa, District of Ewa***
State: ***HI*** Zip Code: ***96818*** Telephone: ***N/A***	State: ***HI*** Zip Code: ***96818*** Telephone: ***N/A***
Type of Ownership: ☐ Private ■ County ☐ Federal Agency ■ Municipal Name _____ ☐ Not Specified ■ State ☐ Other _____ ☐ Indian	How Initially Identified: ☐ Citizen Complaint ■ Federal Program ☐ PA Petition ☐ Incidental ☐ State/Local Program ☐ Not Specified ☐ RCRA/CERCLA Notification ■ Other: ***DERP-FUDS***

3. Site Evaluator Information

Name of Evaluator:	Agency/Organization:	Date Prepared:
Randy Curtis, 314-331-8786	***U.S. Army Corps of Engineers-St. Louis District (CEMVS-ED-P)***	***November 2015***
Street Address: ***1222 Spruce Street***	City: ***Saint Louis***	State: ***Missouri***
Name of EPA or State Agency Contact: ***N/A***	Street Address: ***N/A***	
City: ***N/A***	State: ***N/A***	Telephone: ***N/A***

4. Site Disposition (for EPA use only)

Emergency Response/Removal Assessment Recommendation:	CERCLIS Recommendation:	Signature:
Yes No Date: _____	Higher Priority SI Lower Priority SI NFRAP RCRA Other _____ Date: _____	Name (typed): Position:

EPA **Potential Hazardous Waste Site**
Preliminary Assessment Form - Page 2 of 4

CERCLIS Number: ***Not Applicable***

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site (check all that apply):

Industrial	Agriculture	DOI
Commercial	Mining	Other Federal Facility
Residential	**DOD**	Other _____
Forest/Fields	DOE	

Site Setting:

Urban
Suburban
Rural

Years of Operation:

Beginning Year ***1939***
Ending Year ***1985***
Unknown

Type of Site Operations (check all that apply):

- Manufacturing (must check subcategory)
  - Lumber and Wood Products
  - Inorganic Chemicals
  - Plastic and/or Rubber Products
  - Paints, Varnishes
  - Industrial Organic Chemicals
  - Agricultural Chemicals (e.g., pesticides, fertilizers)
  - Miscellaneous Chemical Products (e.g., adhesives, explosives, ink)
  - Primary Metals
  - Metal Coating, Plating, Engraving
  - Metal Forging, Stamping
  - Fabricated Structural Metal Products
  - Electronic Equipment
  - Other Manufacturing
- Mining
  - Metals
  - Coal
  - Oil and Gas
  - Non-metallic Minerals
- Retail
- **Recycling**
- **Junk/Salvage Yard**
- Municipal Landfill
- **Other Landfill**
- **DOD**
- DOB
- DOI
- Other Federal Facility _____
- RCRA
  - Treatment, Storage, or Disposal
  - Large Quantity Generator
  - Small Quantity Generator
  - Subtitle D
    - Municipal
    - Industrial
  - "Converter"
  - "Protective Filer"
  - "Non- or Late Filer"
- Not Specified
- Other _____

Waste Generated:

Onsite
Offsite
Onsite and Offsite

Waste Deposition Authorized By:

Present Owner
Former Owner
Present & Former Owner
Unauthorized
Unknown

Waste Accessible to the Public:

Yes
No

Distance to Nearest Dwelling, School, or Workplace:

___***0***___ Feet

6. Waste Characteristics Information

Source Type: (check all that apply)	Source Waste Quantity: (include units)	Tier*:
Landfill	**Undetermined**	**A**
Surface Impoundment		
Drums		
Tanks and Non-Drum Containers		
Chemical Waste Pile		
Scrap Metal or Junk Pile	**Undetermined**	**A**
Tailing Pile		
Trash Pile (open dump)	**Undetermined**	**A**
Land Treatment		
Contaminated Ground Water Plume (unidentified source)		
Contaminated Surface Water/Sediment (unidentified source)		
Contaminated Soil	**Undetermined**	**A**
Other		
No Sources		

* C = Constituent, W = Wastestream, V = Volume, A = Area

General Types of Waste (check all that apply)

Metals	**Pesticides/Herbicides**
Organics	Acids/Bases
Inorganics	Oily Waste
Solvents	**Municipal Waste**
Paints/Pigments	Mining Waste
Lab/Hospital Waste	Explosives
Radioactive Waste	
Construction/Demolition Waste	
Other	

Physical State of Waste as Deposited (check all that apply):

Solid	Sludge	Powder
Liquid	Gas	

EPA **Potential Hazardous Waste Site**
Preliminary Assessment Form - Page 3 of 4

CERCLIS Number: : ***Not Applicable***

7. Ground Water Pathway

Is Ground Water Used for Drinking Water Within 4 Miles:
Yes
No

Type of Drinking Water Wells Within 4 Miles (check all that Apply):
Municipal
Private
None

Depth to Shallowest Aquifer:

__***40***__ Feet

Karst Terrain/Aquifer Present:
Yes
No

Is There a Suspected Release to Ground Water:
Yes
No

Have Primary Target Drinking Water Wells Been Identified:
Yes
No

If Yes, Enter Primary Target Population:

__***N/A***__ People

Nearest Designated Wellhead Protection Area:
Underlies Site
> 0 – 4 Miles
None Within 4 Miles

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - ¼ Mile _***N/A***_

> ¼ - ½ Mile _***N/A***_

> ½ – 1 Mile _***N/A***_

> 1 – 2 Miles _***N/A***_

> 2 – 3 Miles _***N/A***_

> 3 – 4 Miles _***N/A***_

Total Within 4 Miles _***N/A***_

8. Surface Water Pathway

Type of Surface Water Draining Site 15 Miles Downstream (check all That apply):

Stream River Pond Lake
Ocean **Bay/Harbor** Other _____

Shortest Overland Distance From Any Source to Surface Water:

__***1,200***__ Feet

___***1/4***___ Miles

Is There a Suspected Release to Surface Water:

Yes
No

Site is Located in:
Annual – 10 yr Floodplain
> 10 yr – 100 yr Floodplain
> 100 yr – 500 yr Floodplain
> 500 yr Floodplain

Drinking Water Intakes Located Along Surface Water Migration Path:
Yes
No

Have Primary Target Drinking Water Intakes Been Identified:
Yes
No

If Yes, Enter Population Served by Primary Target Intakes:

__***N/A***__ People

List All Secondary Target Drinking Water Intakes:

Name	Water Body	Flow (cfs)	Population Served
N/A	**N/A**	**N/A**	**N/A**

Total within 15 Miles _____

Fisheries Located Along the Surface Water Migration Path:
Yes
No

Have Primary Target Fisheries Been Identified:
Yes
No

List All Secondary Target Fisheries:

Water Body/Fishery Name	Flow (cfs)
Quarry Loch	**N/A**
Halawa Stream	**25 cfs**
Pacific Ocean	**N/A**

EPA **Potential Hazardous Waste Site**
Preliminary Assessment Form - Page 4 of 4

CERCLIS Number: : ***Not Applicable***

7. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:
Yes
No

Have Primary Target Wetlands Been Identified:
Yes
No

List Secondary Target Wetlands:

Water Body	Flow (cfs)	Frontage Miles
Quarry Loch	**N/A**	**N/A**
Halawa Stream	**25 cfs**	**N/A**
Pacific Ocean	**N/A**	**N/A**

Other Sensitive Environments Located Along the Surface Water Migration Path:
Yes
No

Have Primary Target Sensitive Environments Been Identified:
Yes
No

List Secondary Target Sensitive Environments:

Water Body	Flow (cfs)	Sensitive Environment Type
N/A	**N/A**	**N/A**

8. Soil Exposure Pathway

Are People Occupying Residences or Attending School or Daycare on or Within 200 Feet of Areas of Known or Suspected Contamination:
Yes
No

If Yes, Enter Total Resident Population:

__***Undetermined***__ People

Number of Workers Onsite:

None
1 – 100
101 – 1,000
> 1,000

Have Terrestrial Sensitive Environments Been Identified on Or Within 200 Feet of Areas of Known or Suspected Contamination:
Yes
No

If Yes, List Each Terrestrial Sensitive Environment

N/A

10. Air Pathway

Is There a Suspected Release to Air:
Yes
No

Enter Total Population on or Within:

Onsite	***N/A***
0 – ¼ Mile	***N/A***
> ¼ - ½ Mile	***N/A***
> ½ - 1 Mile	***N/A***
> 1 – 2 Miles	***N/A***
> 2 – 3 Miles	***N/A***
> 3 – 4 Miles	***N/A***
Total Within 4 Miles	***N/A***

Wetlands Located Within 4 Miles of the Site:
Yes
No

Other Sensitive Environments Located Within 4 Miles of the Site:
Yes (i.e. Pearl Harbor National Refuge)
No

List All Sensitive Environments Within ½ Mile of the Site:

Distance	Sensitive Environment Type/Wetlands Area (acres)
Onsite	**N/A**
0 – ¼ Mile	**N/A**
> ¼ - ½ Mile	**N/A**

[i] US Census Bureau FIPS Codes for Counties and County Equivalent Entities
Website: http://www.census.gov/geo/reference/codes/cou.html
Excel: http://www.census.gov/2010census/xls/fips_codes_website.xls

[ii] U.S. Census Bureau
Website: http://www.census.gov/fastfacts/

APPENDIX F

ORDNANCE TECHNICAL DATA SHEETS

NOT APPLICABLE

Without the final TCRA report and final list of TCRA munition debris/scrap found, the PA investigation chose not to include munition technical data based on preliminary data.

APPENDIX G

TEXTUAL REFERENCES

ELECTRONIC COPY ONLY

*Due to the volume of textual references of source documents gathered and cited for this APA effort, it was determined not to include a printout of them as an appendix. The gathered textual document scans are in Adobe *.PDF format.*

APPENDIX H

STILL PHOTOGRAPH REFERENCES

Scrap Handling Imagery

Oblique Aerial Imagery

Radford High School Imagery

Figure 1 *– Handling of Scrap at Berth 23 - 18 November 1942* [i]

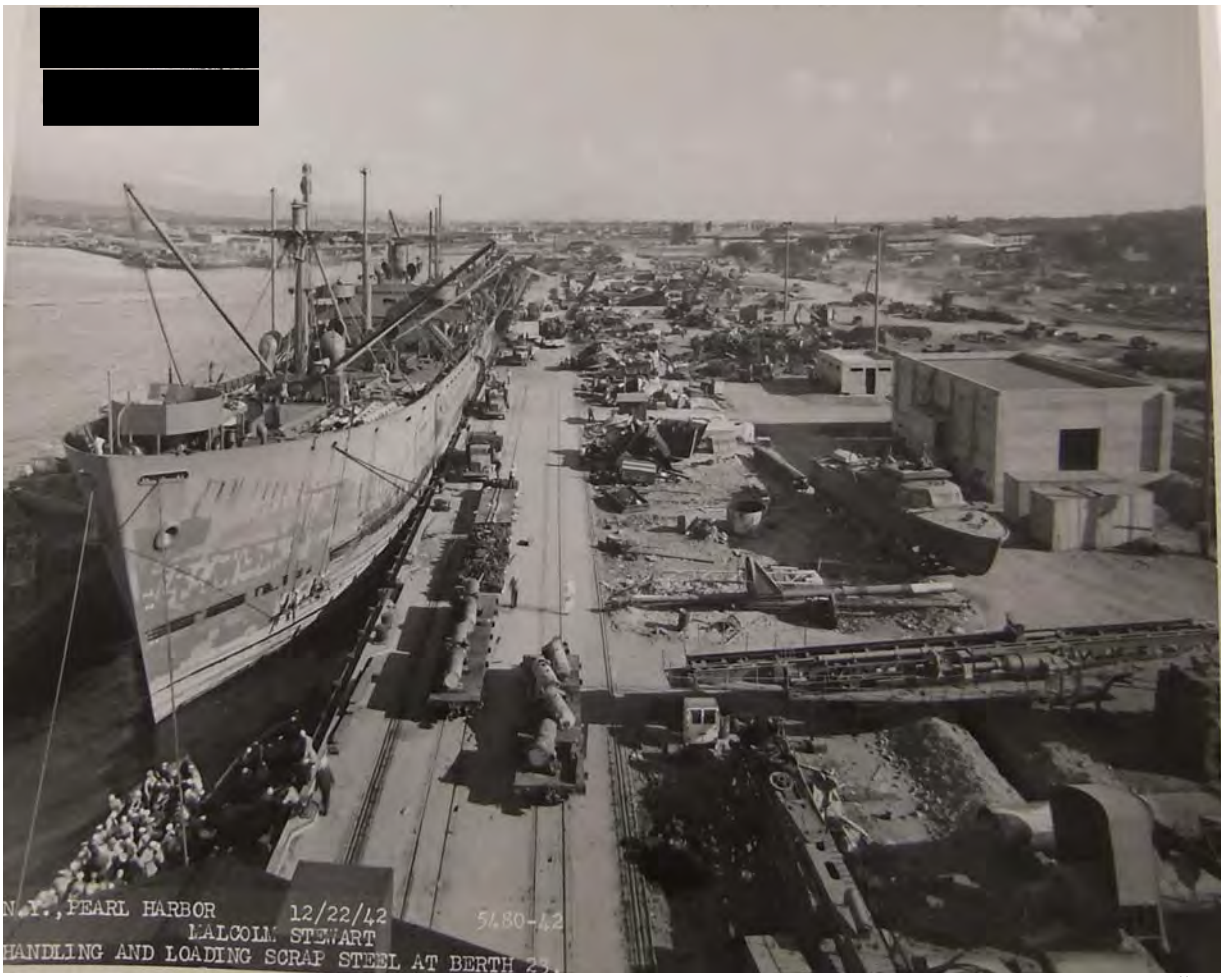

Figure 2 *– Handling and Loading of Scrap Steel at Berth 23 - 22 December 1942* [ii]

Figure 3 *– Scrap Steel Accumulated at Berth 23 for Shipment - 31 December 1942* [iii]

Figure 4 *– Accumulation of Scrap Steel at Berth 23 - 18 January 1943* [iv]

Figure 5 *– Handling Scrap Steel at Berth 23 Headed for Makalapa Salvage - 18 January 1943* [v]

Figure 6 *– Prepared Number One Heavy Melting Steel Scrap and Tin Cans Awaiting Shipment at Berth 23 - 18 May 1943* [vi]

Figure 7 *– Scrap Materials Accumulated at Berth 23 for Shipment - 18 May 1943* [vii]

Figure 8 *–Scrap Rope, Rubber, Tin Cans, and Brass Awaiting Shipment - 18 May 1943* [viii]

Figure 9 *– Armor Covered Cable Awaiting Shipment at Berth 23 - 28 May 1943* [ix]

Figure 10 *– Lead Dross Awaiting Shipment at Berth 23 - 28 May 1943* [x]

***Figure 11** – Sorting Scrap to be Reclaimed at Makalapa Salvage Yard - September 1943*
[xi]

***Figure 12** – Short Steel in Makalapa Salvage Yard - 29 October 1944* [xii]

***Figure 13** – Makalapa Salvage Yard - 29 October 1944* [xiii]

***Figure 14** – Non-Ferrous Metal Pile at Makalapa Salvage Yard - 29 October 1944*[xiv]

Figure 15 *– Ferrous and Non-Ferrous Metal at Makalapa Salvage Yard - 29 October 1944*[xv]

Figure 16 *– Crashed Aircraft Aluminum at Makalapa Salvage Yard - 29 October 1944*[xvi]

Figure 17 *– Unprepared Tin and Aluminum at Makalapa Salvage Yard - 29 October 1944*[xvii]

Figure 18 *– Overall View of Unprepared Scrap at Makalapa Salvage Yard - 29 October 1944*[xviii]

Figure 19 *– "Heavy beams are cut with acetylene torches into suitable sizes for shipping at the salvage yard of the Naval Supply Depot of the 14th Naval District, Pearl Harbor" - 12 February 1945* [xix]

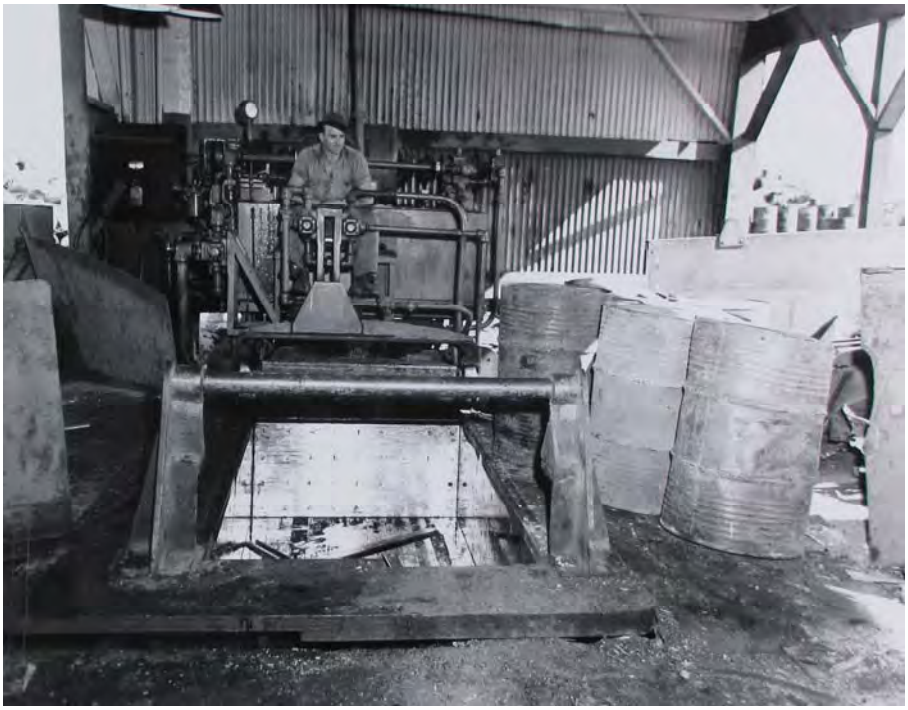

***Figure 20** – "Oil drums damaged beyond repair prepared for shipment at the Naval Supply Depot of the 14th Naval District, Pearl Harbor"- 12 February 1945* [xx]

***Figure 21** – "Oil drums damaged beyond repair prepared for shipment at Naval Supply Depot of the 14th Naval District, Pearl Harbor" - 12 February 1945* [xxi]

Figure 22 *– Makalapa Richardson Salvage Area - No Date* [xxii]

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***Figure 26** – Aerial of Makalapa Crater - 8 May 1942* [xxvi]

***Figure 27** – Aerial of Makalapa Crater - 8 May 1942* [xxvii]

***Figure 28** – Oblique Aerial of Makalapa Crater Looking from the Southwest - 21 May 1942*
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***Figure 29** – Oblique Aerial Makalapa Crater Looking from the Southeast - 21 May 1942*
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***Figure 30** – Oblique Aerial of Makalapa Crater Looking from the Southeast - 26 May 1942* [xxx]

***Figure 31** – Oblique Aerial of Makalapa Crater Looking South-Southeast - 12 December 1943* [xxxi]

Note: Smoke from debris burning on east side of crater.

***Figure 32** – Oblique Aerial of Makalapa Crater Looking East-Southeast - 12 December 1943* [xxxii]

Note: Smoke from debris burning on east side of crater.

***Figure 33** – Oblique Aerial of Makalapa Crater Looking East - 1 May 1944* [xxxiii]

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***Figure 36** – Oblique Aerial of Makalapa Crater Looking East– 9 May 1948*[xxxvi]

***Figure 37** – Aerial of Makalapa Crater – 13 May 1948*[xxxvii]

***Figure 38** – Aerial of Makalapa Crater – October 1954*[xxxviii]

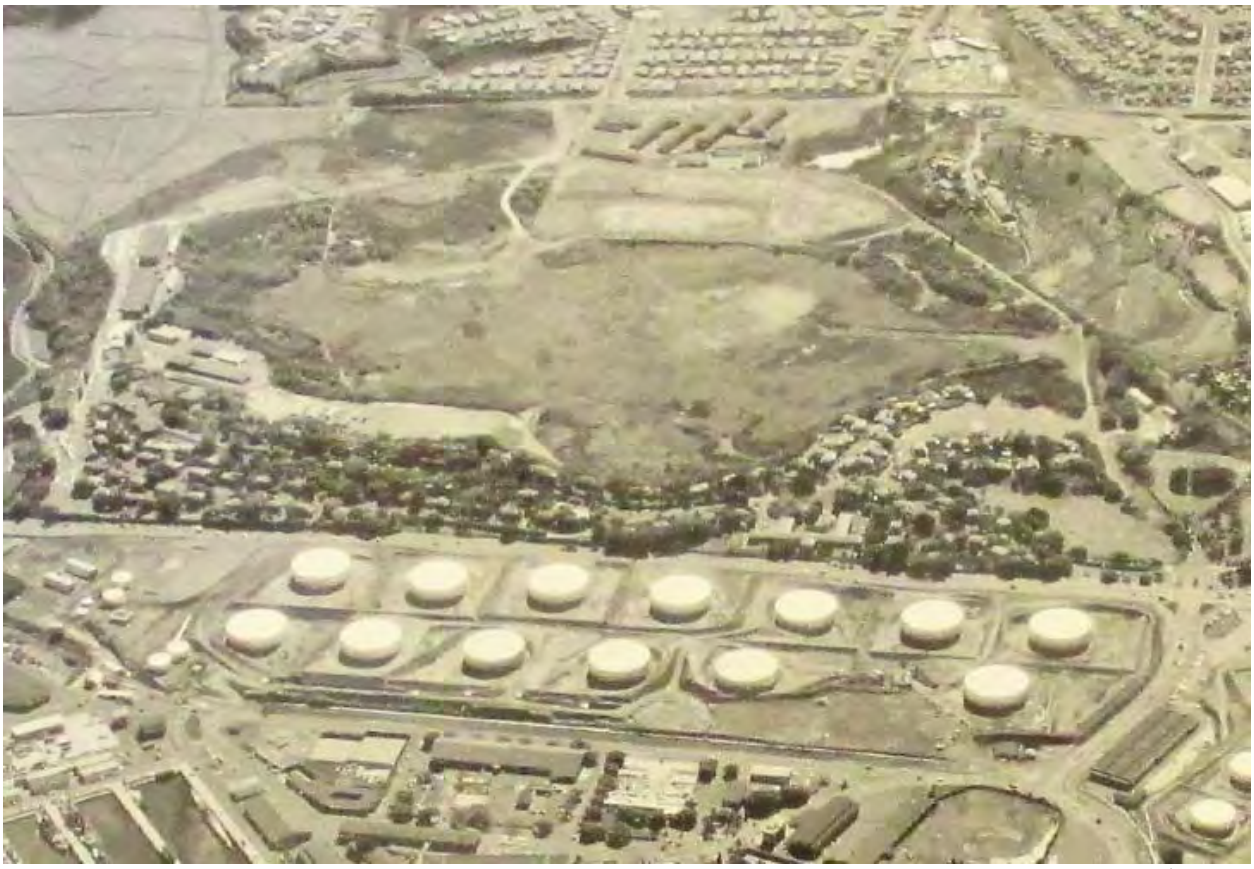

***Figure 39** – Oblique Aerial of Makalapa Crater Looking East – 2 June 1959*[xxxix]

***Figure 40** – Oblique Aerial of Makalapa Crater Looking North – 20 October 1959*[xl]

***Figure 41** – Oblique Aerial of Makalapa Crater Looking West – 20 October 1959*[xli]

***Figure 42** – Oblique Aerial of Makalapa Crater Looking North - May/June 1950* [xlii]

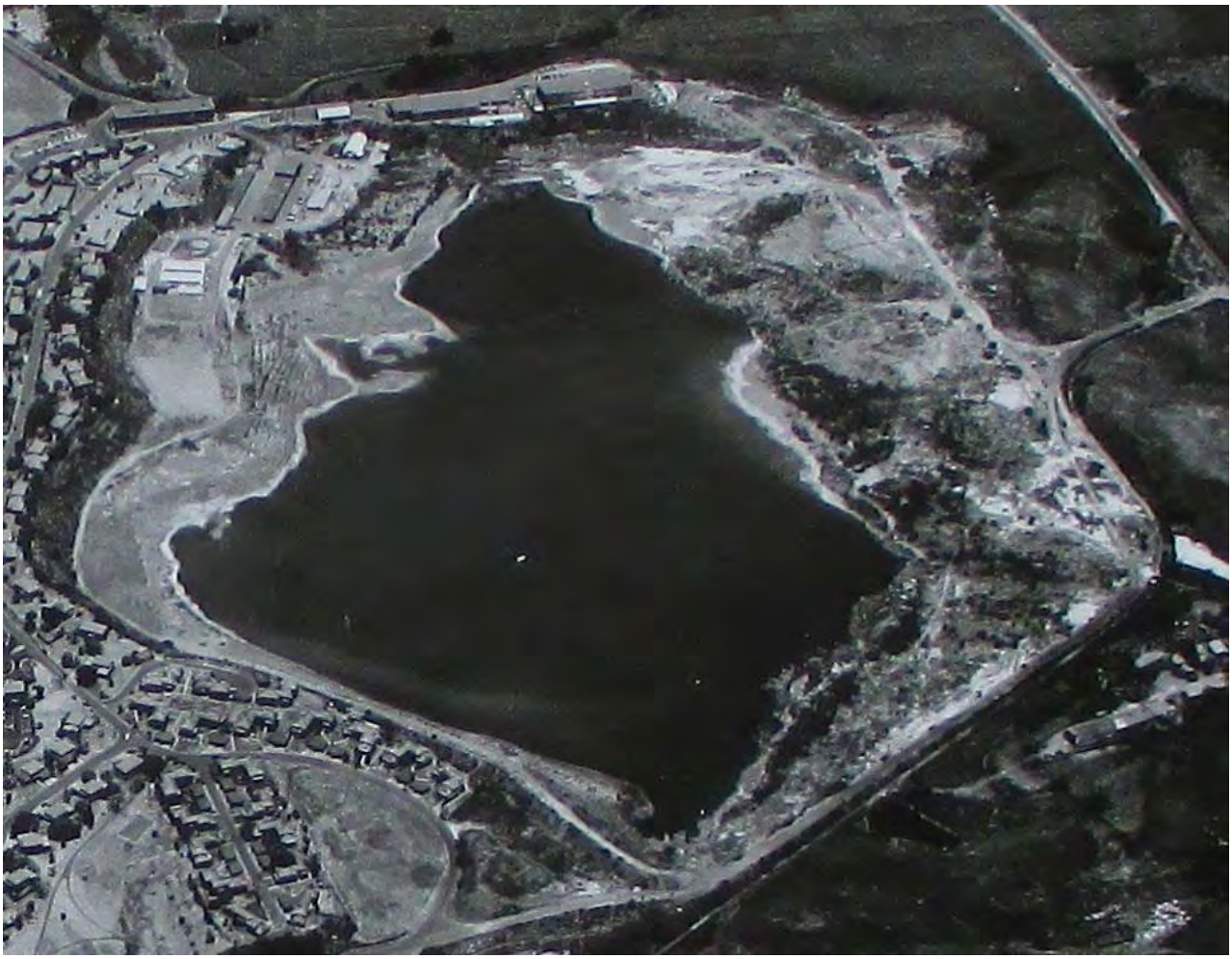

***Figure 43** – Oblique Aerial of Makalapa Crater Looking North - 9 June 1950* [xliii]

***Figure 44** – Oblique Aerial of Makalapa Crater Looking East - 9 June 1950* [xliv]

***Figure 45** – Oblique Aerial of Makalapa Crater Looking South - 9 June 1950* [xlv]

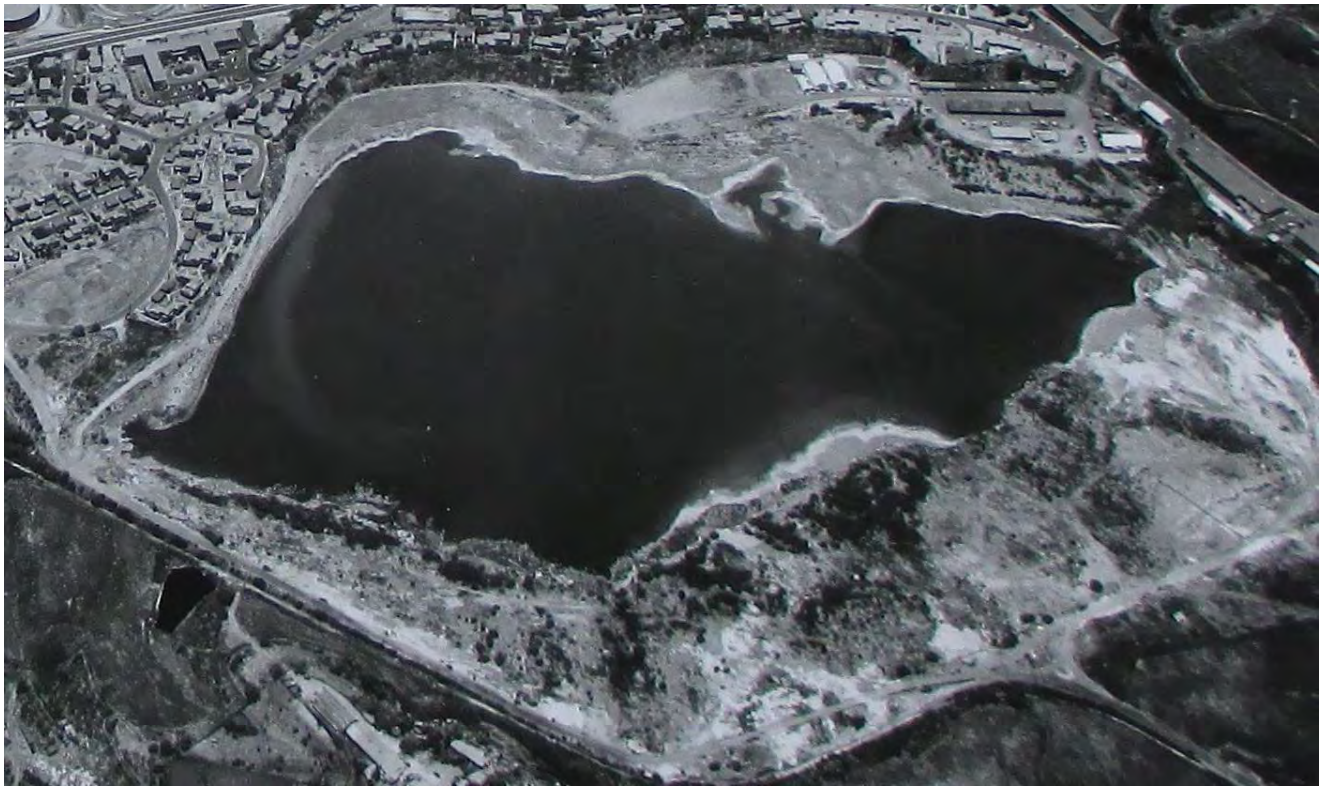

***Figure 46** – Oblique Aerial of Makalapa Crater Looking Northwest - 9 June 1950* [xlvi]

***Figure 47** – Aerial of Makalapa Crater - 21 June 1950* [xlvii]

***Figure 48** – Aerial of Makalapa Crater - April 1957* [xlviii]

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***Figure 50** – Aerial of Makalapa Crater - October 1957* [l]

***Figure 51** – Oblique Aerial of Makalapa Crater Looking East - October 1957* [li]

***Figure 52** – Aerial of Makalapa Crater - October 1957* [lii]

***Figure 53** – Oblique Aerial of Makalapa Crater - October 1957* [liii]

Figure 54 *– Radford High School Administration Building – 22 June 1961*[liv]

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***Figure 56** – Outdoor basketball courts on site – 22 June 1961*[lvi]

***Figure 57** – View of site looking southeast – 22 June 1961*[lvii]

***Figure 58** – Southeast boundary of the site – 22 June 1961*[lviii]

***Figure 59** – View of football and track fields looking north – 22 June 1961*[lix]

Figure 60 *– Central portion of site looking south – 22 June 1961*[lx]

Figure 61 *–View east showing northern boundary of site – 22 June 1961*[lxi]

***Figure 62** – Radford High School from Salt Lake Blvd looking north – August 1961*[lxii]

***Figure 63** – Radford High School property entrance looking north – August 1961*[lxiii]
Note: The road in the foreground is a restricted military highway leading from Salt Lake Blvd to Makalapa. The village of Aiea is visible in the background.

Figure 64 *– View of Parcel 1 looking south – August 1961*[lxiv]
Note: Parcel 2 is visible at the extreme right. A flood-lighting system is also visible.

Figure 65 *–View of Parcel 1 looking southeast – August 1961*[lxv]
Note: Electric pole line easement is visible at the left.

Figure 66 *–View of Parcels 1 & 2 looking west – August 1961*[lxvi]
Note: Parcel 1 is in the foreground. Parcel 2 is in the background. A chain link perimeter fence is also visible.

Figure 67 *–View of athletic fields looking west – August 1961*[lxvii]
Note: Parcel 2 is visible in the background, along with goal posts and a floodlighting system at the athletic field.

[i] 1942-11-18 Handling of Scrap.PDF

[ii] 1942-12-22 Handling and Loading of Scrap.PDF

[iii] 1942-12-31 Pearl Harbor Scrap.PDF

[iv] 1943-01-18 Accumulation of Scrap Steel.PDF

[v] 1943-01-18 Handling Scrap Steel.PDF

[vi] 1943-05-18 Prepared Number 1 Heavy Melting Steel Scrap and Tin Cans.PDF

[vii] 1943-05-18 Scrap Materials Accumulated for Shipment.PDF

[viii] 1943-05-18 Scrap Rope, Rubber, Tin Cans, and Brass Shavings Awaiting Shipment.PDF

[ix] 1943-05-28 Armor Covered Cable Awaiting Shipment.PDF

[x] 1943-05-28 Lead Dross Awaiting Shipment.PDF

[xi] 1943-09-15 PH Bulletin - Scrappers article AECOM_HI War Records Depository.pdf

[xii] 1944-10-29 Makalapa Salvage Yard AECOM_HI War Records Depository.PDF

[xiii] 1944-10-29 Makalapa Salvage Yard AECOM_HI War Records Depository 2.PDF

[xiv] 1944-10-29 Naval Admin Hist WWII CinCPAC Amphib Forces Append 38-12 Salvage.pdf

[xv] 1944-10-29 Naval Admin Hist WWII CinCPAC Amphib Forces Append 38-12 Salvage.pdf

[xvi] 1944-10-29 Naval Admin Hist WWII CinCPAC Amphib Forces Append 38-12 Salvage.pdf

[xvii] 1944-10-29 Naval Admin Hist WWII CinCPAC Amphib Forces Append 38-12 Salvage.pdf

[xviii] 1944-10-29 Naval Admin Hist WWII CinCPAC Amphib Forces Append 38-12 Salvage.pdf

[xix] 1945-02-12 Makalapa Beams at Salvage Yard NARACP_R80G_301501.PDF

[xx] 1945-02-12 Pearl Harbor Oil Drums NARACP_R80G_301500.PDF

[xxi] 1945-02-12 Pearl Harbor Oil Drums Pressed NARACP_R80G_301503.PDF

[xxii] Makalapa Richardson Salvage Area.PDF

[xxiii] Makalapa Salvage.PDF

[xxiv] Scrap Metal in Makalapa.PDF

[xxv] 1941-10-30 Makalapa Crater NARACP_R80G_65886.PDF

[xxvi] 1942-05-08 Pearl Harbor Dry Dock #4 NARACP_R80G_276525.PDF

[xxvii] 1942-05-08 Pearl Harbor Dry Dock #4 NARACP_R80G_276526.PDF

[xxviii] 1942-05-21 Pearl Harbor Makalapa NARACP_R80G_276531.PDF

[xxix] 1942-05-21 Pearl Harbor Makalapa NARACP_R80G_276533.PDF

[xxx] 1942-05-26 Pearl Harbor Makalapa NARACP_R80G_276532.PDF

[xxxi] 1943-12-12 smoking crater closeup.PDF

[xxxii] 1943-12-12b crater closeup.PDF

[xxxiii] 1944-05-01 Makalapa Photo AECOM_Hist.PDF

[xxxiv] 1945-07-14 Pearl Harbor Navy Yard NARACP_R80G_274621.PDF

[xxxv] 1948-04-21 Pearl Harbor Makalapa Aerial Photo4.pdf

[xxxvi] 1948-05 Pearl Harbor Makalapa Aerial Photo.pdf

[xxxvii] 1948-05-13 Pearl Harbor Makalapa Aerial Photo.pdf

[xxxviii] 1954-10 Makalapa Aerial Photo2.pdf

[xxxix] 1959-06-02 Pearl Harbor Makalapa Aerial Photo.pdf

[xl] 1959-10-20 Pearl Harbor Makalapa Aerial Photo1.pdf

[xli] 1959-10-20 Pearl Harbor Makalapa Aerial Photo3.pdf

[xlii] 1950-05 thru 1950-06 Moanalua Housing Area NARACP_R80G_417915.PDF

[xliii] 1950-06-09 Makalapa Housing Area NARACP_R80G_417920.PDF

[xliv] 1950-06-09 Makalapa Housing Area NARACP_R80G_417921.PDF

[xlv] 1950-06-09 Makalapa Housing Area NARACP_R80G_417922.PDF

[xlvi] 1950-06-09 Makalapa Housing Area NARACP_R80G_417923.PDF

[xlvii] 1950-06-21 Makalapa Housing Area NARACP_R80G_417924.PDF

[xlviii] 1950-06-21 Makalapa Housing Area NARACP_R80G_417924.PDF

[xlix] 1957-04 Makalapa Administration Area NARACP_R80G_1036318.PDF

[l] 1957-10 Makalapa Admin Area, Radio Station NARACP_R80G_1036319.PDF

[li] 1957-10 Makalapa Admin, Radio Area NARACP_R80G_1036320.PDF

[lii] 1957-10 Makalapa Admin, Radio Area NARACP_R80G_1036321.PDF

[liii] 1957-10 Makalapa Admin, Radio Area NARACP_R80G_1036322.PDF

[liv] 1961-07-06 Inspection Radford HS Site .pdf

[lv] 1961-07-06 Inspection Radford HS Site .pdf

[lvi] 1961-07-06 Inspection Radford HS Site .pdf

[lvii] 1961-07-06 Inspection Radford HS Site .pdf

[lviii] 1961-07-06 Inspection Radford HS Site .pdf

[lix] 1961-07-06 Inspection Radford HS Site .pdf

[lx] 1961-07-06 Inspection Radford HS Site .pdf

[lxi] 1961-07-06 Inspection Radford HS Site .pdf

[lxii] 1961-09-01 Appraisal Report Radford HS Site.pdf

[lxiii] 1961-09-01 Appraisal Report Radford HS Site.pdf

[lxiv] 1961-09-01 Appraisal Report Radford HS Site.pdf

[lxv] 1961-09-01 Appraisal Report Radford HS Site.pdf

[lxvi] 1961-09-01 Appraisal Report Radford HS Site.pdf

[lxvii] 1961-09-01 Appraisal Report Radford HS Site.pdf

APPENDIX I

MAPS/DRAWINGS REFERENCES

ELECTRONIC COPY ONLY

Due to the volume of maps and drawings references gathered and cited for this APA effort, it was determined not to include a printout of them as an appendix. The gathered maps and drawings scans are in .JPG or .TIF format.

APPENDIX J

INTERVIEWS

NOT APPLICABLE

Interviews were not conducted or necessary for the completion of this report.
Information from interviews conducted during previous investigations was reviewed.

APPENDIX K

ABBREVIATED SITE SAFETY AND HEALTH PLAN (ASSHP)

NOT APPLICABLE

A perimeter property visit was conducted at the site; thus an ASSHP was not necessary.

APPENDIX L

PROPERTY VISIT REPORT

CEMVS-EC-E 18 August 2015

MEMORANDUM FOR RECORD

SUBJECT: PA Visual Property Inspection: Makalapa Crater Navy Salvage Yard - Hawaii

1. Personnel from the St. Louis District Corps of Engineers traveled to Hawaii to perform a property survey of the former Makalapa Crater Navy Salvage Yard. The Preliminary Assessment (PA) program requires a visual property inspection. The PA program supports the Defense Environmental Restoration Program (DERP) at Formerly Used Defense Sites (FUDS).

2. The PA site visit characterized the potential for munitions and explosives of concern (MEC) and Hazardous Toxic Radioactive Waste (HTRW) based on a visual examination at the former Makalapa Crater Navy Salvage Yard. This potential is based on an analysis of the collected information. Prior to the inspection, the PA investigation team determined the areas of the site to investigate. The property inspection included only visual and non-intrusive methods of inspection. The PA investigation team consisted of the following personnel: Randy Curtis of the St. Louis District and Lori Wong of the Honolulu District of the U.S. Army Corps of Engineers.

3. The St. Louis District team traveled to Halawa, District of Ewa, Hawaii to conduct a property inspection of the former Makalapa Crater Navy Salvage Yard on 11 August 2015. Given the ongoing NAVFAC activities on the property and that school was in session at both Radford High School (RHS) and Makalapa Elementary School (MES), the team limited the visit to a periphery visit to familiarize themselves with the property and the current conditions primarily from Joint Base Pearl Harbor-Hickam (JBPHH) property. The recent aerial photo image (see following figure), created with Google Earth software, shows the scope of the PA property visit inspection and the location of where the subsequent photo were taken.

4. The team began at the south end of the FUDS along Bougainville Drive reviewing the RHS lands. At the boundary of RHS and the Navy Hale Keiki School the team looked at the topography between the properties (see following two photos).

Photo 1 *– Panorama looking northwest to northwest towards the RHS baseball field from the southern end of the FUDS - 11 August 2015*
Note: slope from the sidewalk along Bougainville Drive to baseball field.

***Photo 2** – Looking northwest along RHS fence line at western boundary of FUDS - 11 August 2015*

Note: slope from the fields to lower lying vegetated area of JBPHH property behind the Navy Hale Keiki School.

5. From the JBPHH pedestrian bridge overpass to Interstate Highway H-I, the team viewed conditions of the outdoor facilities at RHS and MES (see following four photos).

***Photo 3** – Looking south, southwest at RHS material and equimptment yard north of football field - 11 August 2015*

***Photo 4** – Looking south, southeast at RHS football field from pedestrian bridge overpass of Interstate Highway H-1- 11 August 2015*

Photo 5 *– Looking east, northeast at MES playground and buildings from pedestrian bridge overpass of Interstate Highway H-1 - 11 August 2015*

Photo 6 *– Panorama looking northeast to southeast across the MES playground from the east end of the pedestrian overpass from JBPHH - 11 August 2015*
Note: barricaded area

RANDY CURTIS, P.E.
Project Manager/Civil Engineer

APPENDIX M

PROPERTY VISIT PHOTOGRAPHS

NOT APPLICABLE

Property visit photos are included in Appendix L (Property Visit Report).

APPENDIX N

RISK ASSESSMENT CODE (RAC) WORKSHEET

NOT APPLICABLE

The September 2005 USACE Formerly Used Defense Sites (FUDS) Program Guidance for Performing Preliminary Assessments under FUDS directed the inclusion of Appendix N as "Risk Assessment Code (RAC) Worksheet" for properties with potential MMRP projects. The MRS Prioritization Protocol will replace the RAC Worksheet in the APA when it has been issued for use by USACE.

NOTE: The St. Louis District may provide a rough draft of this appendix as a courtesy starting point for the Honolulu District, should an MRS be approved.

APPENDIX O

TAG REVIEW FACT SHEET

NOT APPLICABLE

The September 2005 USACE Formerly Used Defense Sites (FUDS) Program Guidance for Performing Preliminary Assessments under FUDS directed the inclusion of Appendix O as "TAG Review Fact Sheet." A Technical Advisory Group (TAG) no longer reviews the reports, thus, this appendix is obsolete.

APPENDIX P

RESPONSE TO COMMENTS

DAVID Y. IGE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

June 2, 2016

Ms. Lori L. Wong
Project Manager, Environmental Programs Branch
Programs and Project Management Division
Honolulu District, U.S. Army Corps of Engineers
Department of the Army
Fort Shafter, Hawaii 96858-5440

Re: Formerly Used Defense Site, Makalapa Crater Navy Salvage Yard,
Island of Oahu, Hawaii, Property Number H09HI0484

Dear Ms. Wong:

The Department of Education (DOE) has reviewed the Draft Final Preliminary Assessment report for the Defense Environmental Restoration Program.

The DOE has no comment but would like to be informed of any updates to the Preliminary Assessment and Remedial Investigation at Radford High and Makalapa Elementary Schools.

Thank you for the opportunity to comment.

Should you have any questions, please contact Gary Bignami, Program Specialist of the Environmental Services Unit, at 784-5067 or via email, gary_bignami@notes.k12.hi.us.

Sincerely,

Duane Y. Kashiwai
Public Works Administrator
Facilities Development Branch

DYK:tto

c: Office of School Facilities and Support Services
Facilities Development Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
File:
16-345-SPM

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

June 22, 2016

Ms. Lori Wong
United States Army Corps of Engineers, Honolulu District
Program and Project Management Division
Building 230, ATTN: CEPOH-PP-E
Fort Shafter, HI 96858-5440

Facility/Site: FUDS Makalapa Crater Navy Salvage Yard

Subject: Review of Draft Final PRELIMINARY ASSESSMENT, Makalapa Crater Navy Salvage Yard, Halawa, District of Ewa, Island of Oahu, HI, FUDS Property Number – H09HI0484– 24 March 2016

Dear Ms. Wong:

The Hawaii Department of Health Hazard Evaluation and Emergency Response (HEER) Office has reviewed the draft final preliminary assessment and has no comments at this time.

Please send a finalized version of the report to the HEER Office at your earliest convenience. Should you have any questions concerning the above please feel free to contact me at 586-7574.

Sincerely,

Steven P. Mow
Supervisor
Site Discovery, Assessment, & Remediation Section
Hazard Evaluation and Emergency Response Office

APPENDIX Q

REPORT DISTRIBUTION

DRAFT REPORT DISTRIBUTION

Addressee	No. Copies
U. S. Army Corps of Engineers – Honolulu District ATTN: CEPOH-PP (Takemoto / Wong) Building 252 Fort Shafter, HI 96858-5440	1 (Electronically)

FINAL REPORT DISTRIBUTION

Addressee	No. Copies
U. S. Army Corps of Engineers – Honolulu District ATTN: CEPOH-PP (Takemoto / Wong) Building 252 Fort Shafter, HI 96858-5440	1 (Electronically)

NOTE: Final report to be disseminated at the discretion of the USACE Honolulu District.

APPENDIX R

REPORT PLATES

REPORT PLATES

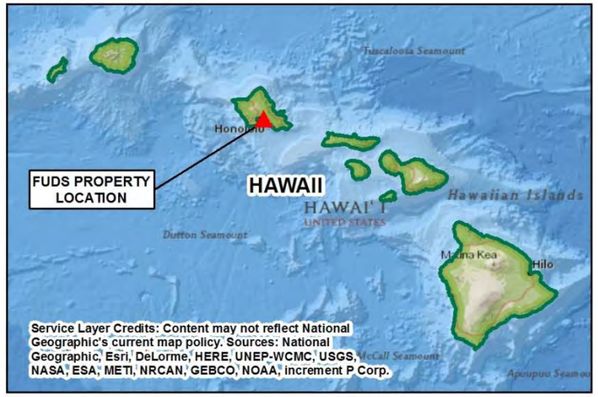
1 Makalapa Crater Navy Salvage Yard Vicinity Map

Map files completed in association with this Preliminary Assessment are based on historic cartographic, aerial and site visit data collected during this investigation. The thematic maps were created using ArcGIS.

The thematic maps were created by scanning and warping selected historic data to reference points collected from non-stable selected base maps such as U.S. Geological Survey (USGS) 7.5 minute, quadrangle sheets, National Imaging and Mapping Agency (NIMA) maps, or satellite imagery. The horizontal scale and horizontal datum of the base maps is generally known. In this case the datum used was 1927 North American Datum; the plates were generated in 1983 North American Datum. Attempts have been made to rectify the data to the referenced base maps; however, distortions in scale and contortions of the features are present. These distortions are a result of inaccuracies in the source data, as well as the processes of scanning and rectifying the data**.** Much of the data on the maps lack sufficient information to support a determination of accuracy.

Many of the historic maps used were hand-drawn or built on locations that were inaccurate by modern standards. In general, historic map inaccuracies are unknown and not quantifiable. The unknown inaccuracies may then be magnified by the georeferencing process; therefore, thematic maps generated from historic maps and drawings will have accuracy no greater than the least accurate source.

The lineage and source of the historic data used to generate the thematic maps is unknown. The majority of Federal Geographic Data Committee (FGDC) Metadata fields are therefore unknown. A metadata file that gives all available pertinent information has been provided with this product. The statements above are inclusive of all available information regarding the historic data sources and the thematic maps generated. The thematic maps are not original digital mapping data; are scanned and warped data with selected unique feature annotation. The intended purpose of the mapping data is for photo-interpretation and not design. The vector data and associated symbology is unique to the intended purpose. The majority of the digitized features are not part of the current Tri-Service CADD Standards list of features and associated line types and symbology (i.e., range fans, pits, disturbed land). The mapping data produced does comply with applicable Tri-Service Standards.



Legend

APPROXIMATE FUDS BOUNDARY

N

U. S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MAKALAPA CRATER NAVY SALVAGE YARD
FUDS PROPERTY NUMBER – H09HI0484
HALAWA, DISTRICT OF EWA
ISLAND OF OAHU, HI

VICINTY MAP

PROJ. DATE: Nov 2015		PLATE NO. 1

H:\OEW2015\Hawaii\Makalapa_Crater\Makalapa_Plate_1.mxd