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HAWAIIAN HOMES COMMISSION

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M. WAIALEALE SARSONA
EXECUTIVE ASSISTANT

STATE OF HAWAI'I
DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879
HONOLULU, HAWAI'I 96805

October 5, 2011

Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

RECEIVED
'11 OCT 10 A8:30
OFC. OF ENVIRONMENTAL QUALITY CONTROL

Aloha Director:

Subject: Finding of No Significant Impact (FONSI), General Lease No. 293 (GL 293), Kalaeloa Solar One and Kalaeloa Solar Two, Kalaeloa, Oahu

This is to inform you that the Hawaiian Homes Commission (HHC), at its meeting of September 19, 2011, acting in its capacity as landowner, approved the FONSI for the Final Environmental Assessment submitted by the applicant, Keahole Solar Power, LLC, for its project Kalaeloa Solar One and Two, to develop a solar power production facility.

The Department of Hawaiian Home Lands requests that the FONSI for the project be published on the next publication date of the OEQC Bulletin in order to complete the environmental review process.

In order to complete the environmental review requirements, enclosed are the following:

1. Finding of No Significant Impact
2. One copy of the Final Environmental Assessment
3. OEQC Bulletin Publication Form
4. One CD containing all of the above documents

Should you have any questions regarding this memo, please contact Todd Gray, Land Agent, at (808) 620-9460. For specific questions relating to the project, please contact Faith Caplan, AICP, TEC Inc., at (808) 528-1445.

Me ke aloha,

Linda Chinn, Administrator
Land Management Division

enc.

OEQC Publication Form
The Environmental Notice

Name of Project: Kalaeloa Solar One and Two

Applicable Law: Hawaii Revised Statutes Chapter 343, Environmental Impact Statements

Type of Document: Final Environmental Assessment

Island: Oahu
District: Ewa
TMK: [1] 9-1-13:028 (portion)
Permits Required: Grading and grubbing permit
Conditional use permit - minor

RECEIVED
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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Name of Applicant/Developer Keahole Solar Power, LLC
Address 2800 Woodlawn Drive, Suite 234
City, State, Zip Honolulu, Hawaii 96822
Contact Sheldon Char, Project Executive
Phone 808-729-2300

Approving Agency: State of Hawaii, Department of Hawaiian Home Lands
Address P.O. Box 1879
City, State, Zip Honolulu, Hawaii 96805
Contact and Phone Todd Gray, 808-620-9460

Consultant: TEC Inc.
Address 1003 Bishop Street Suite 1550
City, State, Zip Honolulu, HI 96813
Contact and Phone Faith Caplan, Project Manager 808-528-1445

Project Summary: Keahole Solar Power, LLC is proposing to develop two 5MW renewable energy projects in Kalaeloa, Oahu, Hawaii. Kalaeloa Solar One would utilize concentrating solar power (CSP) thermal technology and Kalaeloa Solar Two would be a current photovoltaic (PV) power generating facility.

Each system would generate 5 MW of electricity that would be provided to the Hawaiian Electric Company (HECO) via two power purchase agreements. The electricity would feed into the existing HECO power grid. The project supports the State of Hawaii Clean Energy Initiative goal of having 70 percent of the State's energy come from renewable sources by 2030. Currently, the electrical load profile on the island of Oahu is 350 MW peak, with approximately 80 MW of electricity generated from renewable sources, most of which is from solar powered PV panels.

The proposed project location is in the northeast portion of the Kalaeloa Community Development District, the redevelopment of which is the responsibility of Hawaii Community Development Authority (HCDA). The approximately 80-acre site is owned by State Department of Hawaiian Home Lands (DHHL).

The project would include a solar thermal array of approximately 9,500 Sopogy™ CSP collectors (Kalaeloa Solar One) and approximately 18,600 SunPower™ PV panels (Kalealoa Solar Two) with support facilities.

The CSP collectors and PV panels track the sun east to west during the day. The CSP collectors focus the sunlight on the absorber pipe that is filled with organic thermal oil that increases temperature while being conveyed through the rows of CSP collectors. The heated fluid drives an engine to produce electricity for the existing HECO power grid. The PV panels provide electricity directly to the existing power grid. Approximately 6 full time employees would be required to operate the CSP facility seven days per week throughout the year. The PV facility would be operated remotely and no onsite full-time employees are required.

The proposed action includes vegetation removal and grading, assembling and mounting the CSP collectors and PV panels, and constructing a CSP support/generator building, cooling towers, utility poles for an overhead electrical line, concrete pads for equipment, perimeter fencing, a substation, drainage basin and septic system on site.

The project would have beneficial socioeconomic impacts. No significant adverse impacts are anticipated to air quality, biology, noise, geology and soils, land use, socioeconomics and traditional cultural practices, hazardous materials and waste, utilities and public services, or visual resources. With implementation of best management practices and adherence to existing laws and regulations, potential impacts to water and archaeological resources would be minimized.

Determination: State of Hawaii, Department of Hawaiian Home Lands has issued a Finding of No Significant Impact

Final
Environmental Assessment

Kalaeloa Solar One and Two

Tax Map Key [1] 9-1-13: Parcel 28
Kapolei, Hawaii

September 2011

Prepared for:
Keahole Solar Power, LLC
2800 Woodlawn Drive,
Suite 234
Honolulu, Hawaii 96822

Prepared by:
TEC Inc.
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

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FINAL
ENVIRONMENTAL ASSESSMENT
KALAELOA SOLAR ONE AND TWO
OAHU, HAWAII

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List of Acronyms and Abbreviations

AC	alternating current
ACOE	Army Corps of Engineers
AIRFA	American Indian Religious Freedom Act
AIS	archeological inventory survey
ALISH	Agricultural Lands of Importance to the State of Hawaii
AMP	Archaeological Monitoring Plan
ARPA	Archaeological Resources Protection Act
BMPs	Best Management Practices
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ch	Chapter
CO	carbon monoxide
County	City and County of Honolulu
CR	Coral Outcrop
CSP	concentrating solar power
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	Decibels
dBA	A-weighted Sound Level
DC	direct current
DBEDT	Department of Business, Economic Development and Tourism
DHHL	Department of Hawaiian Home Lands
DLNR	Hawaii Department of Land and Natural Resources
DNL	day-night average sound level
DOE	Department of Education
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health
DOT	Hawaii Department of Transportation
DPP	Department of Planning and Permitting
DPW	Department of Public Works
EA	Environmental Assessment
EMF	electric and magnetic fields
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Signification Impact
ft.	feet/foot
ft^2	square foot/square feet
GPS	Geographic Positioning System
HAAQS	Hawaii Ambient Air Quality Standards
HAR	Hawaii Administrative Rules
HB	House Bill
HBMP	Hawaii Biodiversity and Mapping Program
HCDA	Hawaii Community Development Authority
HCEI	Hawaii Clean Energy Initiative
HECO	Hawaiian Electric Company
HPP	Historic Preservation Plan
HRHP	Hawaii Register of Historic Places
HRS	Hawaii Revised Statutes
IAMP	Integrated Archaeological Mitigation Plan for the Proposed Kalaeloa Solar One and Two Projects
IARII	International Archaeological Research Institute
ICNIRP	International Commission on Non-Ionizing Radiation Protection
KSP	Keahole Solar Power, LLC
kV	kilovolt
LBP	Lead-Based Paint
MBTA	Migratory Bird Treaty Act
MnC	Mamala Stony Silty Clay Loam
mgd	million gallons per day
$\mu g/m^3$	micrograms per cubic meter
MW	megawatt
NO2	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASBP	Naval Air Station Barbers Point
NAGPRA	Native American Graves and Repatriation Act
NAVFAC Pacific	Naval Facilities Engineering Command, Pacific Division
NHPA	National Historic Preservation Act
NPDES	National Pollution Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
OEQC	Office of Environmental Quality Control
Pb	lead
PCB	polychlorinated biphenyl
PHNWR	Pearl Harbor National Wildlife Refuge
PM_x	Particulate matter of size x
POL	Petroleum Oil and Lubricant
Ppm	parts per million
PUC	Hawaii Public Utilities Commission
PURPA	Public Utility Regulatory Policies Act
PV	photovoltaic
RCRA	Resource Conservation and Recovery Act
ROW	right-of-ways
RPS	Renewable Portfolio Standard
SEL	Sound Exposure Level
SHPD	State Historic Preservation Division
SMA	Special Management Area
SO2	sulfur dioxide
TMK	Tax Map Key
UIC	Underground Injection Control
U.S.	United States of America
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture

USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WRCC	Western Regional Climate Center
WWII	World War II
WWTP	Waste Water Treatment Plant

Project Summary

***Project Name*:**	Kalaeloa Solar One and Two
***Proposed Action*:**	Develop two on-grid 5 megawatt (MW) solar power generating facilities: Kalealoa Solar One, using Sopogy™ concentrating solar power thermal technology; Kalaeloa Solar Two, using SunPower™ photovoltaic technology.
Applicant/Developer:	Keahole Solar Power, LLC 2800 Woodlawn Drive, Suite 234 Honolulu, Hawaii 96822 Attn: Sheldon Char, Project Executive
Tax Map Key:	[1]9-1-013:028 (portion)
Location:	Kalaeloa, Honouliuli, Ewa District, Oahu, Hawaii
Property Owner:	State of Hawaii, Department of Hawaiian Home Lands
Lessee:	Kalaeloa Solar One
Approving Agency:	State of Hawaii, Department of Hawaiian Home Lands
State Land Use District:	Urban
Community/ Development Plan:	Ewa Development Plan, Kalaeloa Special Area
County Zoning:	F-1 Military and Federal Preservation on zoning maps, subject to P-2 General Preservation development standards subsequent to Navy conveyance of land in 1999.
Special Designations:	Kalaeloa Community Development District managed by Hawaii Community Development Association. Adoption of Master Plan and administrative rules are pending.
HRS Chapter 343 Trigger:	Use of State of Hawaii land
Summary:	Keahole Solar Power, LLC is proposing to develop two 5MW renewable energy projects in Kalaeloa, Oahu, Hawaii. Kalaeloa Solar One would utilize concentrating solar power (CSP) thermal technology and Kalaeloa Solar Two would be a current photovoltaic (PV) power generating facility. Each system would generate 5 MW of electricity that would be provided to the Hawaiian Electric Company (HECO) via two power purchase agreements. The electricity would feed into the existing HECO power grid. The project supports the State of Hawaii Clean Energy Initiative goal of having 70 percent of the State's energy come from renewable

sources by 2030. Currently, the electrical load profile on the island of Oahu is 350 MW peak, with approximately 80 MW of electricity generated from renewable sources, most of which is from solar powered PV panels.

The proposed project location is in the northeast portion of the Kalaeloa Community Development District, the redevelopment of which is the responsibility of Hawaii Community Development Authority (HCDA). The approximately 80-acre site is owned by State Department of Hawaiian Home Lands (DHHL).

The project would include a solar thermal array of approximately 9,500 Sopogy™ CSP collectors (Kalaeloa Solar One) and approximately 18,600 SunPower™ PV panels (Kalealoa Solar Two) with support facilities.

The CSP collectors and PV panels track the sun east to west during the day. The CSP collectors focus the sunlight on the absorber pipe that is filled with organic thermal oil that increases temperature while being conveyed through the rows of CSP collectors. The heated fluid drives an engine to produce electricity for the existing HECO power grid. The PV panels provide electricity directly to the existing power grid. Approximately 6 full time employees would be required to operate the CSP facility seven days per week throughout the year. The PV facility would be operated remotely and no onsite full-time employees are required.

The proposed action includes vegetation removal and grading, assembling and mounting the CSP collectors and PV panels, and constructing a CSP support/generator building, cooling towers, utility poles for an overhead electrical line, concrete pads for equipment, perimeter fencing, a substation, drainage basin and septic system on site.

The project would have beneficial socioeconomic impacts. No significant adverse impacts are anticipated to air quality, biology, noise, geology and soils, land use, socioeconomics and traditional cultural practices, hazardous materials and waste, utilities and public services, or visual resources. With implementation of best management practices and adherence to existing laws and regulations, potential impacts to water and archaeological resources would be minimized.

Determination: State of Hawaii, Department of Hawaiian Home Lands has issued a Finding of No Significant Impact

SECTION 1
PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

Kalaeloa Solar Power, LLC (KSP) is proposing to develop two 5 megawatt (MW) solar power generating facilities in Kalaeloa, Oahu, Hawaii. The two facilities would be independently owned and operated. The Kalaeloa Solar One would be owned and operated by Kalaeloa Solar One LLC and utilize Sopogy™ concentrating solar power (CSP) thermal technology. Kalaeloa Solar Two would be owned by Kalaeloa Solar Two, LLC and operated by SunPower Corporation and utilize SunPower™ photovoltaic (PV) panel and tracking systems. The two facilities would each generate 5 MW to be sold to Hawaii Electric Company (HECO) through separate power purchase agreements approved by the Hawaii Public Utilities Commission (PUC).

The CSP collectors use mirrors and optics to concentrate energy from the sun. The thermal energy heats organic oil in a pipe at the center of each CSP collector. The heated oil is conveyed through other units and ultimately drives an engine to generate electricity.

The PV panels convert solar radiation into direct current (DC) electricity using solar panels with cells of monocrystalline silicone. The cells are protected by tempered glass. The DC is ultimately converted onsite to alternating current (AC).

Both CSP and PV collectors follow the sun east to west throughout the day.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed project is to reduce Oahu's dependence on fossil-fuel for power generation. The proposed action would employ two different renewable energy technologies to produce a total of 10 MW that would feed into HECO's existing power grid. The collective power generated would provide electricity to power approximately 2,500 homes, result in the offset of 452,460 tons of emissions over 30 years and eliminate the need for 35,075 barrels of oil per year. The proposed action would assist the State in reaching the Hawaii Clean Energy Initiative (HCEI) goal of having 70 percent of the State's energy come from renewable sources by 2030. As part of the HCEI, an agreement was signed on October 20, 2008 by key stakeholders: the Hawaiian Electric companies, the State Governor, the Energy Division of the State Department of Business, Economic Development and Tourism (DBEDT) the State Consumer Advocate, and the U.S. Department of Energy. One component of the agreement is that the Hawaiian Electric companies will integrate up to 1,000 MW of renewable energy resources on Oahu.

Other initiatives include:

- Hawaii Greenhouse Gas Emissions Reduction Law, Act 234 2007, which established a policy to reduce the greenhouse gas emissions to 1990 emissions levels by 2020.
- Act 95 2004 and House Bill (HB) 1464 2009. Act 95 requires Hawaii's utilities to make renewable energy account for an increasing percentage of their power generation portfolio. HB 1464 increased the percentages of required renewable energy (For example: 15 percent of net energy sales by December 31, 2015).

The reduced dependence on fossil fuels for energy generation has the following benefits to Hawaii's environment:

- reduction in greenhouse gas emissions;
- reduction in dependency on foreign imports of fossil fuel and associated price volatility; and
- reduction in the volume of fossil fuel and associated risks of spills during transport and storage.

1.3 ENVIRONMENTAL REVIEW

Chapter (Ch) 343, Hawaii Revised Statutes (HRS), as amended, Environmental Impact Statements, requires that a government agency or private developer proposing to undertake a project consider the environmental impacts of the proposed project. Use of state lands is among the criteria in HRS Ch 343 that triggers the need for an Environmental Assessment (EA). The project would be located on approximately 80 acres of land leased from the State of Hawaii Department of Hawaiian Home Lands (DHHL). This EA has been prepared in accordance with HRS Ch 343, as amended, Hawaii Administrative Rules Title 11 (HAR 11-200-17), State of Hawaii Department of Health (DOH), Chapter 200, Environmental Impact Statement Rules.

1.3.1 Pre-EA Assessment Consultation

In preparation of the Draft EA, a pre-assessment consultation letter was sent to agencies and organizations on August 6, 2010. The distribution list and correspondence received is included as Appendix A1 to this EA. Key issues raised included:

- presence of threatened and endangered plants, and anchialine pools,
- presence archaeological resources and burials,
- impact of reflectivity and thermal currents on air navigation,
- potential impacts to navigable waters of the U.S., and
- prevailing land use zoning.

Additional communication occurred with:

- State Department of Transportation (DOT), Airports,
- Federal Aviation Administration (FAA),
- State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW),
- State Historic Preservation Division (SHPD), and
- Kapolei Hawaiian Civic Club.

1.3.2 Draft EA Review

The Hawaii Office of Environmental Quality Control (OEQC) published DHHL's anticipated Finding of No Significant Impact (FONSI) as a Draft EA in *The Environmental Notice*, which initiated a 30-day comment period from January 8 through February 6, 2011. *The Environmental Notice* is posted online (http://oeqc.doh.hawaii.gov/Shared%20Documents/Environmental_Notice) and contains a link to the Draft EA. Comments were sent to TEC Inc., as the applicant's representative.

In addition to being available on the OEQC website and at the Kapolei Library, the Draft EA was provided to the entities listed in the next sections. Those that provided comment are indicated by **BOLD typeface.** Comment and response letters are included in Appendix A2.

1.3.2.1 Federal Agencies

Copies of the Draft EA were sent to the following Federal agencies for review:

- **Federal Aviation Administration (FAA),**
- Department of the Army, Regulatory Branch,
- Naval Facilities Engineering Command,
- U.S. Fish and Wildlife Service (USFWS), and
- U.S. Coast Guard.

1.3.2.2 State Agencies

Copies of the Draft EA were sent to the following state agencies for review:

- Department of Agriculture,
- **Department of Accounting and General Services,**
- Department of Business, Economic Development and Tourism (DBEDT), Office of Planning,
- **DBEDT, Hawaii State Energy Office,**
- Department of Defense,
- **Department of Education (DOE),**
- Department of Health (DOH), Environmental Planning Office,
- **DOH, Hazard Evaluation and Emergency Response Office,**
- **DOH, Indoor and Radiological Health Branch**
- **DOH, Wastewater Branch**
- **Hawaii Community Development Authority (HCDA),**
- Department of Hawaiian Home Lands (DHHL),
- DHHL, Hawaiian Homes Commission,
- Department of Human Services,
- Department of Labor and Industrial Relations,
- **Department of Land and Natural Resources (DLNR), Land Division,**
- **DLNR, State Historic Preservation Division (SHPD),**
- **DLNR, Division of Aquatic Resources**
- **DLNR, Division of Forestry and Wildlife (DOFAW)**,
- DLNR, Oahu Island Burial Council,
- **Department of Transportation (DOT),**
- DOT, Airports Division,
- University of Hawaii, Environmental Center,
- Housing Finance and Development Corporation, and
- **Office of Hawaiian Affairs.**

1.3.2.3 City and County of Honolulu Agencies

Copies of the Draft EA were sent to the following City and County of Honolulu agencies for review:

- **Fire Department,**
- **Police Department**,
- **Board of Water Supply,**
- Department of Planning and Permitting (DPP),
- **Department of Design and Construction,**
- **Department of Environmental Services,**
- **Department of Facility Maintenance,**

- **Department of Parks and Recreation,** and
- **Department of Community Services.**

1.3.2.4 Other

Copies of the Draft EA were sent to the following non-governmental agencies for review:

- Hawaiian Electric Company (HECO),
- Hawaiian Telcom,
- Ahahui Siwila Hawaii O Kapolei
- Makakilo/Kapolei/Honokai Hale Neighborhood Board #34,
- Kapolei Community Development Corporation,
- Malu'ohai Residents Association, and
- Kaupea Homestead Association.

1.3.3 Final EA

Comments on the Draft EA were considered and addressed in preparation of this Final EA and the agency determination. Key issues and reference to the relevant Final EA sections are as follows:

- clarification of ownership of and coordination of water service to project site (Section 3.11),
- clarification of ownership of the wastewater system at the site and disposal methods of wastewater from the site (Section 3.11),
- impact of reflectivity and thermal currents on air navigation (Section 3.1), and
- presence of archaeological resources and burials (Section 3.7).

Subsequent to the Draft EA, the project description was refined and FAA completed their studies of potential impacts to air navigation.

A *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* was conducted at the request of State Historic Preservation Division (SHPD) and is included as Appendix B. SHPD requested the AIS to supplement the existing field investigation reports because there was a concern that possible additional undocumented archaeological resources existed within the project area, due to changes in archeological standards since previous surveys were conducted (Appendix A2 SHPD Draft EA comment letter). The AIS supersedes the *Integrated Archaeological Mitigation Plan (IAMP) for the Proposed Kalaeloa Solar One and Two Projects* dated 2010 that was included in the Draft EA.

.

SECTION 2
PROPOSED ACTION

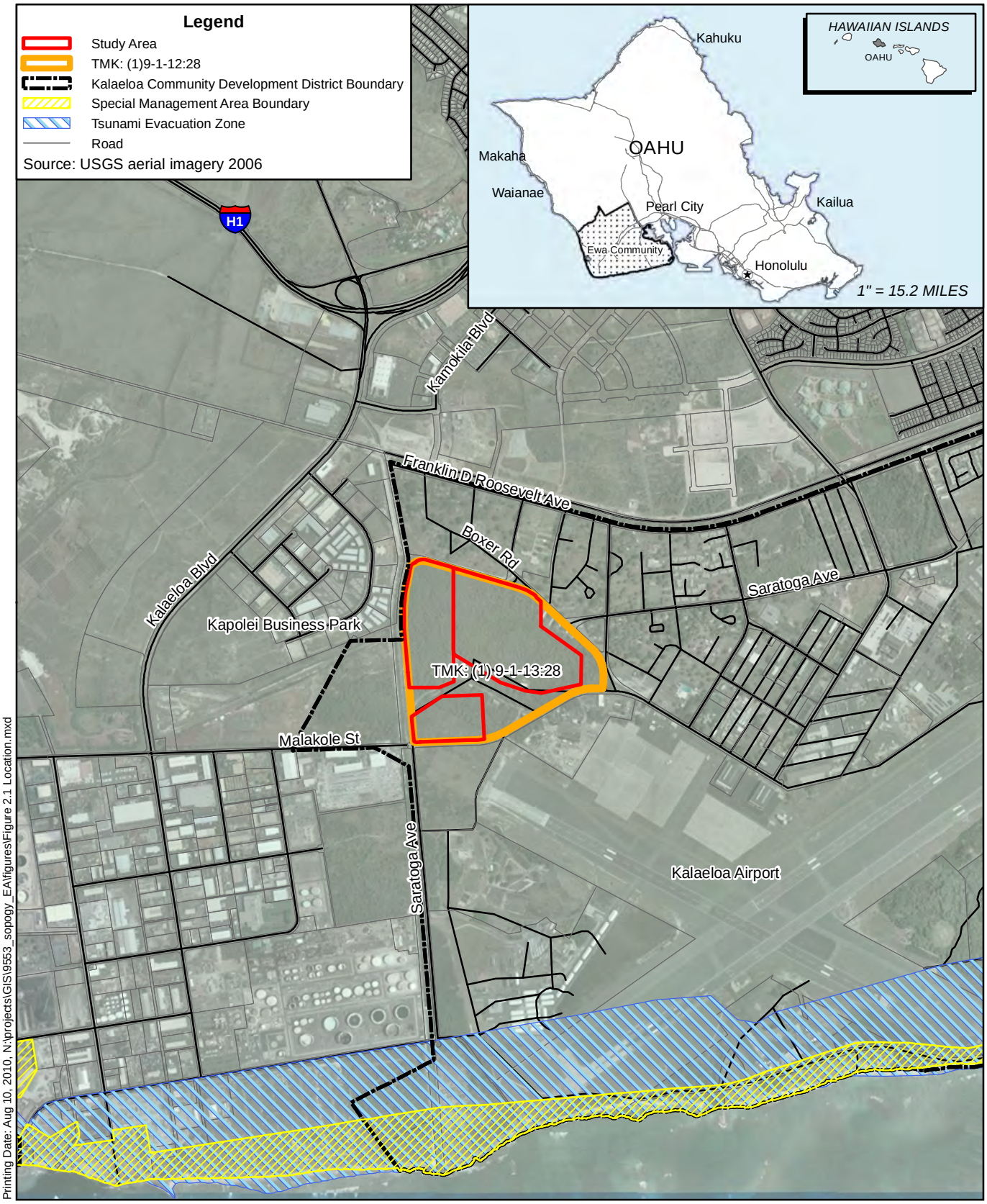
2.1 LOCATION

The project site is located within the *ahupua'a* of Honouliuli on the southwestern portion of the island of Oahu, in the district of Ewa (Figure 2.1). It is in the northwest area of the former Naval Air Station Barbers Point (NASBP) that was closed in 1999. NASBP is currently the Kalaeloa Community Development District managed by the HCDA. The Navy has retained some NASBP lands, but most have been conveyed to others. The proposed project site is undeveloped, and has no known physical address. The site is void of structures, roads, or other obvious improvements. It consists of about 80 acres within Tax Map Key (TMK): (1) 9-1-13: parcel 028, which is 137 acres. DHHL owns the parcel. The CSP portion of the site is notionally sited within the northeast "study area" polygon as identified on Figure 2.2. The PV portion of the site would be sited within the two remaining non-contiguous polygons identified on the Figure. The project areas shown on Figures 2.1 and 2.2 are larger than 80 acres and represent the study areas for this EA.

The boundaries of the proposed lease area have not been finalized. The lease with DHHL is based on net usable area, with cultural features not included. The final lease boundaries would avoid significant archaeological sites, and include consultation with SHPD. Previously identified archaeological sites in the vicinity of study area were field-verified and an archeological inventory survey (AIS) conducted to identify any sites that were missed (Section 3.7). The final lease boundary will be determined after an archeological monitoring plan (AMP) has been implemented, with adjustments for newly discovered features and

The study area is covered by dense kiawe and lowland scrub vegetation, except the southernmost portion, which is graded. The area is about 46 feet (ft.) above mean sea level with a topographic gradient in the south-southwesterly direction.

There is no existing formal access to the site and there is a fence and canal aligned parallel to the west boundary of the site (Figure 2.2). All study areas can be accessed via unpaved roads. Where access to these unpaved roads is blocked off at intersections with roads in the north and south, off-road trails are available that go around each roadblock. Access to the study areas north of Mumba Street is from H-1 via Kamokila Boulevard, leading to Franklin D Roosevelt Avenue and adjacent unpaved roads to the north and west borders of the site (Figure 2.2). The study area south of Mumba Street can be accessed from Midway Road and Mumba Street, but there is no paved road that extends into the area.

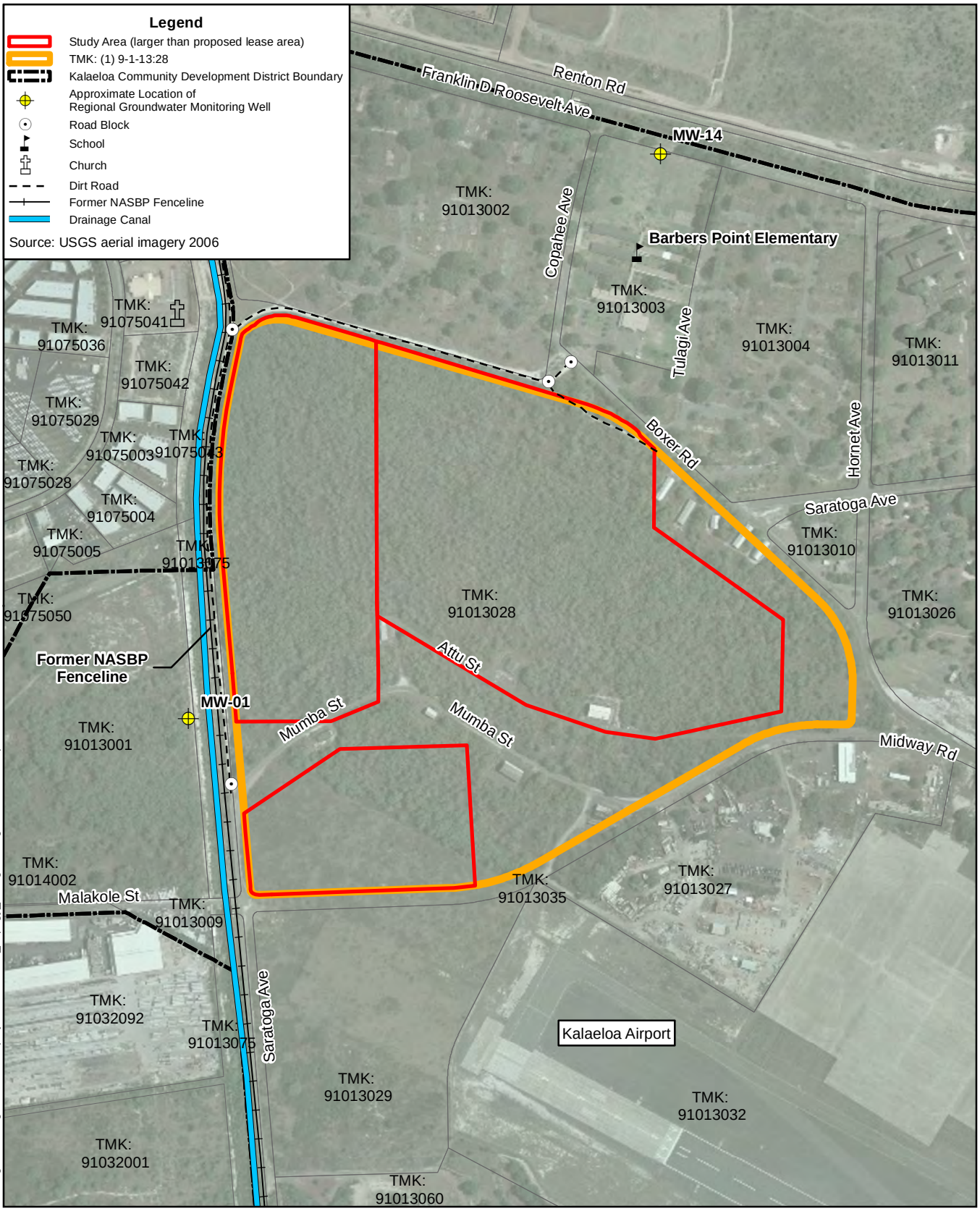


Printing Date: Aug 10, 2010, N:\projects\GIS\9553_sopogy_EA\figures\Figure 2.1 Location.mxd

Feet
0 1,150 2,300
0 275 550
Meters

Figure 2.1
Location Map
Kalaeloa Solar One and Two

N
W E
S



Printing Date: Aug 19, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 2.2 Site Map.mxd

Feet: 0, 360, 720
Meters: 0, 100, 200

Figure 2.2
Site Map
Kalaeloa Solar One and Two

N W E S

2.2 CONSTRUCTION

KSP is proposing to construct two 5 MW power generating facilities in Kalaeloa using two renewable energy technologies: CSP and PV.

Vegetation would be removed with minimal grading required. The site is relatively flat and little if any dirt would be brought to or removed from the site. Security fencing (chain-link) and entrance gates would be constructed at the perimeter of the site.

Entrances to the CSP and PV sites have notionally been sited (Figure 2.3). These entrance locations are subject to consultation with HCDA, who is preparing an infrastructure master plan for Kalaeloa The point of connection to the HECO power grid would be a developer-provided substation (150 ft. by 150 ft.) at the northwest corner of the site (Figure 2.3).

Five archeological preservation sites are included in the project conceptual plan (Figure 2.3), and are subject to ongoing consultation with SHPD.

2.2.1 CSP Facilities

The conceptual plan for the CSP facility is shown on Figure 2.3. This plan is subject to revision and modification based on the negotiated lease and agency consultation.

Approximately 9,500 CSP collectors would be aligned north-south in rows of 14 or 28 collectors per row. The collectors would be mounted to concrete anchors on grade and assembled in rows connected by carbon steel piping to a power block. The installation has a wind-resistant rating of 125 mph. Other operating equipment that would be installed includes: storage tanks for the thermal fluid, pumps, flow meters, and temperature sensors. Unpaved compacted access roads would circulate throughout the site, to allow easy access to the panels and facilities (Figure 2.3).

The curved shape of the MicroCSP™ parabolic trough collector allows the concentration of thermal energy from the sun, while also resulting in minimal external reflection or creation of thermal currents. The CSP collectors concentrate the sun's rays onto the central absorber pipe (concentration ratio of 60:1), centrally located inside the parabolic trough at approximately one foot above the bottom of the panel, as shown in Figure 2.4. A heat transfer fluid, in this case a Food and Drug Administration (FDA) approved organic mineral oil, is heated in the absorber pipe. The closed pipe system conveys the heat transfer fluid through the CSP collectors. A pump is used to circulate the heat transfer fluid from the CSP collectors to a support/generator building where the 300-500º F thermal fluid 1) generates steam to drive a steam turbine generator and generate AC electricity, or 2) is temporarily retained in storage tanks before being conveyed to the engine block. Benefits from having storage tanks for the thermal fluid include an uninterrupted electricity supply in the eventuality of clouds or rain where there could be very little or no solar energy.

The support/generator building where this energy conversion and storage would occur is a single-story, pre-engineered structure on concrete slab on grade. The building would be approximately 30 ft. tall, measure approximately 107 ft. by 129 ft., and would house electrical, pump and controls equipment, as well as a restroom, storage area, and control room. It would be constructed near the southern boundary of the CSP site, between an electrical equipment yard and the storage tank area (Figure 2.3). The thermal

fluid is cooled and recycled through the CSP collectors. The cooling process would rely on water from an onsite source well and the use of cooling towers, located just south of the support/generator building (Figure 2.3). Cooling water would be disposed of through two injection wells located next to the cooling towers (Figure 2.3). The project drainage design includes a new six-foot deep retention basin for collection of stormwater runoff. The basin would lie mostly along the southern boundary of the CSP site and is designed to expand into a depressed area to the north and east if required during large storm events (Figure 2.3). Finally, in its conceptual stage is a plan for anticipated sewer generation from one bathroom to be handled by an onsite septic system and 14'x30' leaching field just south of the support/generator building (Figure 2.3).

Power generated at the support/generator building would be transferred to the HECO system at a new developer-provided substation (150 ft. by 150 ft.) at the northwest corner of the site (Figure 2.3). Utility poles of 40 ft. in height will run between the CSP and PV facilities and will carry an overhead primary 12.47 kV electrical line, connecting the support/generator building with the HECO system. Both the CSP and PV facilities would independently connect with the HECO distribution system through this substation.

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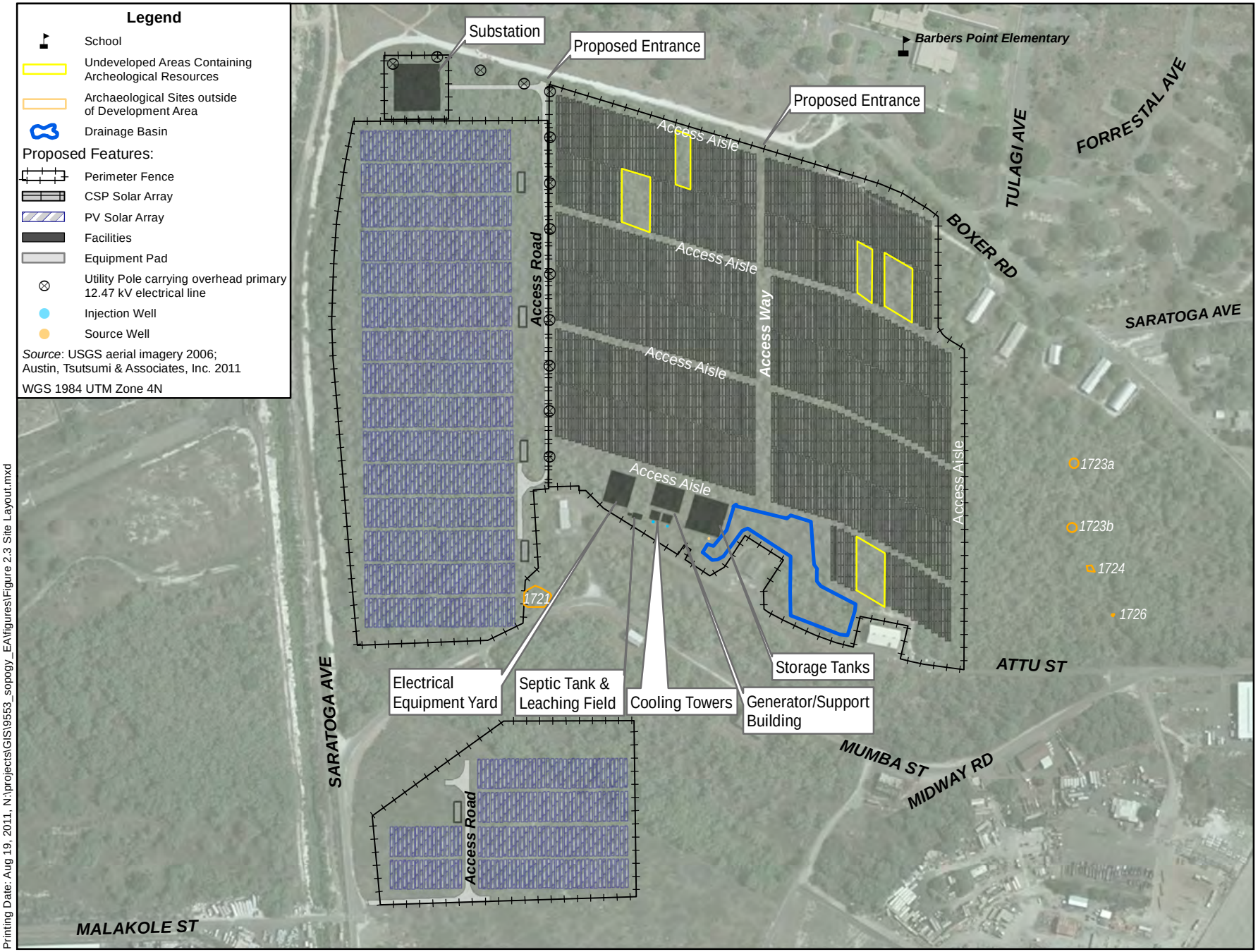

Printing Date: Aug 19, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 2.3 Site Layout.mxd

Feet: 0, 230, 460
Meters: 0, 60, 120

Figure 2.3
Conceptual Layout
Kalaeloa Solar One and Two

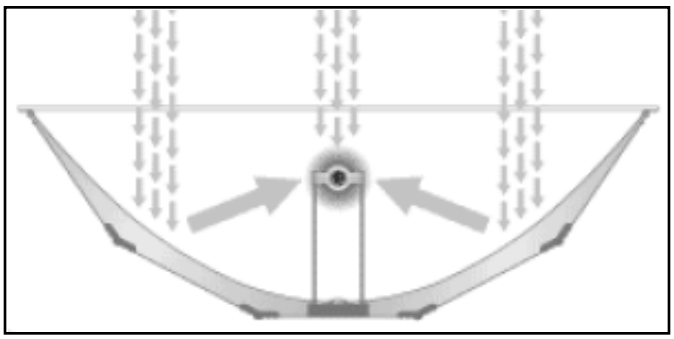

Figure 2.4. Cross-sectional Schematic of the CSP Collector

MicroCSP™ employs a single axis tracking mechanism to maximize the amount of radiant energy captured. The CSP collectors are aligned on a north-south axis and track the sun from east to west throughout the day. Because the purpose of the collectors is to focus the full energy of the sun's rays onto the heat absorber pipe, the reflective mirrors are aligned and calibrated to absorb all incoming rays. Most reflective rays would be directed to the lower portion of the CSP collector. At any time, the operator of the facility can manually override any programming to rotate the collectors so the mirrors are upside-down (Figure 2.5), or in "stow" position. Figure 2.5 is a photograph of the Holaniku installation on the Island of Hawaii. It shows the CSP collector directed to the ground when not in use.

Figure 2.5. Photo of Sopogy™ CSP Installation

The system that moves the mirrors to track the sun uses electric motors on each row to drive them. There is one motor for every fourteen collectors, as well as an inclinometer (to sense the current angle of each row) and a pair of limit switches to prevent the row from turning too far in either direction. Four sets of fourteen collectors make one loop. There is one controller for every 3 loops. This device is mounted in the middle and power runs from it to each of the loops. The row controller is responsible for calculating the angle of the sun, and driving each motor one at a time until it is pointed directly at the sun.

Each morning, HECO-supplied power would be used to heat the oil to operating temperature. The system is self-sufficient for the remainder of the day. Additional HECO power is required in the evening for the computer server. Five (5) MW is the anticipated net output to HECO. The CSP system is a closed loop and no air emissions are anticipated.

2.2.2 PV Facilities

The conceptual plan for PV facilities is also shown on Figure 2.3. This plan is subject to revision and modification based on the negotiated lease and agency consultation.

The PV panels are monocrystalline, aligned in north-south rows that rotate to track the daily east-west movement of sun. The rows are linked together as "building blocks" with a single controller and drive unit. The drive unit is a ½ horsepower ac motor (Figure 2.6, left). Approximately 25 drive motors are required. The installation is designed for 105 mph wind resistance. Approximately, 18,600 ground-mounted panels are proposed to provide 5 MW of electricity. The panels would be mounted to square corrosion resistant galvanized steel torque tubes that are stabilized and secured to a rigid frame. Multiple panels are connected in series to create a "string", and multiple strings are connected in parallel at a "combiner box". Upon exiting the combiner box, the DC power travels to a three phase inverter which outputs AC power which is then delivered to HECO (Figure 2.6, right). The inverters contain a safety protocol known as "Anti-Islanding" that will automatically shut off the PV facilities in the event the HECO grid loses power. This prevents electricity from leaving the PV facilities and injuring utility line workers who may be working on a downed power line near the facility. . Also, integrated with the PV facility is a Supervisory Control And Data Acquisition (SCADA) that includes a data logger and sensors to record AC power generation and equipment to record ambient temperature, irradiance, and wind speed. The data can be monitored and the plan can be controlled remotely via a high-speed internet connection.

The PV system would be interconnected with the substation at the site that would be physically shared with but electrically independent from the CSP system. No air emissions or waste material would be generated onsite.

Figure 2.6. SunPower™ Installation: Drive Unit (left), Equipment Pad and PV Units (right)

2.2.3 Labor and Schedule

During construction, there would be a peak of 135 workers onsite for the PV facility and approximately 60 for the CSP facility. The construction of the two facilities would likely overlap to some extent over the

anticipated 5 month duration; however, the facilities would be constructed independently. Permits for the facilities would be obtained independent of each other. Construction would begin after all necessary permits and approvals have been obtained for each facility (Section 4.2). Construction would occur Monday through Friday during daylight hours. Funding for the proposed action is private. No federal, state or county funding is proposed.

2.3 OPERATIONS

The CSP and PV facilities would operate independently seven days per week throughout the year. There would be no evening operations. The CSP component would require 6 full-time employees. No onsite full-time employees would be required for the PV component.

The PV operations would require a small auxiliary load for tracker motors and data acquisition and meteorological stations, but the net power generation would be 5 MW of AC. The CSP component may rely on HECO power for starting the system every morning, but the net power generated would also be 5 MW.

Currently the United States Navy owns the Kalaeloa water and wastewater system (see Section 3.11 for more detail). The City and County of Honolulu (County) would provide fire and police protection. Communications (internet and telephone) would be provided to the site. Stormwater would be managed onsite (Section 3.5), as would be onsite wastewater (Section 3.11). Potable water supply plans are described in Section 3.11. Minimal quantities of lubricants would be stored and used onsite in accordance with local and federal regulations (Section 3.9).

2.4 MAINTENANCE

The PV panels are rinsed by rainfall but occasionally may require pressurized washing with de-ionized water. CSP collectors will not require washing as rainfall provides sufficient cleansing for collection of solar radiation. Pumps and other moving parts require semi-annual lubrication.

2.5 ALTERNATIVES ELIMINATED FROM CONSIDERATION

2.5.1 CSP Facilities

The proposed site at Kalaeloa was not the only site considered for the proposed action. A key requirement for identifying site alternatives was the project's need for adequate solar energy. This requirement ruled out Oahu's windward shores and inland areas, which tend towards overcast and rainy conditions due to the geology of the island. In addition, for the fastest implementation possible, agriculturally-zoned parcels were ruled out because zoning laws require a special land use permit to develop agriculturally zoned land, which can take one year or more to secure.

The project siting criteria included:

- Average Direct Normal Irradiance or direct solar radiation of at least 5.5 $kWh/m^2/day$;
- Access to water for the condenser cycle;
- Access to existing transmission and distribution infrastructure suitable for project size
- Ability to achieve south or near south-facing exposure
- Flat land with less than one degree slope; and

- Area free of shading from mountains, buildings, or trees.

Based on these criteria, sites were limited to sections of Central, South and West Oahu.

Central Oahu, which includes the Kunia district, is mostly zoned for agricultural use. Renewable energy projects sited on agricultural land with grade A and B soil types (soils with the highest productivity), require special use land permits that need about a year for processing and approval. Most of the Central Oahu area, a former pineapple plantation area, is made up of grade A and B soil types. In addition, Central Oahu has a tendency toward cloud cover in the afternoon, making it less desirable for solar power generation than coastal areas on the South or West coasts of Oahu.

On the west side of Oahu, the only available parcel that met the criteria for establishing a solar thermal project was land owned by the DHHL in Maili (TMK:(1)-8-7-10-007). The land has a relatively flat area with good solar resources and access to power lines and a water source. Though this area was identified as a good site for solar energy collection, community concerns regarding land utilization prevented its selection. With the growing homeless situation on the west side of Oahu, there was a the potential for community concerns that the land be used toward a project that used land that would not directly address the homeless problem. Since the parcel in question already houses a transitional shelter, there are plans to expand the units to alleviate the number of residents living on the beaches. Under these circumstances, gaining community support could pose a significant challenge, extending the approval process, increasing costs and undermining project viability. Furthermore, although the power generation from the facility would reduce the amount of oil the utility burns to generate electricity, it would not directly reduce electricity rates for the residents on the Waianae and Maili coast. The utility infrastructure at the Waianae Parcel is not ideal, because Waianae is located at the end of line of the current power grid. For all of these reasons, the Waianae Parcel was considered as an alternative, but not carried forward.

2.5.2 PV Facilities

PV technology shares similar siting criteria to CSP technology with respect to slope, solar radiation, south-facing exposure, shading, and proximity to existing transmission and distribution infrastructure. Project site evaluations were similar to those listed for CSP facilities.

Several sites within Kalaeloa were considered within the State Department of Transportation (DOT) – Airports and FAA jurisdiction at the Kalaeloa Airport, located south and southeast of the currently proposed site. One of many proposals included the use of a fix tilt PV system, where the PV panels would be elevated 12 to15 ft. on a steel structure, creating shaded parking areas for general aviation aircraft. The power generated from the facility would be sold to HECO via a power purchase agreement with a predetermined contract rate and DOT-Airports would receive rent income from general aviation tenants for the shaded tie down stalls beneath the elevated PV system. However because current lease rate parameters that guide the DOT-Airports/FAA have not been developed for this dual use concept the site was considered infeasible at this time.

2.6 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the PV and CSP solar energy farm would not be constructed. 10 MW of renewable energy would not be provided to HECO from the site. There would be a lost opportunity to assist the State in meeting its HCEI goal of having 70 percent of the State's energy come from renewable

sources by 2030. Consequently, the alternative does not meet the purpose and need and is not a feasible alternative. It represents existing conditions and is useful as a baseline, against which to measure the impacts of the proposed action.

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SECTION 3
AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS

This section describes the existing conditions for each resource that may be impacted by the proposed action or the No-Action Alternative.

Analysis includes potential construction and operations, and direct and indirect impacts. Indirect impacts are defined in HAR 11-200-2 as "effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." Indirect effects could include induced changes in the pattern of land use and related effects on air and water and other natural systems.

3.1 LAND USE

Land use includes existing and planned land uses. Zoning regulations and planning guidance are also described in this section.

3.1.1 Existing Conditions

3.1.1.1 Land Ownership

In 1941, land owner James Campbell leased what became the NASBP to the U.S. Navy (U.S. Navy 1992). NASBP was recommended for closure by the Base Realignment and Closure (BRAC) of 1993, and was officially closed in 1999.

As of 2006, 25 percent (929 acres) of the former NASBP was retained by the Navy, 44 percent (1,621 acres) was conveyed to government or private owners, and 31 percent (1,146 acres) remained pending conveyance (HCDA 2006). The project site is located on a portion of TMK: (1):9-1-13:28, which is currently owned by DHHL. KSP proposes to enter into a 20 year lease for the project site.

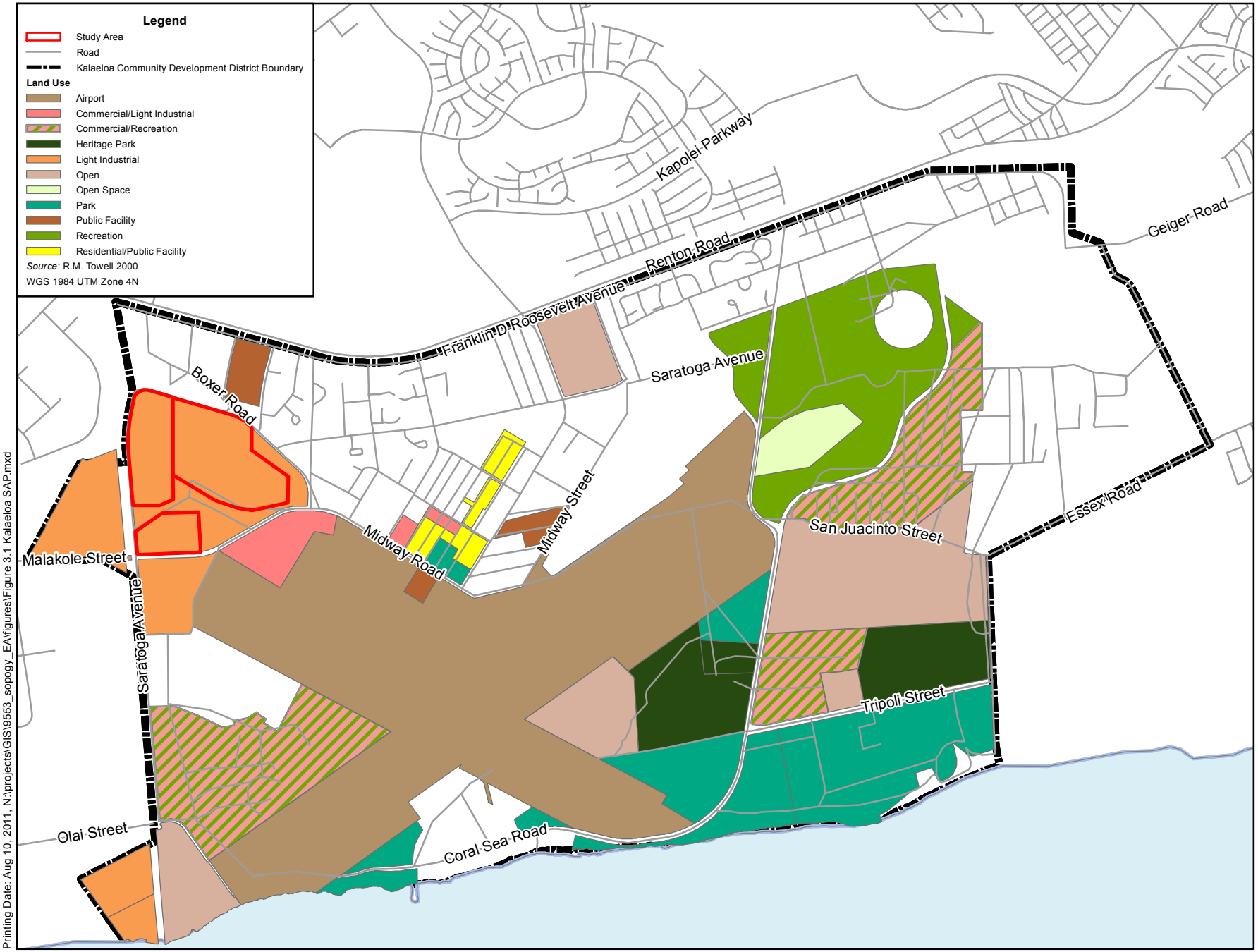
3.1.1.2 Regional Land Use

The Ewa Development Plan was written by the County Planning Department in 1997, and was updated in 2008 to guide land use in the region. The NASBP Redevelopment Commission was formed in 1994 and developed a Community Redevelopment Plan in 1997 that was adopted by the Navy and is in compliance with the County's Ewa Development Plan. The County adopted the Kalaeloa Redevelopment Plan as a Special Area Plan of the Ewa Development Plan dated December 2000. The 2008 DHHL Kapolei Regional Plan does not include goals for the project area.

3.1.1.3 Kalaeloa Land Use and Zoning

Currently, the site is undeveloped and vegetated. Based on a review of historical photographs, the site was vacant throughout the NASBP operations (TEC Inc. 2010a and b).

The Special Area Plan designates the project site (and entire TMK parcel) as Parcel 4 intended for commercial/light industrial land uses (Figure 3.1) and the I-1 zoning classification would apply; however, the proposed zoning was never adopted in official zoning maps.



Feet
0 1,250 2,500
0 325 650
Meters

Figure 3.1
Kalaeloa Special Area Plan Land Use Designations
Kalaeloa Solar One and Two

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The County zoning maps continue to show the project site as F1- Military and Federal Preservation, but the site is no longer federal land and the default zoning is P-2 General Preservation (Appendix A1, County pre-assessment consultation letter).

The proposed action would conform to the County's P-2 General Preservation. The County has determined this project is considered a power generation project, which are considered "Utility Installations, Type B", and subject to a minor conditional use permit (Appendix A1, County pre-assessment consultation letter).

In July 2002, Act 184 of the 2002 Hawaii State Legislature transferred redevelopment responsibility from the NASBP Redevelopment Commission to the HCDA. The Kalaeloa Master Plan was prepared in 2006 (HCDA 2006), and designated land to be used for residential, light industrial, eco-industrial, military, and parks and recreation purposes (Figure 3.2). Neither the Master Plan nor administrative rules for development standards have been officially adopted. Once they are adopted, the County would defer to HCDA for development approvals within the Kalaeloa Development District. In the interim, P-2 General Preservation development standards apply to the project.

Under the proposed Kalaeloa Master Plan, the project site (and entire TMK parcel) is located within parcels 1N and 1Q, designated for eco-industrial land use. These parcels are specifically intended to contribute to reducing the State's dependence on fossil fuels (HCDA 2006). Eco-industrial uses are defined as environmentally compatible industries that benefit the entire population of Oahu. Solar energy is specifically named in the Master Plan (2006) as a permitted use. HCDA has reviewed the EA for consistency with the rules that are being developed and has determined that the project would be an acceptable land use (Appendix A2, HCDA Draft EA comment letter).

The adjacent properties north, east, south, and southwest are within the HCDA Kalaeloa Community Development District boundaries. Residential areas were historically located north of the project site. The housing was demolished and the area is overgrown with vegetation. Barbers Point Elementary School occupies a parcel north of the project site and Boxer Road (Figure 2.2). Outside of the project site but within the same TMK parcel are warehouse-type buildings (Figure 2.2). West of the site and the drainage canal are Kapolei Business Park, including offices, warehouses, a church and a portion of Kalaeloa that is undeveloped (TEC Inc. 2010a and b) (Figure 2.2).

3.1.1.4 Land Use Constraints

The Kalaeloa Airport was transferred to the DOT under a public benefit conveyance. The airport is a reliever airport and would serve 60 percent of the small single-engine and light twin engine propeller aircraft forecasted to be based in Honolulu and about 50 percent of the general aviation aircraft projected to be based at Dillingham Airfield in 2020 (DOT 2010). The airfield is also the U.S. Coast Guard's primary aviation Search and Rescue facility for 12 million square miles of the Central Pacific Region (Appendix A1, U.S. Coast Guard Draft EA comment letter).

There are two parallel runways (4R-22L and 4L-22L approximately aligned northeast-southwest and an intersecting cross wind runway (11-29) approximately aligned northwest-southeast (Figure 3.3). The southernmost project site boundary is near the end of Runway 11. For noise abatement, Runway 11 is used for departures only and Runaway 29 arrivals only. The overflight is to avoid residential areas and schools located north and east of the airport (FAA 2010a).

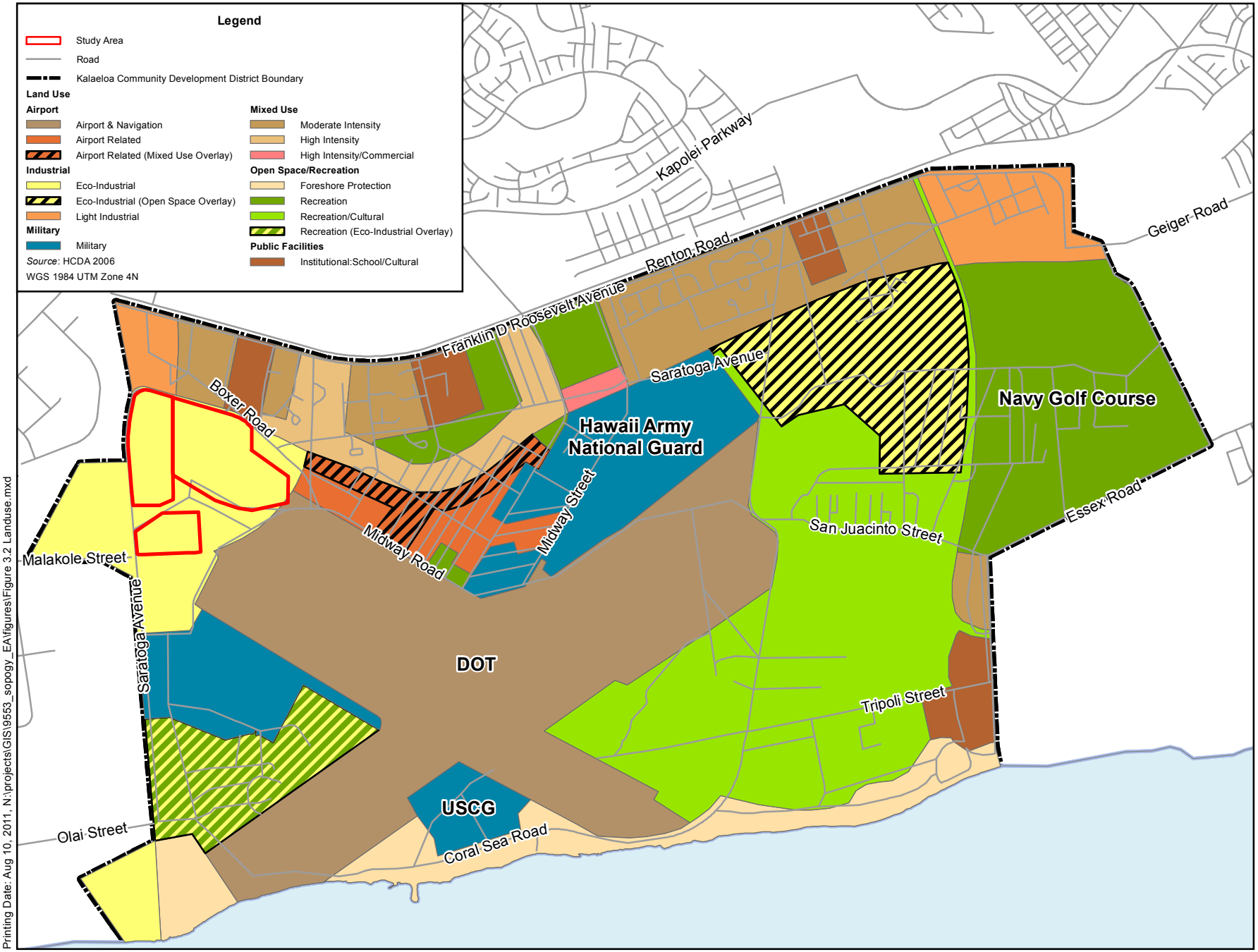

Figure 3.2
Kalaeloa Master Plan Land Use Designations
Kalaeloa Solar One and Two

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There are development restrictions near airports: Horizontal Zones and Approach Zones. The site is within the 180-ft height limit Horizontal Zone generated by Kalaeloa Airport runways (Figure 3.3). The southwest corner of the site is within the Approach Zone of Runway 11, where the height limitation is between 60 and 100 ft. (Figure 3.3).

The site is not within the County's Special Management Area (SMA), as shown on Figure 2.1 and is not subject to SMA development standards. Other constraints associated with flood zones and Tsunami zones are addressed under Water Resources (Section 3.5).

3.1.2 Impacts

For the purposes of this EA, the land use impacts are considered significant if the proposed land use:

- is inconsistent or incompatible with existing land use plans,
- precludes an existing land use activity, or
- is inconsistent or incompatible with planned land uses.

3.1.2.1 Proposed Action

Land Ownership

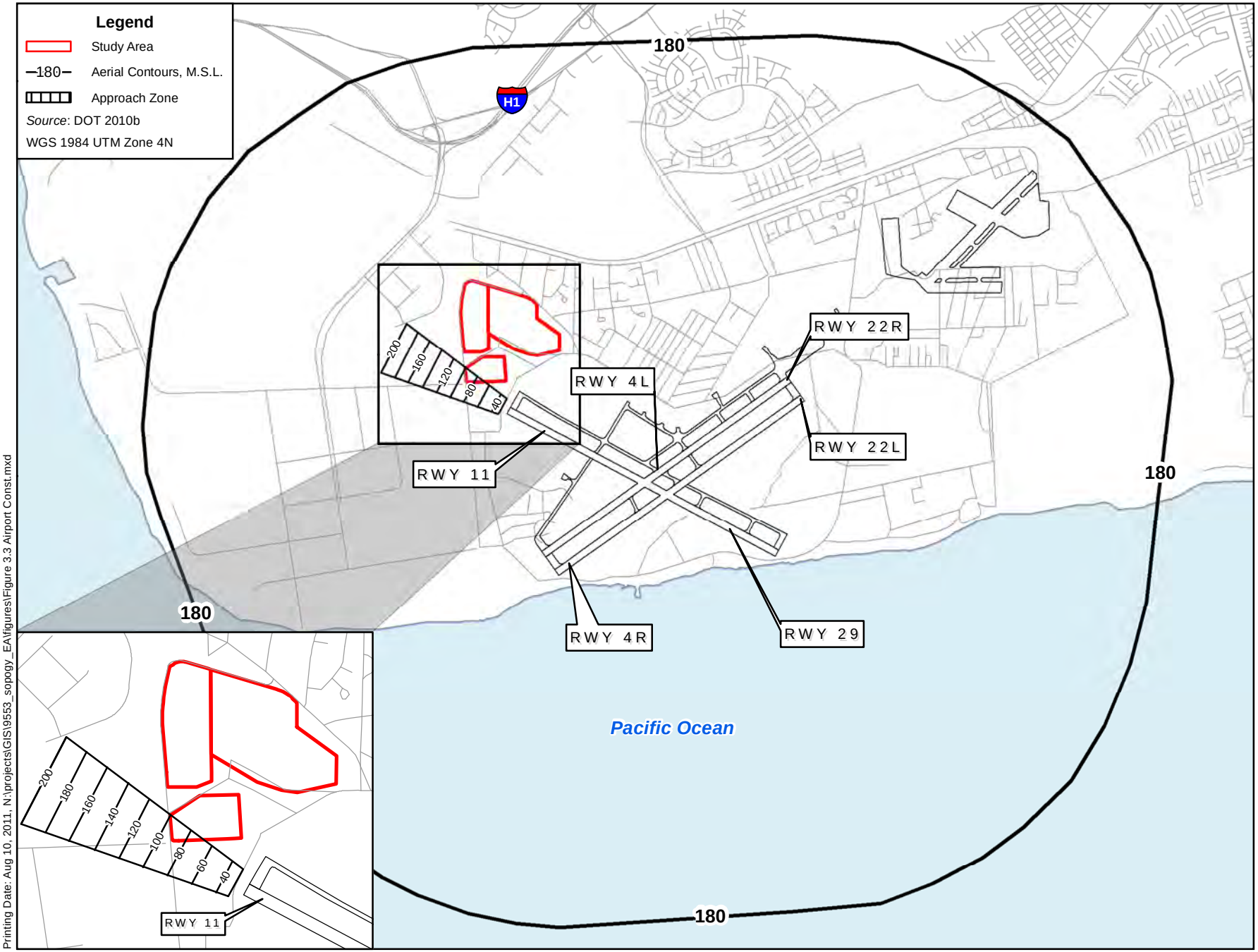
The site is vacant and there would be no pre-existing land use to relocate. The landowner would continue to be DHHL.

Regional and Kalaeloa Land Use and Zoning

Under the existing P-2 General Preservation zoning, this project would be a Utility Installation, Type B and would require a Minor Conditional Use Permit from the County, according to the September 14, 2010 pre-assessment consultation letter from the County DPP (Appendix A1).

The solar farm is an eco-industrial use that is consistent with the Ewa Development Plan Industrial designation, Kalaeloa Community Redevelopment Plan Special Area Plan Light Industrial or Mixed Use Moderate Intensity zoning designations and the HCDA Kalaeloa Master Plan, Eco-industrial land use designation. However these zoning designations have not been adopted and administrative rules for the HCDA Kalaeloa Community Development District are pending. HCDA expects these administrative rules to be adopted before summer 2011 (Appendix A2, HCDA Draft EA comment letter), however, as of the date of this Final EA, they are still pending.

The surrounding land uses are generally vacant, commercial or airfield related. Notable exceptions are Barbers Point Elementary School to the north and a church in Kapolei Business Park to the west (Figure 2.2). Neither of these shares a boundary with the project site. The project is essentially a field of solar collectors and panels and is compatible with surrounding land uses.



Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.3 Airport Const.mxd

Feet
0 2,050 4,100
0 590 1,180
Meters

Figure 3.3
Airport Constraints
Kalaeloa Solar One and Two

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W E
S

Land Use Constraints

The proposed facility heights would not exceed the 180 ft. horizontal zone (Figure 3.3) limit that DOT mentioned in their comment letter (Appendix A1). The substation is notionally sited at the northern boundary of the site and would not be within the runway visual approach zones. Only the southernmost portion of the PV site is within the runway 11-29 visual approach zone (Figure 3.3), but there are no structures proposed that would exceed the 60 to 100 ft. height restriction. The portion of the PV facility that would be within the approach zone would be less than 10 ft. in height.

Consultation letters received during pre-assessment and Draft EA comment periods (Appendix A) expressed concern for potential impacts on air navigation including: 1) thermal currents near the site could create hazardous turbulence, and 2) reflected light from the solar panels could impact visibility. In addition, a review of FAA's Technical Guidance for Evaluating Selected Solar Technologies on Airports (FAA 2010b) indicated such concerns existed in relation to CSP projects.

The shape of the CSP collector would not produce significant glare or reflection that would pose a distraction to aviation. The focal point created by the parabolic mirror would not allow concentrated rays to escape. The reflected incident rays of the sun would be generally directed to the lower portion of the CSP collector and aircraft flying above would not be exposed to reflected incident rays. The thermal current issue was addressed at larger installations of the CSP technology in California. In those particular examples, at approach altitude (200-300 ft.) the four observers in two aircraft experienced no unusual turbulence or thermal plume rising from the solar array. The turbulence above and downwind was similar to overflight of smooth water (State of California 2007).

The flat PV panels are designed to capture and retain as much of the solar spectrum as possible. PV solar panels are less reflective than a host of other materials, including water, wood shingle, bare soil, vegetation, galvanized steel (used in industrial roofs) or window glass. In general, the FAA considers solar PV compatible with airport land use (FAA 2010b).

In compliance with FAA regulations, KSP met with FAA and DOT-Airports, and filed Form 7460-1: Notice of Proposed Construction or Alteration with the FAA. KSP provided information on the notional siting of all facilities and buildings associated with the proposed action to the FAA.

In response to the information submitted, FAA conducted a series of twenty-three aeronautical studies (study numbers 2010-AWP-6926-OE, 2010-AWP-6927-OE, 2010-AWP-6928-OE, 2010-AWP-6929-OE, 2010-AWP-6930-OE, 2011-AWP-694-OE, 2011-AWP-695-OE, 2011-AWP-696-OE, 2011-AWP-697-OE, 2011-AWP-698-OE, 2011-AWP-699-OE, 2011-AWP-700-OE, 2011-AWP-701-OE, 2011-AWP-1093-OE, 2011-AWP-1088-OE, 2011-AWP-1091-OE, 2011-AWP-1089-OE, 2011-AWP-1087-OE, 2011-AWP-1090-0E, 2011-AWP-1092-OE, 2011-AWP-702-OE, 2011-AWP-703-OE, 2011-AWP-704-OE). Each study resulted in a Determination of No Hazard to Air Navigation. The FAA determinations are provided in Appendix D of this report. As requested by the FAA, the project will file FAA Form 7460-2, Notice of Actual Construction or Alteration within the recommended number of days after construction of various facilities reaches their greatest height.

In the event that a situation occurred that caused a reflection or generated thermal currents with impacts on air navigation, both the CSP and PV collectors' glass surfaces could be redirected to the ground within a minute of activation.

No other potential land use constraints were identified at the site. No indirect impacts to land use in the area surrounding the project site would occur. The project is consistent and compatible with existing and planned surrounding land uses. No significant impacts to land ownership or use would occur as a result of the proposed action. No cumulative land use impacts were identified.

3.1.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the proposed site would occur. DHHL would continue to own the land. Therefore, there would be no significant impact to land ownership or use under the No-Action Alternative.

3.2 AIR QUALITY

Air quality is defined as the ambient air concentrations of pollutants determined by the U.S. Environmental Protection Agency (USEPA) to be of concern to the health and welfare of the general public. The designated criteria pollutants include:

- ozone (O_3),
- carbon monoxide (CO),
- nitrogen dioxide (NO_2),
- sulfur dioxide (SO_2),
- particulate matter less than 2.5 microns in diameter ($PM_{2.5}$),
- particulate matter less than 10 microns in diameter (PM_{10}), and
- lead (Pb).

The Clean Air Act (CAA) of 1970 established air quality regulations and National Ambient Air Quality Standards (NAAQS). The DOH enforces air pollution regulations and sets guidelines to maintain the NAAQS and Hawaii Ambient Air Quality Standards (HAAQS) within the State of Hawaii.

Table 3.1 lists NAAQS and HAAQS in parts per million (ppm) and micrograms per cubic meter ($\mu g/m^3$). These are the maximum allowable concentrations of criteria pollutants considered allowable to protect human health and welfare. NAAQS have both primary and secondary standards. Primary standards are aimed at protecting human health in areas that are considered sensitive such as residential neighborhoods, churches, libraries, schools and parks. Secondary NAAQS are aimed at protection of plants and animals.

Table 3.1 National and Hawaii State Ambient Air Quality Standards

Criteria Pollutant	*Averaging Time*	*HAAQS*	*NAAQS*	
			Primary	*Secondary*
Hydrogen Sulfide	1-Hour Maximum	0.025 ppm ($35\ \mu g/m^3$)	--	--
Ozone	8-Hour Maximum	0.08 ppm ($157\ \mu g/m^3$)	0.075 ppm ($147\ \mu g/m^3$)	0.075 ppm ($147\ \mu g/m^3$)
Carbon Monoxide	1-Hour Maximum	9 ppm ($10\ mg/m^3$)	35 ppm ($40\ mg/m^3$)	--
	8-Hour Maximum	4.4 ppm ($5\ mg/m^3$)	9 ppm ($10\ mg/m^3$)	--

Criteria Pollutant	*Averaging Time*	*HAAQS*	*NAAQS*	
			Primary	*Secondary*
Lead	Average Over 3 Months	--	0.15 µg/m^3	0.15 µg/m^3
	Quarterly Average	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3
Nitrogen Dioxide	Annual Mean	0.04 ppm (75 µg/m^3)	0.053 ppm (100 µg/m^3)	0.053 ppm (100 µg/m^3)
Particulate Matter (PM_{10})	Annual Mean	50 µg/m^3	--	--
	24-Hour Average	150 µg/m^3	150 µg/m^3	150 µg/m^3
Particulate Matter ($PM_{2.5}$)	Annual Mean	--	15.0 µg/m^3	--
	24-hour Average	--	35 µg/m^3	--
Sulfur Dioxide	Annual Mean	0.03 ppm (80 µg/m^3)	0.03 ppm (80 µg/m^3)	--
	24-Hour Maximum	0.14 ppm (365 µg/m^3)	0.14 ppm (365 µg/m^3)	--
	3-Hour Maximum	0.5 ppm (3,000 µg/m^3)	--	0.5 ppm (3,000 µg/m^3)
Note: HAAQS = Hawaii Ambient Air Quality Standards; NAAQS = National Ambient Air Quality Standards				

Air quality can be affected by both stationary and mobile sources. Examples of stationary sources include combustion and industrial stacks. Mobile sources include vehicular traffic and aircraft. Areas that exceed ambient air quality standards are designated as nonattainment areas and areas that comply with ambient air quality standards are designated as attainment areas. Areas without data to determine whether they are in attainment or nonattainment status are considered unclassified and are assumed to be in attainment.

The DOH Clean Air Branch regulates stationary sources of air pollutants and issues permits. Permits limit emissions of pollutants and require monitoring. The State does not regulate mobile sources; however, these sources must meet NAAQS.

3.2.1 Existing Conditions

Winds at the project site are generally northeasterly trade winds. The nearest air quality monitoring station run by the DOH Clean Air Branch is located in Kapolei, and measures CO, NO_2, PM_{10}, $PM_{2.5}$, and SO_2. The Kapolei area is in attainment with both the HAAQS and NAAQS for all criteria pollutants and is not subject to the CAA General Conformity Rule.

Campbell Industrial Park is likely the largest source of stationary air emissions on the island of Oahu, yet is within an attainment area. There are no significant stationary air emission sources at Kalaeloa. Furthermore mobile sources such as motor vehicles are not likely to significantly degrade air quality.

3.2.2 Impacts

CAA requirements (Table 3.1) are used to determine if impacts of the proposed action are significant. Since the area is currently in attainment, any emissions causing any criteria pollutant to rise above attainment levels would be significant. Additionally, air emissions that would expose sensitive receptors (e.g., schools, housing, childcare centers, etc.) to substantial pollutants or create odors are also considered significant.

3.2.2.1 Proposed Action

During the construction phase, emissions would be generated by heavy machinery powered by fossil-fuels and dust emissions as a result of grading and operation of equipment on cleared soil. Construction emissions would be temporary (less than two months for grading).

Best management practices (BMPs) to control dust during construction would be required by County grading and grubbing permit conditions. BMPs include dust fences to keep the dust on-site, and watering to minimize the amount of dust produced. All construction activities would comply with regulations for fugitive dust control under HAR Section 11-60.1-33 that require reasonable precautions to prohibit visible fugitive dust beyond the property line. If generators are used, a stationary source permit would be obtained from the DOH Clean Air Branch.

Emissions are not expected to exceed the CAA major source threshold of 250 tons per year for construction. Construction emissions would be less than significant with implementation of the proposed action.

Operational emissions associated with the proposed action would be limited to employee vehicular traffic at the CSP project area. No other operational emissions are anticipated. Operations would result in an indirect beneficial impact due to a reduced dependence on fossil fuel to generate electricity, and a resulting reduction in the generation of criteria pollutants.

The proposed action's operation and construction impacts on air quality would be less than significant. Construction BMPs would minimize direct and indirect impacts to ambient air quality. There would be no additive adverse cumulative impact on air quality during operations.

3.2.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the proposed site would occur. Therefore, there would be no significant impact to air quality under the No-Action Alternative.

3.3 NOISE

Noise is defined as an unwanted or annoying sound. Sound is made up of sound waves that travel to the auditory organs. Sound, often described by the relative term "loudness," is measured in decibels (dB). A decibel is a logarithmic ratio, thus an increase of 10 dB is perceived as a 100 percent increase in sound. Noise can be generated by both natural and human-created sources. Noise can have negative effects on physical and psychological health, affect workplace productivity, and degrade quality of life.

Human perception of sound is accounted for by factors other than the actual sound level, including the duration of the sound, the frequency of the sound, and fluctuations in sound level. The human ear can recognize frequencies between 20 and 20,000 hertz, but is most sensitive to frequencies of 1,000 to 8,000 hertz. Because there are multiple factors contributing to perception of sound, sound levels are weighted. A-weighted sound levels (dBA) place emphasis on frequencies between 1,000 and 8,000 hertz (Newman 1984). Table 3.2 shows sound levels and their associated noise impacts.

Table 3.2. Sound Levels

Sound Level (dBA)	*Noise Impact Level*
60	Average Urban Noise
70	Noise level of minor concern
75	Noise level of moderate concern
80	Intrusive noise level
85	Problematic noise level
90	Noise level to be avoided
Source: Newman et al. 1984	

Sound exposure level (SEL) is another weighted measure of sound that incorporates the duration of a sound event with the sound level. The day-night average sound level (DNL) is the average sound level of all SEL values within a 24-hour period. Because humans are more sensitive to noise annoyance at night, a 10-dBA penalty is assigned to noise occurring between 10:00 pm and 7:00 am. The FAA uses the DNL to measure impacts associated with air traffic, and the DNL is used in environmental analysis because it has proved to be a consistent measure of noise annoyance.

Construction noise, often created by heavy machinery, is generally limited to day-time hours. Construction requires a permit from the DOH. The maximum acceptable sound level for construction is 78 dB. Construction noise may be generated Monday through Friday between 7:00 am and 6:00 pm and Saturday between 9:00 am and 5:00 pm. Construction generating more than 78 dB during these hours requires a noise permit from the DOH. Construction occurring outside the designated hours requires a community noise variance from the DOH.

3.3.1 Existing Conditions

Existing noise in the Kalaeloa area is predominantly created by roadway and air traffic. Roadway traffic in the vicinity of the proposed action site is relatively light and does not create a noise disturbance. The Kalaeloa Airport is southeast of the proposed site and is used daily by the U.S. Coast Guard, Honolulu Community College, and University of North Dakota flight school. The proposed site is outside the projected 60 dB contour for the airports (DOT 2010) and is located under the final approach path for Honolulu International Airport. The Kalaeloa Airport annual aircraft operations for 2020 are projected to be 203,600 (DOT 2010).

3.3.2 Impacts

The primary factors considered in determining the significance of potential noise impacts is the extent or degree to which implementation of the proposed action would alter the current noise environment and affect sensitive receptors in the area. Potential changes in the noise environment can be beneficial (i.e., if the number of sensitive noise receptors exposed to unacceptable noise levels is reduced), negligible (i.e., if the total area exposed to unacceptable noise levels is essentially unchanged), or adverse, (i.e., if they result in increased exposure to unacceptable noise levels).

3.3.2.1 Proposed Action

Project activities would comply with the Administrative Rules of the DOH, Chapter 11-46, Community Noise Control. Construction of the proposed action would require a noise permit from the DOH if it exceeds 78 dB Monday through Friday between 7:00 am and 6:00 pm and Saturday between 9:00 am and

5:00 pm. Construction occurring outside the designated hours is not anticipated, therefore a community noise variance from the DOH would not be required. Noise levels would be typical of standard construction activities, would cease with the completion of proposed construction activities, and would only occur during normal working hours. Construction workers would be subject to federal and local safety regulations requiring hearing protection. There would be no significant impacts from noise on the nearest sensitive receptors, namely the Barbers Point Elementary School to the north or the church to the west of the project site in the Kapolei Business Park area.

Operations at the site would not generate noise that exceeds the acceptable noise levels beyond the site boundaries. The CSP engine would generate noise but would be housed in a building. There would be no significant short-term or long-term impacts on ambient noise associated with the proposed action.

3.3.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the proposed site would occur. Therefore, there would be no significant impact to ambient noise under the No-Action Alternative.

3.4 GEOLOGY AND SOILS

Geology describes the characteristics of surface and subsurface materials that make up land. These characteristics include stability, slope, compatibility, shear strength, and productivity. Soil characteristics determine the ability for the ground to support structures and facilities and determine likelihood of erosion and run-off. Topography describes surface features of an area and is usually described with respect to elevation, slope, aspect, and landforms.

3.4.1 Existing Conditions

3.4.1.1 Geology

The underlying geology of the Ewa Plain is composed of basalt from the lava flows of the Waianae Volcanic Series that originally created the west side of the island some three million years ago (Macdonald et al. 1970:423). The coral reef limestone overlies the basalt, and is found in a layer lying 50 to 1,000 feet below the surface of the land. Fluctuations in sea level produced alternating layers of terrestrial sedimentary rock types in the coastal plain areas (Naval Facilities Engineering Command, Pacific Division [NAVFAC Pacific] 1994).

Sinkholes, depressions in the surface of the earth where there is little fill over the coral reef limestone, are found across the Ewa Plain. Unique anchialine pools, which are sinkholes that connect to the ocean through cracks in the substrate, are preserved at the Kalaeloa Unit of the Pearl Harbor National Wildlife Refuge, approximately 8 miles east of the proposed action site.

3.4.1.2 Soil

Soil in the Kalaeloa area is limited to a thin layer of topsoil and is reddish in color (U.S. Department of Agriculture [USDA] 1972). The site is covered predominantly by soil categorized as Coral Outcrop (CR) and Mamala Stony Silty Clay Loam (MnC) (USDA 2010) (Figure 3.4). CR consists of calcareous coral sand. MnC consists of coral stones in the reddish-brown loam surface, underlain by coral limestone. Run-off is slow, and the erosion rate of Mamala stony silty clay loam is low.

In 1975, the U.S. Department of Agricultural Soil Conservation Service (now Natural Resources Conservation Service) initiated a nationwide inventory of soils to identify soils that were considered prime, unique or other farmlands of state-wide and local importance. The State of Hawaii developed a similar classification adopted by the State Department of Agriculture under the title "Agricultural Lands of Importance to the State of Hawaii" (ALISH). Prime agricultural lands are best suited for food, forage and timber crops. Unique agricultural land is defined as land other than prime, used for production of food, feed, fiber, and forage crops. Other agricultural land is for the production of food, feed, fiber and forage crops, but not classified as prime or unique.

According to the 1977 ALISH Ewa area map, the project site is not classified as prime, unique or agricultural land. The site is not currently used for agriculture. Neither of the types of soil found on the proposed site qualifies as Prime Farmland (USDA 2010). Both soils are well drained; meaning standing water is unlikely to be found after rainfall.

3.4.1.3 Topography

The Kalaeloa area has a maximum elevation of 65 ft. along its northern border to sea level at its southern coast, with a general surface gradient to the south. The proposed site location has elevations ranging from 36 to 50 ft. above mean sea level (Figure 3.4). Three sumps or depressions are located on the project site, and all three are typically dry (Figure 3.4). The area slopes very lightly with grades averaging one to two percent.

3.4.2 Impacts

Potential impacts to geology and soils include soil erosion, degradation of unique geological features, significant change in topography, or use of prime farmlands. Measures taken during the construction process can prevent significant impacts to soil.

3.4.2.1 Proposed Action

Soil at the proposed site is not considered Prime or Important for agriculture by the USDA. Both CR and MnC are well drained and sufficient to support the structures as described in the proposed action.

Because of the relatively flat topography of the proposed site, grading would be minimal. Solar panels would be mounted to concrete anchors or other stabilizing structure on grade. Building foundations would total approximately 48,000 ft^2, including equipment pads, the substation and a support/generator building. Minimal grading and subsurface excavation would be required for the installation of the panels or to set the footings and slab foundations for the buildings. A small amount of soil would be displaced, relative to the 80-acre site, and a minor amount of new impervious surfaces would be created. Stormwater would be managed onsite and is discussed in Sections 3.5 and 3.11.

An Erosion Control Report was prepared assessing the grading of the site (Austin, Tsutsumi & Associates, Inc., 2011a). The report found that the rate of soil loss during and after project construction would fall below the allowable limit of 1 ton per acre per year. The report concluded no adverse impact to soils was expected.

A topographic survey of the site is in progress and grading and grubbing permits would be required from the County DPP prior to construction. Finally, BMPs to prevent erosion would be implemented during the

construction process. These could include temporary silt fences and dust screens around the construction site, a temporary sediment basin, and adequate water spraying with a water wagon or sprinkler system during construction.

There would be no anticipated significant direct or indirect impacts to geology and soil resources during operation of the proposed action. There would be no additive cumulative impact on geology or soils.

3.4.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the proposed site would occur. Therefore, there would be no significant impact to geology or soil under the No-Action Alternative.

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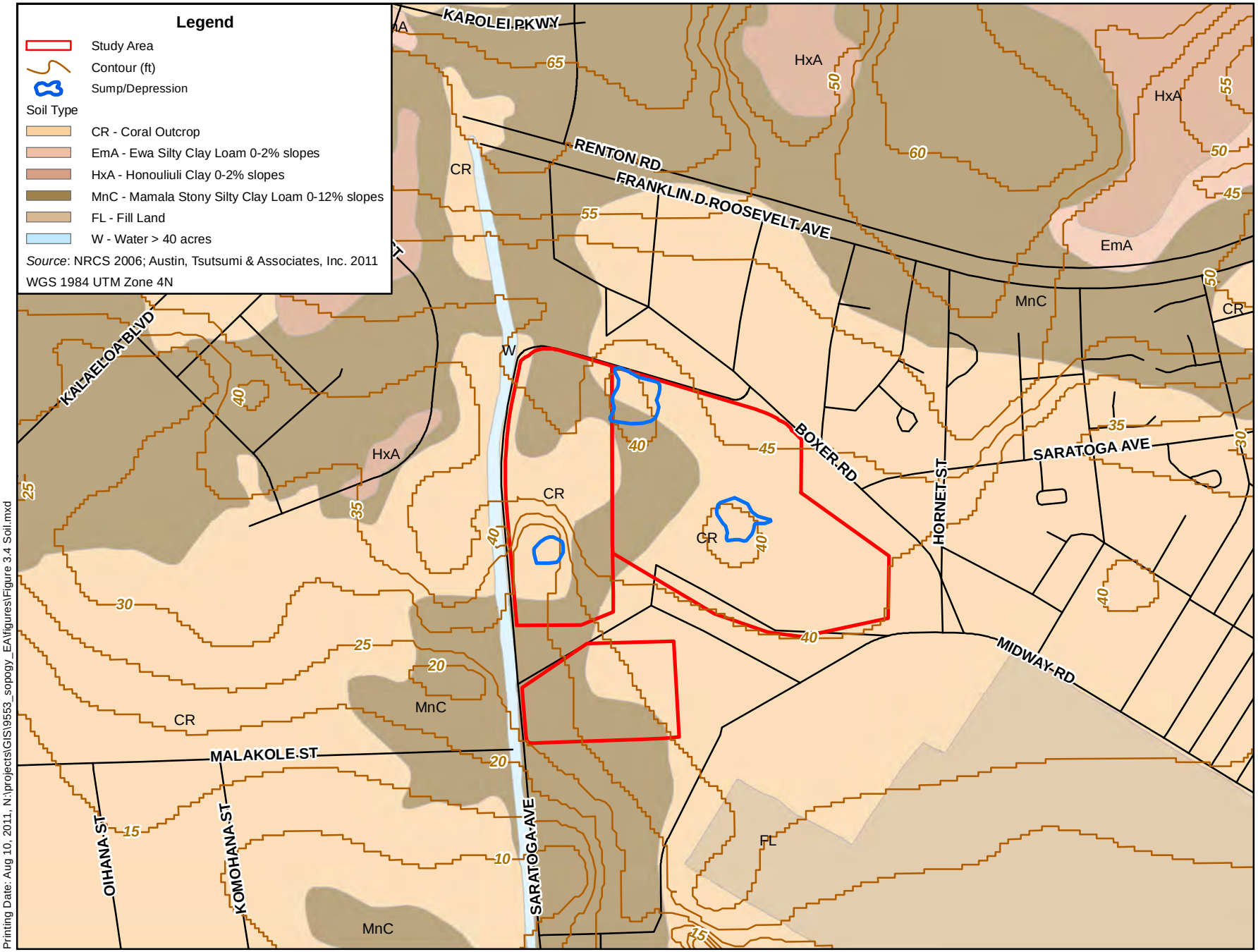

Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.4 Soil.mxd

Feet
0 485 970
0 130 260
Meters

Figure 3.4
Topography and Soils
Kalaeloa Solar One and Two

N
W E
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3.5 WATER RESOURCES

Water resources include surface water, groundwater, nearshore water and wetlands. Surface water includes all water found on land, such as stormwater, lakes, canals, streams and rivers. Groundwater is found in aquifers beneath the surface of the earth, and its quality is of great importance because it is often used for potable water. For the purposes of this document, nearshore waters are defined as coastal waters extending from the shore to a depth of 60 ft.

In 1972, the Clean Water Act (CWA) was enacted to protect water resources. The U.S. Army Corps of Engineers (ACOE) is the enforcing agency of the CWA. The purpose of the CWA is to restore and maintain the health of water resources in the U.S. by preventing pollution and assisting in proper wastewater management (USEPA 2010). Wetlands are addressed in Section 3.6.

3.5.1 Existing Conditions

3.5.1.1 Surface and Nearshore Water

Kalaeloa is relatively dry, with an annual precipitation average of 20.3 inches (HCDA 2006). Because there is little precipitation and the soils in the area are well-drained, there are no streams or rivers in the Kalaeloa area.

The proposed site is located approximately 2 miles northwest of Ordy Pond and more than one mile north of the coastline. There is an unnamed drainage canal that is aligned parallel to and approximately 33 ft. west of the western boundary of the site. The drainage canal terminates at the Pacific Ocean, considered a traditionally navigable water, and as such, a water of the U.S. subject to ACOE jurisdiction and permitting requirements (Appendix A1, ACOE Draft EA response letter).

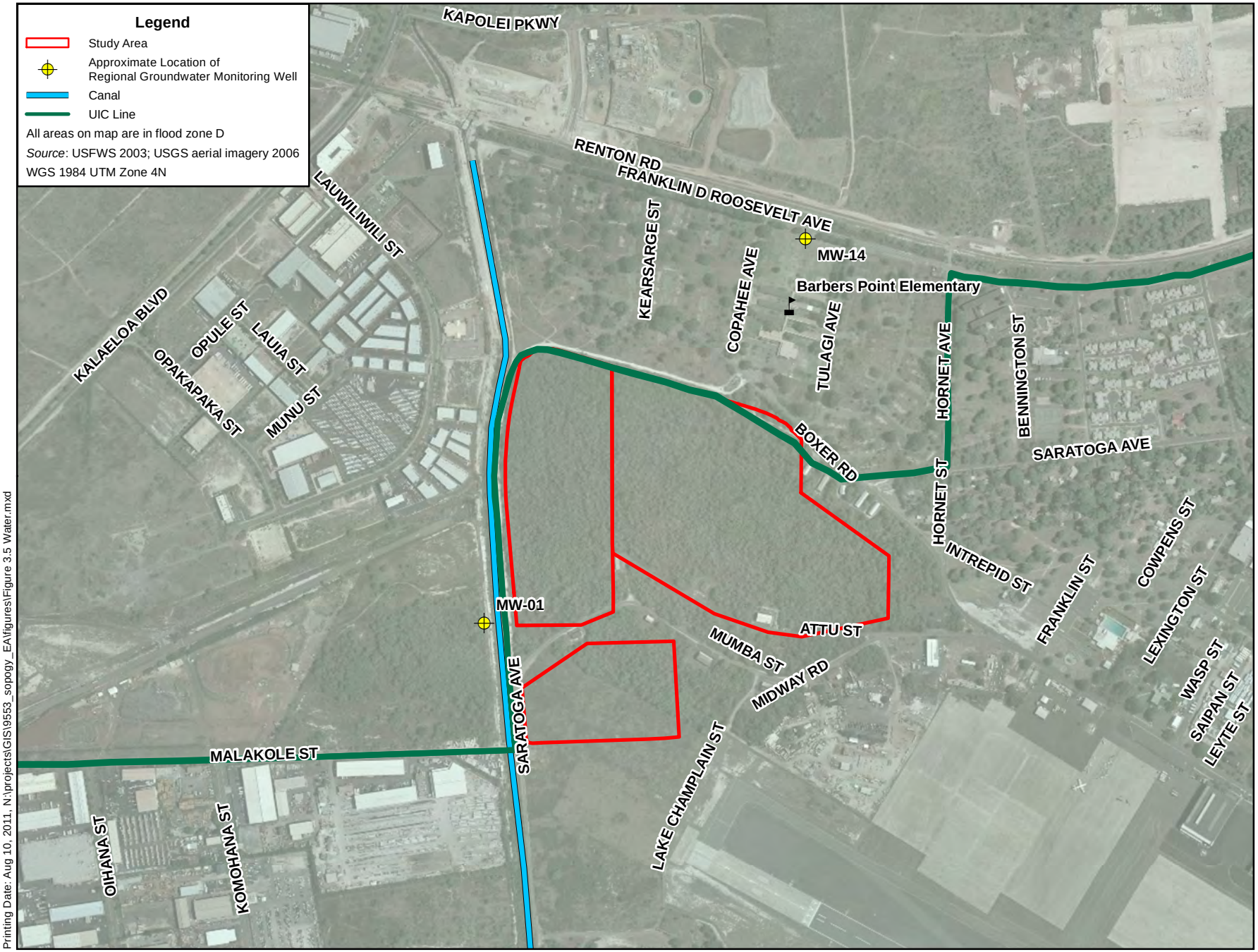
There are no surface waters at the project site. Stormwater ponding is rare at the proposed site because rainfall readily permeates into the sub-surface aquifer. Three sumps or depressions are located on the project site, and all three are typically dry (Figure 3.4).

3.5.1.2 Flood and Tsunami Zones

Flood plains are low-lying areas that may be subject to flooding. Regional stormwater management has historically resulted in flooding at the northern boundary of Kalaeloa. In the past, the Navy installed drywells north of the project site to address stormwater in the family housing area.

There is no record of flooding at the project site. The proposed site lies outside of the 100-year floodplain and it is located in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Flood Zone D, where flood hazards are undetermined but possible. There are no Flood Insurance Program regulations for developments within Zone D (Appendix A2, DLNR Engineering Division Draft EA response letter). Stormwater would be managed onsite and is discussed in Sections 3.5 and 3.11.

The site is located approximately one mile from the ocean, and is not located within the Tsunami Inundation Zone (Figure 2.1).



Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.5 Water.mxd

Feet
0 485 970
0 140 280
Meters

Figure 3.5
Water Resources
Kalaeloa Solar One and Two

N
W E
S

3.5.1.3 Ground and Potable Water

Groundwater in Hawaii is stored in a caprock-confined aquifer. The groundwater at the site is within the Ewa aquifer system of the Pearl Harbor Aquifer sector. There is a deeper confined aquifer in a deep layer of basalt and a shallow unconfined aquifer in the overlying caprock. The groundwater in the confined aquifer is brackish with a chloride content ranging from 250 to 1,000 milligrams per liter. In the Kalaeloa area, the underlying aquifer meets federal but not State drinking water standards, thus it is not used for potable water (TEC Inc. 2010a and b). The shallow aquifer in the Kalaeloa area is also brackish with chloride content ranging from 1,000 to 5,000 milligrams per liter. The water is not suitable for consumption or irrigation without desalination (TEC Inc. 2010a and b).

The Navy Public Works provides potable water to the areas surrounding the proposed site from a well located three miles north of Kalaeloa. The potable water system is private, and the water meets state and federal drinking water standards. The well has the ability to pump 6,000 gallons per minute and two reservoirs provide a total storage capacity of two million gallons (Earth Tech 1998). The Navy is in the process of divesting of the water system, as described in Section 3.11. There are two regional groundwater monitoring wells (Figure 3.5).

The underground injection control (UIC) line, established by the State as the boundary between potable and non-potable groundwater sources, runs along the northern border of the study area and extends down the western border parallel to the canal (Figure 3.5). Since the study area is directly adjacent to the ocean side (makai) of the UIC line, groundwater beneath the study area is not considered a potential drinking water source. Borings at least 20 ft. deep taken at the proposed CSP site by Geolabs, Inc. found no groundwater (Austin, Tsutsumi & Associates, Inc., 2011a). Although groundwater flow under the study area has not been studied directly, groundwater tends to flow from higher elevations to lower elevations; therefore, potential groundwater flow under the study area is anticipated to travel north to south toward the ocean (TEC Inc. 2010a and b).

3.5.1.4 Stormwater

During Navy operations, approximately 216 dry wells were installed at NASBP, primarily for regional stormwater drainage. No wells were identified at the project site (NAVFAC Pacific 1994). Approximately ten wells were identified topographically upgradient of the project site (NAVFAC Pacific 1994).

A Drainage Report assessing the drainage at the proposed CSP site found that currently, runoff at the project site drains to the three sumps or depressions located on the project site (Figure 3.4) (Austin, Tsutsumi & Associates, Inc., 2011b). The runoff flows overland to the sumps, which are able to efficiently absorb all stormwater flowing into them. There are no drainage ways to convey runoff. All runoff at the project site is absorbed by the existing sumps, resulting in zero discharge of surface water to any drainage way or open water (Austin, Tsutsumi & Associates, Inc., 2011b).

3.5.2 Impacts

Potential impacts to water resources analyzed in this section include impacts to surface, nearshore, and ground water. Impacts to water would be significant if contamination of the groundwater, high levels of runoff into nearshore waters, or discharge affecting surface water in the vicinity were to occur as a result

of an action. Impacts would also be deemed significant if changes to flood hazards occurred as a result of the proposed action.

3.5.2.1 Proposed Action

Surface and Nearshore Water

Temporary BMPs would be implemented during construction to contain surface flows within the project site. HAR Chapter 11-55 requires a National Pollution Discharge Elimination System (NPDES) Permit for construction activities disturbing an acre or more of land. An NPDES Notice of General Permit Coverage permit dated March 17, 2011 addressing discharge of stormwater associated with construction activities has been obtained for the CSP site (Austin, Tsutsumi & Associates, Inc. 2011b). The NPDES Permit process requires submittal of a stormwater management plan prior to commencement of construction, including a list of BMPs to be implemented and any additional plans to prevent increase in runoff. Requirements of the permit and of the project erosion control plan will be adhered to for project construction and operations.

Operations at the site would increase impervious surfaces at the site by approximately 48,000 ft^2. This is a minor amount of new impervious surface relative to the acreage at the site (approximately 80 acres). As discussed in Section 3.5.1.4, all runoff at the project site is currently absorbed by the three existing sumps within the study area (Figure 3.4). A new six-foot retention basin would be constructed near the sump nearest to the southern portion of the CSP site (Figure 2.3). The basin would lie mostly along the southern boundary of the CSP site and is designed to expand into a depressed area to the north and east if required during large storm events. The project drainage design allows stormwater runoff to run overland towards the south, into the retention basin, enabling the full retention and infiltration of stormwater runoff during operations, including any additional runoff that would result from an increase in impervious surfaces (Austin, Tsutsumi & Associates, Inc. 2011b). Additional runoff would continue to be absorbed by the existing sumps.

Specific storm management controls have not been developed for the PV site, but they may include berms along the southern edge of the site. Project stormwater management plans, combined with low rainfall levels of the area, indicates stormwater within the project site would not have significant impact to surrounding surface water resources.

There are no activities proposed at the site that would result in the discharge of dredged or fill material into the drainage canal located west of the site. No tributaries were identified that might feed into the canal from the site. There would be no anticipated impact to the waters of the drainage canal located west of the project site. No U.S. ACOE permits would be acquired.

Flood and Tsunami Zones

The proposed site is not within the 100-year floodplain, nor is it in the Tsunami Inundation Zone (Figures 3.5 and 2.1). There would be no increase in flood or tsunami hazards as a result of the proposed action. Any potential impacts of regional stormwater flow onto the site, are addressed by the site drainage plan, as discussed above.

Groundwater

No hazardous material use or disposal is anticipated at the site. Regulated materials such as diesel fuel would be stored in compliance with current regulations.

Groundwater resources would not be adversely impacted by construction or operation under the proposed action.

3.5.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the proposed site would occur. Therefore, there would be no significant impact to water resources under the No-Action Alternative.

3.6 BIOLOGICAL RESOURCES

Biological resources are defined as plant and animal species and their habitat. For the purposes of this EA, special consideration is given to plants and animals that are crucial to the ecosystem or protected by federal or state law. The Endangered Species Act (ESA) was established in 1973 to protect threatened and endangered plants and animals. The ESA is enforced by the USFWS and National Oceanic and Atmospheric Association. Biological resources are split into vegetation, wildlife, special-status species, and unique habitat and areas of special concern in this EA. Special-status species include those listed as threatened or endangered under the ESA or state law. The unique habitat and areas of special concern include wetlands and other especially important habitat types that have been identified. Marine biological resources were not included as they would not be impacted by the proposed action that is located inland.

Biological resources are discussed for the entire former NASBP but the focus for the description in this EA is the area within one-half mile of the project site.

3.6.1 Existing Conditions

3.6.1.1 Vegetation

Vegetation for the former NASBP was described in a 1984 botanical survey conducted for the entire base (Botanical Consultants 1984). Flora at NASBP included approximately 170 plant species. The dominant vegetation types were kiawe-koa haole scrub with an understory of various introduced grasses and forbs and strand vegetation along the beach area. Koa haole is *Leucaena leucocephala* and kiawe is *Prosopis pallida*. Within these general habitat types on NASBP are several sites that support endangered plant species as described in the Special-Status Species Section 3.6.1.3.

The vegetation within the proposed project site was mapped in the 1984 survey as kiawe-koa haole scrub. This was confirmed in a botanical survey conducted for the proposed project area in October 2010 (Appendix C). Either one or a mix of the two dominant tree species, kiawe and koa haole, was observed throughout the entire parcel. A small grove of approximately ten living (and a few dead) endemic wiliwili (*Erythrina sandwicensis*) trees were present in the eastern portion of the study area and outside of the conceptual layout for the solar array (Figure 3.6). Other non-native trees were scattered throughout, with the most common being Chinese banyan (*Ficus microcarpa*). The understory was dominated by the non-native Buffelgrass (*Cenchrus ciliaris*). The primary native understory species present were the shrub ilima (*Sida fallax*) and the vine *Cassytha filiformis*. A few individuals of the endemic shrub maiapilo (*Capparis*

sandwichiana) were observed in the southern portion of the eastern side of the study area and outside of the conceptual layout for the solar farm (Figure 3.6). This endemic shrub, while not a listed species, is noted as vulnerable to extinction (Wagner et al. 1999).

3.6.1.2 Wildlife

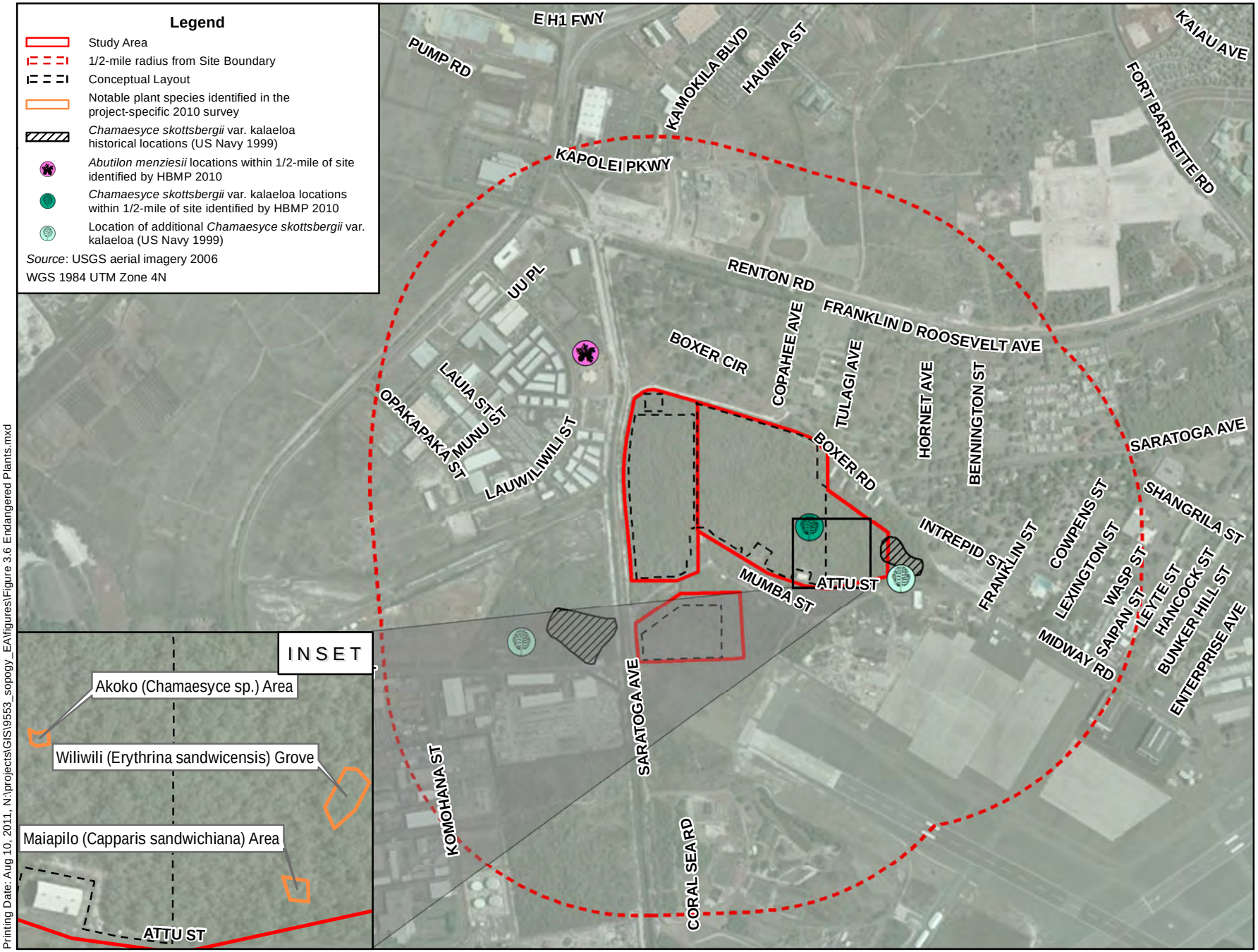
Birds were the dominant wildlife identified on the former NASBP (Botanical Consultants 1984). Twenty-three (23) species were identified during the 1984 survey, of which 17 were ubiquitous, introduced species; five were indigenous; and one, the Oahu elepaio (*Chasiempis sandwichensis ibidis*), was endemic. The survey reported that the elepaio was found in an area of mangrove forest. The species is no longer present in the area (USFWS 2006). Within the proposed project site only a few birds were observed during the October 2010 botanical survey and during another reconnaissance visit to the site in July 2010. Species that were observed included a single barn owl (*Tito alba*), northern cardinal (*Cardinalis cardinalis*), spotted dove (*Streptopelia chinensis*), red-vented bulbul (*Pycnonotus cafer*), and gray francolin (*Francolinus pondicerianus*).

Given the current highly disturbed condition of the site and lack of native vegetation, any other birds that might be using the area would most likely be non-native species or indigenous species common throughout Oahu such as the kolea (Pacific golden plover; *Pluvialis fulva*).

The Migratory Bird Treaty Act (MBTA) of 1918, enforced by the USFWS, protects migratory birds (USFWS 2010a). The MBTA implements the United States' commitment to international agreements with Canada, Japan, Mexico, and Russia that protect selected species of migratory birds and their parts. All birds native to any part of the U.S. are covered under the MBTA. Birds not protected by the MBTA include non-native species intentionally or unintentionally introduced into the United States or its territories with human assistance as well as certain other groups of birds (FR 75(39): 9295). The only birds observed on the project site during the botanical survey in October 2010 that are covered under the MBTA are the red cardinal and the barn owl, neither of which are native to Hawaii.

The nearby Kalaeloa Airport has a formal agreement with the U.S. Department of Agriculture. The agreement with Animal and Plant Health Inspection Services and Wildlife Services allows for the controlled eradication of birds that create a hazard to planes. Airport personnel are trained in bird hazing and keep records of all bird strike incidences. The airport exchanges bird information with the USFWS, State DLNR, DOFAW and The Audubon Society (Ramos 2010).

Given the disturbed nature of the area, the only mammals likely to be found at the proposed project site would be the introduced Indian mongoose (*Herpestes auropunctatus*), rodents and feral cats. A feral cat was observed during the botanical survey in October 2010 and evidence of rodents chewing on the bark of trees was also observed.



Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.6 Endangered Plants.mxd

Figure 3.6
Location of Plant Species of Special Interest
Kalaeloa Solar One and Two

3.6.1.3 Special-Status Species

The Hawaii Biodiversity and Mapping Program (HBMP) provided information for occurrences within one-half mile of the proposed site based on a site-specific request (HBMP 2010). They reported locations for two listed plant species, the Ewa Plains akoko (*Chamaesyce skottsbergii* var. *kalaeloana*, also called var. *skottsbergii* in some studies and also known historically as *Euphorbia skottsbergii*) and red ilima (*Abutilon menziesii*). Both of these species are federal- and state-listed endangered. The HBMP reported up to 24 Ewa Plains akoko in two studies conducted in 1984 and 1993. Specific locations for the Ewa Plains akoko were mapped in the 1999 NASBP Closure Environmental Impact Statement (U.S. Navy 1999) and these are shown on Figure 3.6. Some or all of these locations may have been grouped together in the HBMP (2010) site-specific report.

Additional information on the Ewa Plains akoko is provided in the latest USFWS 5-Year Review for this species (USFWS 2007). The description for the plants found in historical studies at the proposed project site location, taken from the 5-Year Review, is quoted below:

> *In 1979, 18 of these plants were recorded at the northwest corner of the Air Station* (Char and Balakrishnan 1979*). In a 1993 survey of this area only seven plants were found (*Whistler 1993*), with four additional plants recorded in another part of this area in 1994. In a 1998 survey for C. skottsbergii var. kalaeloana, only one plant was located in the northwestern corner of the Air Station* (Whistler 1998).

Subsequent to these studies, Whistler (2008) conducted a survey of the study area (DHHL parcel), as well as other parcels throughout Kalaeloa during a wet period (from December 18, 2007 to February 10, 2008). This survey was conducted over the entire DHHL parcel by a two- or three-man crew walking transect lines approximately 10 meters apart. He reported that the major portion of the parcel is covered with a kiawe/koa haole forest dominated by kiawe and koa haole and the most common shrubs including the native ilima and the alien klu (*Acacia farnesiana*), usually in areas of little or no canopy. Although he noted that suitable rocky substrate was present on the parcel, Whistler (2008) did not find any Ewa Plains akoko, or any other listed plants. Whistler's 2008 survey and review of past studies and records from the area in that report led him to conclude that "It appears that over the years there has been a continual decline in the number of individuals on this parcel, probably because of competition from alien species for sunlight and moisture." He speculates that "Perhaps the 'akoko has been unable to reproduce at a sufficient rate to maintain the population, and consequently when the adults have died, the species has disappeared from the parcel."

A project-specific botanical survey was conducted over the entire study area from October 18-21, 2010 (Appendix C) and a small area with *Chamaesyce* sp. plants was identified (Figure 3.6 inset). Some of the plants were dead. The live plants were identified as *C. hypericifolia*. One of the dead plants was quite large, upright, and woody at the base; however this plant was also determined to be a specimen of *C. hypericifolia*, based on examination of the plant by Bishop Museum staff (Imada 2010). No federal- or state-listed species were identified in the proposed development area.

HBMP (2010) also provided data showing that approximately 700 feet to the northwest of the proposed study area is a reported occurrence of red ilima (*Abutilon menziesii*), in an old canefield. The red ilima is a federal- and State-listed endangered species. No information was supplied on numbers of individuals in this occurrence.

In addition to the species discussed above, the USFWS (2010b) noted that the following federally-listed species are known to occur near the proposed project location: round-leafed chaff-flower or 'Ewa hinahina (*Achyranthes splendens* var. *rotundata*) and two species that potentially occur in anchialine pools, opae ula (*Halocaridinia rubra*), and the orange-black damselfly (*Megalagrion xanthomelas*). The federal- and State-endangered round-leafed chaff-flower is found approximately 1.0 mile south of the proposed study area along the coast. This species is on land currently managed by the USFWS (see further discussion in the next section).

On August 2, 2011 the USFWS proposed designating a portion of the proposed project area as critical habitat for Chamaesyce skottsbergii var. skottsbergii. The public comment period is open until October 3, 2011, after which USFWS evaluates comments and makes a decision whether to designate the critical habitat as proposed, to modify or eliminate areas it has proposed, or cancel the designation of critical habitat for the species altogether. As described in this EA, recent surveys have been conducted in the entire proposed project area for this species and it has not been found.

There are no anchialine pool species of concern since this habitat does not occur in the study area (see Section 3.6.1.4).

3.6.1.4 Unique Habitat and Areas of Special Concern

The only wetlands identified on the former NASBP is Ordy Pond, an anchialine pool approximately two miles from the study area, and a seasonal freshwater wetland along the western boundary of the former NASBP that is approximately 1,500 feet south of the southern-most parcel of the study area (U.S. Navy 1999). Several other wetlands and deepwater habitats were mapped in the area for the USFWS National Wetland Inventory. These include the canal adjacent to the west end of the study area and small areas located over 2,000 feet from the study area.

Two unique ecological features or sites, Ordy Pond and the Pearl Harbor National Wildlife Refuge (PHNWR), are greater than one mile from the study area. Ordy Pond is a highly eutrophic, brackish, coastal, anchialine pond located off of Tripoli Street east of the Kalaeloa airport runways. It is the only permanent water body on the former NASBP lands and comprises approximately 3 acres with less than one acre of open water. The pond is surrounded by American mangrove (an introduced species) and supports mosquito fish that are potential food for the Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*), an endangered species, as well as various migratory birds (U.S. Navy 1999). The Navy transferred the area to the University of Hawaii after BRAC for research and study purposes (U.S. Navy 1999).

The PHNWR consists of two wetland units and one coastal upland unit (USFWS 2010c). The wetland units are located greater than 5 miles east from the study area. The 38-acre Kalaeloa unit, approximately one mile south of the proposed study area, contains raised limestone coral reef and has the last remaining native coastal dryland plant communities that were once widespread throughout the Ewa plain (USWFS 2008, 2009). The site is unique because of its rare anchialine pools consisting of sinkholes that are connected to the groundwater and experience tidal influence. This habitat also supports native coastal plants such as the endangered plant species *Achyranthes splendens* (USWFS 2008, 2009). The Kalaeloa unit is closed to the general public. No anchialine pools are present on the proposed project parcels based on historical surveys and none were observed during the site-specific botanical survey conducted for this project.

In addition to the habitats described above, it is also noted that there a many sinkholes located in the study area, primarily in the eastern portion of the CSP project area and in the northeastern portion of the southern project area (the portion not bulldozed). These areas are located outside of the proposed development area. A sinkhole preserve was established in 2008 on Kapolei Property Development land to the west of the study area. This preserve was established because of research on these sinkholes by Dr. Alan Ziegler, and the recognized importance of the sinkholes in preserving a rich fossil record, particularly of extinct Hawaiian bird species.

3.6.2 Impacts

Potential impacts to biological resources are significant if they affect an important, sensitive, or unique resource, a large portion of a biological resource, or cause long-term impacts to biological resources. Special-status species are protected by law and any impact to those species is significant.

3.6.2.1 Proposed Action

Vegetation

Construction associated with the proposed action within the proposed development area would permanently remove the vegetation that is present in the study area. The plant communities on the study area are dominated by non-native species and are common in lowland coastal areas in Hawaii.

The small grove of ten native wililwili trees are outside the development area and are likely to be outside the final lease area and would not be disturbed by construction or operations. This species is not a protected species. However, numbers have been reduced due to loss of habitat from development and the recent (2005) infestation by a non-native gall wasp of all *Erythrina* spp. in Hawaii has resulted in further loss of wiliwili trees (Hawaii Ecosystems at Risk [HEAR] 2010). The few maiapilo shrubs present would also be retained and not disturbed. This species is somewhat uncommon, particularly on Oahu, but it has no official protected status. Wagner et al. (1999) note that it is vulnerable to extinction.

With these avoidance measures, the proposed project would not result in a significant adverse impact to vegetation.

Wildlife

The barn owl and cardinals observed in the study area are protected by the MBTA. Neither of these species is native to Hawaii. No native bird species is likely to regularly use the study area. Given the presence of other similar habitat in the area, it is likely that the non-native birds present on the study area would move to another location. In any event, there would be no significant impact to the population of these species on Oahu. No rare or wildlife species of conservation concern have been reported or observed in the proposed project area. Based on this information there would be no significant impact to wildlife from the proposed action.

Special Status Species

Three federal and state-listed endangered plant species, Ewa Plains akoko (*Chamaesyce skottsbergii* var. *kalaeloana*), red ilima (*Abutilon menziesii*), and Ewa hinahina (*Achyranthes splendens* var. *rotundata*), have been found in the vicinity based on surveys conducted or recorded by the HBMP (see Section 3.6.1

for findings of these studies), but only Ewa Plains akoko was reported in the project study area. The botanical surveys conducted in December 2007 through February 2008 and October 2010 did not positively identify any of these species in the proposed development area. No other special-status species are known to occur in the study area. Therefore, no impact to special status species was identified for the proposed action.

Unique Habitat and Areas of Special Concern.

The only features of special concern in the study area are the numerous sinkholes present, generally in the eastern portion of the site outside of the development area. Sinkholes are abundant in this area of Oahu and a nearby preserve has been established (see Section 3.6.1). There are no known features of these sinkholes that are unique to only this area. No listed species are known from sinkholes in the study area. Large sinkholes that were identified in the eastern portion of the study area during the survey would be excluded from the lease. Sinkholes within the development area are further described in Section 3.7.

Based on the features known to be present in the development area, there would be no significant impact to unique habitat or areas of special concern.

3.6.2.2 No-Action Alternative

Under the No-Action Alternative, no changes to the development area would occur. Therefore, there would be no significant impact to biological resources under the No-Action Alternative.

3.7 ARCHAEOLOGICAL RESOURCES

Cultural resources are the historic districts, sites, structures, artifacts, or other evidence of human activity considered important to a culture or community for scientific, traditional, religious, or various other reasons.

Cultural resources include historic properties as defined by the National Historic Preservation Act of 1966 (NHPA), cultural items as defined by the Native American Graves and Repatriation Act (NAGPRA), archeological resources as defined by Archaeological Resources Protection Act (ARPA), sacred sites as defined by Executive Order 13007 to which access is afforded under American Indian Religious Freedom Act (AIRFA), and collections and associated records as defined in 36 Code of Federal Regulations (CFR) 79. In Hawaii, the SHPD maintains a database of previously recorded archaeological sites and historic structures; refers interested parties to native and indigenous groups including Hawaiian organizations; and facilitates consultation with those who may hold expertise with respect to cultural, traditional and customary uses and practices.

Cultural resources can be divided into three major categories: archaeological resources, architectural resources, and traditional cultural resources.

1. *Archaeological resources* are areas of physical evidence of human alteration of the earth, including but not limited to: roads, fences, trails, and battlegrounds.

2. *Architectural resources* are structures of historic significance, including but not limited to: dwellings and other buildings, canals, dams, and bridges.

3. *Traditional cultural resources* can include archaeological resources, topographic features, habitats, plants, animals, and minerals that Native Hawaiian groups consider essential for the continuance of traditional culture. Traditional cultural resources can also include important archaeological resources such as human burials.

Under NHPA, significant cultural resources need to be considered for potential adverse impacts from the proposed action. Archaeological and architectural resources generally must be greater than 50 years old and features must be preserved and recognizable to be considered eligible to the National Register of Historic Places (NRHP). To be determined a significant cultural resource, archaeological or architectural resources must meet one or more criteria as defined in 36 CFR 60.4 for inclusion in the NRHP:

> *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:*
>
> *(a) That are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *(b) That are associated with the lives of persons significant in our past; or*
>
> *(c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
>
> *(d) That have yielded or may be likely to yield information important in prehistory or history.*

NRHP Criteria are sometimes also applicable to cemeteries, birthplaces, graves of historical figures, religious properties, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years if they fall under the following (National Park Service 1997):

> *(a) A religious property deriving primary significance from architectural or artistic distinction or historical importance; or*
>
> *(b) A building or structure removed from its original location but which is primarily significant for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or*
>
> *(c) A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building associated with his or her productive life; or*
>
> *(d) A cemetery that derives its primary importance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or*
>
> *(e) A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or*

(f) A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or

(g) *A property achieving significance within the past 50 years if it is of exceptional importance.*

In addition to NRHP criteria, one other criterion (e) has been added for significance under the Hawaii Register of Historic Places (HRHP) evaluation:

Have an important value to the native Hawaiian people or other another ethnic group with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity (Chapter §13-275-6).

Typically, criterion (e) is invoked in Hawai'i when human burials are present in archaeological contexts. However, the criterion has also been used when other resources such as Traditional Cultural Properties (TCP) are being evaluated.

The SHPD administers HRS Chapter 6E, Historic Preservation. All projects that have potential to impact historic resources are subject to SHPD review.

3.7.1 Existing Conditions

The Ewa Plain was described by early missionaries as a desolate wasteland, although it was periodically inhabited by native Hawaiians who cultivated dryland plants during times of high rainfall and harvested marine resources on a more regular basis (Handy et al. 1972). The proposed project area is located within the Honouliuli ahupua`a of Oahu that is believed to have once supported a semi- permanent population in pre-Euro-American contact Hawaiian society (Davis 1979). Evidence suggests that the lowland, coastal portion of the Ewa Plain was inhabited as early as 1,000 A.D. (Athens et al. 1997) and utilized into the early twentieth century for cattle ranching, sisal production, and sugarcane planting (Davis et al. 1986).

The U.S. Marines purchased 206 acres at Kalaeloa in 1932 and the property became the NASBP. Construction on the base began in November 1941, but the Navy revised the building plans to make the buildings bombproof following the Japanese attacks on Pearl Harbor December 7, 1941. The Navy commissioned NASBP on April 15, 1942, and the 3,700-acre installation was manned by 12,000 Navy servicemen.

After World War II (WWII) ended, NASBP became the primary Naval Air Station for Naval operations in the Pacific throughout the Cold War era until its close. NASBP closed in 1999 in accordance with a BRAC recommendation. Since then, the former NASBP installation has had ongoing redevelopment by federal, state, and county agencies, as well as military and private organizations.

Archaeological surveys have identified numerous sites of significance at NASBP ranging from pre-Euro-American contact Hawaiian to WWII-era sites, including sites with human skeletal remains present (Helber, Hastert, and Fee 1997). NASBP also contains Category I and Category II historic buildings that are significant from the installation's history during WWII and the early Cold War Era. Sinkholes, depressions in the surface of the earth where there is little fill over the coral reef limestone bedrock, are

found across the Ewa Plain. These sinkholes were used by Hawaiians, who cultivated crops in the floor of larger pits and sometimes buried family members within the sinkholes (McAllister 1933).

Modern archaeological investigations in Honouliuli include those conducted along the coast from Ewa beach to Barbers Point (Dunn et al. 1991; Jourdane 1979; Hommon and Ahlo, Jr. 1983; Davis 1979, 1995; Davis et al. 1986; Miller 1993), and others conducted in residential and golf course developments within former sugarcane fields between Ewa and the H-1 Freeway (Davis 1988; Jayatilaka et al. 1992); what is now termed the "Second City".

A *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* was conducted at the request of State Historic Preservation Division (SHPD) and is included as Appendix B. SHPD requested the AIS to supplement the existing field investigation reports because there was a concern that possible additional undocumented archaeological resources existed within the project area, due to changes in archeological standards since previous surveys were conducted (Appendix A2 SHPD Draft EA comment letter). The AIS supersedes the *Integrated Archaeological Mitigation Plan (IAMP) for the Proposed Kalaeloa Solar One and Two Projects* dated 2010 that was included as an appendix to the Draft EA. The IAMP was based on existing field survey data for the site and vicinity, and included a construction monitoring plan.

The discussion below references both previous investigations within the NASBP (Haun 1991; Welch 1987; Tuggle and Tomonari-Tuggle 1994; Tuggle 1997; Beardsley 2001), and the Appendix B AIS.

Within the study areas, the Bishop Museum (Haun 1991) recorded six habitation complexes, four of which are still extant, while Beardsley (2001) recorded an additional 10 sites all of which have since been destroyed. The Haun (1991), Tuggle (1997), and Beardsley (2001) inventory surveys were submitted to and approved by SHPD. These inventory surveys are summarized in the Appendix B AIS.

The AIS recorded 16 sites in the survey areas. Of this total, four sites were considered eligible for NRHP. Three of these were previously recorded sites (habitations 1718, 1719, and 1721) and one is a newly recorded site (7185) (Figure 3.7). They are all considered eligible for the NRHP under Criterion D for sites which have yielded, or may be likely to yield, information important in prehistory or history. In addition, site 1721 is considered eligible for the HRHP under Criterion e because isolated, disarticulated human burials and skeletal remains were found in the Feature A modified sinkhole. Based on the mapping of these sites during the AIS, Geographic Positioning System (GPS) boundaries are shown on Figure 3.7 and the sites are briefly described in the table below:

Table 3.3. NRHP/HRHP Eligible Archaeological Sites Within the Project Conceptual Layout

Site, Project Location, and NRHP/HRHP Significance	*Feature*	*Feature Type*	*Feature Function*	*AIS Recommendation*
1718 Feature Complex – CSP Site – NRHP Significance D				
	A	Enclosure	Temporary Habitation	Preservation
	B	Mound	Agriculture	None
	C	L-Shape	Temporary Habitation	None
	D	C-Shape	Temporary Habitation	None
	E	Mound	Agriculture	None
	F	C-shaped Wall	Agriculture	None
	G	Modified Outcrop	Agriculture	None
	H	Mound	Agriculture	None
	I	Mound	Agriculture	None
	J	Circular Enclosure	Temporary Habitation	Preservation
	K	Terrace	Agriculture	None
	L	Mound	Agriculture	None
1719 Feature Complex – CSP Site - NRHP Significance D				
	A	C-Shape	Agriculture	Preservation
	B	Rectangular Enclosure	Temporary Habitation	Preservation
	C	Irregular-shaped Enclosure	Temporary Habitation	Preservation
	D	C-Shaped Wall	Agriculture	None
	E	Cairn	Temporary Habitation	None
	F	Area of mounds, modified outcrops, wall segments	Agriculture	None
1721 Feature Complex – PV Site – NRHP Significance D and HRHP Significance e				
	A	Modified Sinkhole	Temporary Habitation	Preservation of Site
	B	Linear Wall	Temporary Habitation	
	C	L-Shaped Wall	Temporary Habitation	
	D	L-Shaped Wall	Temporary Habitation	
	E	Mound	Agriculture	
	F	Linear Wall	Agriculture	
	G	Linear Wall	Agriculture	
	H	Modified Sinkhole	Agriculture	
7185 Sinkhole – CSP Site - – NRHP Significance D				
	A	Sinkhole	Agriculture	None
	B	Sinkhole	Agriculture	None
	C	Sinkhole	Agriculture	None
	D	Sinkhole	Agriculture	Preservation
	E	Sinkhole	Agriculture	None
Source: AIS (Appendix B)				

3.7.2 Impacts

Federal regulations (36 CFR § 800.5 of the NHPA) characterize a significant impact as any change in integrity to a resource that is eligible for the National Register if the characteristics that make the resource eligible are altered. Damage, alteration of the resource, sale of property, or other degradation of the resource would be considered significant. In addition to analysis of known cultural resources, the potential for discovery of further resources, including human remains, is analyzed in this section.

State of Hawaii environmental impact significance criteria are listed in HAR Title 11, 200-12, including, "1. Involves an irrevocable commitment or loss or destruction of any natural or cultural resource." Section 5.2 lists all the criteria and summarizes the impacts.

3.7.2.1 Proposed Action

For planning flexibility, the archaeological resources study area included a larger area than would be required for project development. The conceptual layout boundary is shown as a dashed line on Figure 3.7. Figure 3.7 shows how the project development area was reduced to avoid potential impact to archeological sites 1723a and 1723b, 1724, 1726, and 1721 (Figure 2.3). These sites will be excluded from the final DHHL lease.

Of the sites that remain within the conceptual layout, the AIS recommends the preservation of Features A and J within Site 1718, Features A, B and C within site 1719, and Feature D within Site 7185 (Table 3.3). The project conceptual plans identify five archeological preservation sites within the conceptual layout (Figures 2.3 and 3.7) that would conform to the AIS recommendations.

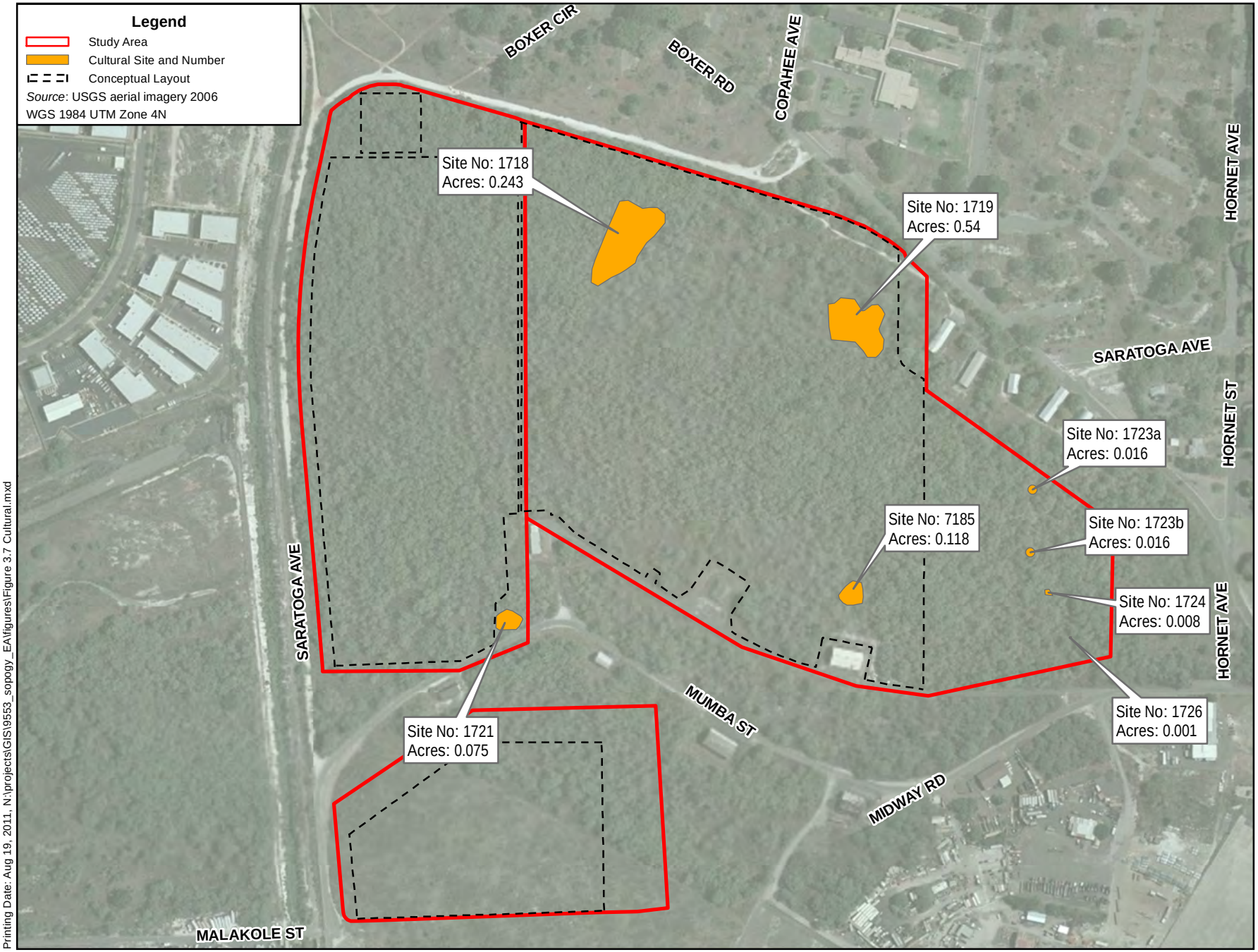
A Historic Preservation Plan (HPP) will be prepared, approved by SHPD and implemented for the sites identified for preservation. The HPP identifies the sites and features to be preserved, buffer zones, and short-term and long-term preservation strategies. Preservation measures may include routine maintenance, establishment of a protective buffer around the site, and opportunity for community access for cultural or education purposes. The HPP is implemented prior to construction and through the project operations phase.

An Archaeological Monitoring Plan (AMP) is required for construction phase of the project. It includes locations and descriptions of sites to be preserved, protection measures to be taken for the sites prior to and during, and archeological monitoring during grading and grubbing activities. It describes actions required if burials are encountered.

Construction will not commence until the AIS, AMP and HPP are reviewed and accepted by SHPD. No adverse impacts to significant archaeological resources are anticipated under the proposed action.

3.7.2.2 No-Action Alternative

Under the No-Action Alternative, proposed construction activities would not occur. However, the AIS would not have been conducted and the public and other businesses in the area will retain their access to the historic sites. There would be potential for inadvertent disturbance of the sites or vandalism, and a potential for significant adverse impact if the sites are left unprotected.



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Feet
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Figure 3.7
Location of Cultural Resource Sites Recommended for Preservation
Kalaeloa Solar One and Two

N
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3.8 SOCIOECONOMICS AND CULTURAL ENVIRONMENT

Socioeconomics describes human activity and population characteristics, focusing on measures of economic activity. Often socioeconomics are studied to determine the impact of an economic change on human activity. Development can impact community services, local employment levels, and housing availability.

3.8.1 Existing Conditions

3.8.1.1 Socioeconomics

The population of the State of Hawaii was 1,360,301 in 2010 (U.S. Census Bureau [USCB] 2010). The proposed site is located on Oahu Census Tract 85. In 2000, the Ewa area population was 68,000 (DPP 2008). The Ewa region is being developed as a new urban center with community facilities, roads, commercial areas, and housing developments. The projected population for the Ewa area by 2030 is 177,000 (DPP 2008).

Employment in the region is largely industrial, commercial and retail. Approximately 15,000 jobs were located in the Ewa Region in 2000 and that number is projected to grow to 64,000 by 2020 (HCDA 2010). About one third of the residents work in the region, but that percentage is expected to increase with the projected economic growth in the region. Recent and planned housing projects for the area include affordable housing; there is a demand for housing from households earning between $35,000 and $55,000 (HCDA 2010).

The project site is currently vacant and does not contribute to the region's employment or housing statistics. The site is owned by DHHL, but does not provide revenue to support DHHL's mission. It is unsuitable for housing development, due in part to proximity to the airport. The site is heavily vegetated and there is no formal access. There are no recreational facilities at the site and no evidence of recreational activities (i.e., hiking trails, ballfields) was observed during the biological and archaeological surveys. No traditional (or modern Hawaiian) cultural activities were identified that occur at the project site today.

3.8.1.2 Traditional Practices and Settlement Patterns

Articles IX and XII of the State Constitution of Hawaii (Ch 343, HRS) require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. EAs and environmental impact statements need to assess the impacts of a proposed action on cultural practices and features associated with a project site. Act 50 (April 26, 2000), HRS 343-2 further amends the definition of environmental impact statement to include "effects of a proposed action on the economic welfare, social welfare, and cultural practices of the community and State."

Traditional native Hawaiian cultural practices and settlement patterns in the Ewa Plain likely reflected its proximity to Pearl Harbor and its aquatic resources, rather than the allure of the plain itself which was described by Vancouver in 1798 as "one barren, rocky waste, nearly destitute of verdure, cultivation or inhabitants…" (Handy and Handy 1972). The name Ewa, if translated as meaning "crooked" (Pukui, Elbert, and Mookini 1974), is a reference lost in the past.

Prior to European contact, the plain of Kaupe'a was known to Hawaiian travelers as a place of "spirits without good intentions" (I'i 1963) in which the goddess Pele's sister Hi'iaka was told that local residents only grow *'uala* or sweet potatoes and plait *pilipili'ula* grasses into meager coverings (Maly 1996). Other cultural practices associated with the demi-god Kamapua'a and the sacred hill of Pu'uokapolei situated at the *mauka* edge of the plain include solar observation rituals and *hula* (Kamakau 1976), while legendary near-coastal practices included the planting of the first breadfruit tree in the islands from the ancestral homeland of Kahiki within a sinkhole in Kualaka'i (Beckwith 1970).

Sterling and Summers (1978) describe this unidentified site where "Tradition credits the introduction of the breadfruit tree in these islands to Kahai, a son of Moikeha, who brought a species from Upolu in the Samoan group on his return voyage from Kahiki, and planted same at Puuloa, Oahu".

After its agricultural transformation was begun in the early twentieth century, McAllister (1933) mentions the remains of traditional farming observed on the Ewa Plain as "holes and pits in the coral were formerly used by the Hawaiians" and that "the soil on the floor of the larger pits was used for cultivation, and even today one comes upon bananas and Hawaiian sugar cane still growing in them".

More recently in a report entitled *Report on Archaeological Survey of the Proposed 'Ewa-Marina Community Development Ewa Beach, Oahu Island*, Davis (1979), concluded that "the number of cultural features, the size of individual habitation structures, and the extent of the sited areas now indicate that the whole of the coastal portion of the Ewa plain once supported a large and possibly permanent resident prehistoric population." Coastal or lowland settlement was assumed to have occurred as early as A.D. 600 (Davis et al. 1986), with upland settlement occurring later.

In contrast, his report on the proposed Ewa Gentry project area (Davis 1988) concluded that the lack of human habitation sites inland may be the result of this portion of the Ewa plain having been "exposed windswept grassland subject to possibly the driest conditions in the region. As such, this would not have been a particularly suitable locale for anything but the shortest of short-term occupations."

This interpretation of traditional settlement patterns has been further refined in recent years by Tuggle (1997) in which he sees a strong correlation between cyclical climatic oscillations favorable to human occupation of the Ewa plain and clusterings of radiocarbon dates within three broad periods: A.D. 1300-1450, 1450-1700, and after 1700. Tuggle interprets the archaeological evidence of short-term occupation in habitation sites such as 50-80-12-1724 (Figure 3.7) as indicative of periodic reoccupation of certain locales located near sinkhole complexes, and not seasonal occupation on a yearly basis.

Since the 1930s and the development of NASBP, remains of traditional settlement patterns in the proposed KSP project area have been impacted to differing degrees (Tuggle 1995), while access to pursue traditional cultural practices has been curtailed by military fencing of the property. There is an interest among Hawaiian civic organizations to re-establish traditional cultural practices in Kalaeloa.

Kalaeloa Heritage Park has been established in Kalaeloa and is intended to be part of a cultural landscape throughout Kalaeloa. The goal is to establish partnerships among the civic organizations, HCDA, landowners and developers for the protection of known and newly discovered archaeological sites for possible inclusion in an expanded Kalaeloa Heritage Park.

3.8.2 Impacts

Impacts are deemed significant if a proposed action adversely impacts the economic welfare, social welfare, and cultural practices of the community.

3.8.2.1 Proposed Action

Construction activities would have a short-term beneficial impact on the economic welfare in the region. There would be construction employment opportunities and increased spending in the area. Operation under the proposed action would result in the creation of jobs for six full time employees, with a slight beneficial impact on the economy.

The project would not benefit housing or other community services such as schools and recreational areas; nor would it have an adverse impact on these services. No appreciable, long-term regional economic changes would occur upon implementation of the proposed action. Spending patterns in the community would not be affected. Therefore, minimal impacts to local or regional socioeconomic characteristics would result from the proposed action.

The proposed action would have beneficial indirect impacts on DHHL's mission through the collection of lease fees. In addition, there is a condition in the lease that would commit one percent of the lessee net annual profit to fund a renewable energy program benefitting native Hawaiians, which would include items such as:

- developing a vocational curriculum administered through the Hawaiian language Immersion Schools,
- establishing a short-certification course for students interested in learning about renewable energy, and
- making presentations to school children on alternative energy and provide career opportunity information.

These efforts and the lease fee would have social and economic beneficial impact to the Hawaiian community.

The impact on traditional practices at the site would be discussed in conjunction with SHPD consultation, and will be informed by the AIS that has been conducted. Some or all of the sites identified in the vicinity of the project may be suitable for incorporation into the Kalaeloa Heritage Park. This would be dependent on partnership agreements with HCDA, DHHL, and Hawaiian civic organizations.

3.8.2.2 No-Action Alternative

Under the No-Action Alternative, proposed construction activities would not occur. The opportunity for lease revenue to benefit the DHHL mission and the Hawaiian community would be lost. Therefore, there would be adverse impacts to socioeconomics with implementation of the No-Action Alternative.

3.9 HAZARDOUS MATERIALS AND WASTES

Hazardous wastes and materials include a wide range of liquids, gases, and solid waste and materials that can potentially harm humans, animals, and the environment. Chemicals or materials released unsafely or

in abundance into the community can become hazards to the community, and in certain forms, can cause serious injury, health problems, property damage, and death (FEMA 2010).

Federal regulations that enforce proper storage and disposal of hazardous materials and wastes include:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),
- Resource Conservation and Recovery Act (RCRA),
- Toxic Substances Control Act,
- Federal Water Pollution Control Act,
- Clean Air Act,
- Clean Water Act,
- Safe Drinking Water Act,
- Federal Insecticide, Fungicide and Rodenticide Act,
- Emergency Planning and Community Right-to-Know Act, and
- Pollution Prevention Act.

3.9.1 Toxic Materials

Toxic materials are specific hazardous materials identified in regulations. Toxic materials include asbestos, lead-based paint (LBP), and polychlorinated biphenyls (PCBs). Asbestos are minerals that have historically been a commonly used construction material because of their insulating properties and durability. However, when asbestos-containing material is inhaled it can lead to asbestosis and lung cancer.

Historically, lead pigment increased the lifespan of paint and decreased corrosion. In 1978, the federal government banned the use of LBP. Buildings constructed prior to 1978 currently need to be inspected for LBP. Health risks from exposure to LBP can include permanent damage to the central nervous system and young children are at the greatest risk of exposure. Ingestion of paint chips or dust is the most common method of exposure.

PCBs are chemical compounds with low flammability, high heat capacity, and low electrical conductivity that were historically used as heat insulating materials and as dielectric fluids in electrical transformers and capacitors. PCBs are known to cause skin irritation and cancer and are highly persistent in the environment. In 1979, the USEPA banned most uses of PCBs. In addition, effective controls have been mandated related to existing PCB-containing equipment.

3.9.2 Hazardous Wastes

Hazardous wastes are specifically defined or determined as such based on their ignitability, corrosiveness, reactivity, and toxicity. Toxic materials include: products used for various maintenance or repairs and identified as hazardous on manufacturer material safety data sheets; petroleum, oils, and lubricants (POL); antifreeze; and miscellaneous other waste streams.

RCRA, as amended by the Hazardous and Solid Waste Amendments (and corresponding Hawaii HARs), define hazardous waste as:

- A solid waste not specifically excluded from being classified as a hazardous waste under 40 CFR 261.4(b) that exhibits any of the characteristics (i.e., ignitability, corrosivity, reactivity, toxicity) described in 40 CFR 261; or

- is listed in 40 CFR 261 Subpart D; or
- is a mixture containing one or more listed hazardous wastes from 40 CFR 261 Subpart D.

Any combination of wastes that poses a substantial present or potential hazard to human health or the environment that has been discarded or abandoned is a hazardous waste.

RCRA requires that hazardous waste be tracked from cradle-to-grave. This hazardous waste tracking system mandates the collection and retention of key information including: the generator of the waste, how the waste is routed to the receiving facility, a description of the waste, the quantity of the waste, identification of the facility that receives the waste, and other relevant data.

USEPA and Hawaii universal waste regulations streamline hazardous waste management standards for federally-designated "universal wastes," which include batteries, pesticides and mercury-containing materials. Universal wastes are considered hazardous however they are unique in that they are not considered in the determination of generator status.

3.9.3 Existing Conditions

A 2010 Environmental Site Assessment (TEC Inc. 2010a and b) researched the history of the study areas and conducted a site investigation and interviews with those who may have information on the history of the proposed site. No evidence of releases of hazardous substances, pollutants, or contaminants was identified. However, there was unauthorized dumping of household items, car tires and other rubbish off the roadways.

The site was vacant during Navy use of the land (1940s to 1999), as depicted in a 1928 topographic map, and no structures were identified at the site from historical photos. There was no evidence that the site contains asbestos, LBP or PCBs. The lease agreement with DHHL would specifically exclude the buildings on TMK parcel 9-1-013:028 that may be affected by asbestos or PCB. Historical environmental reports for the NASBP did not identified potential environmental concerns for the project site (TEC Inc. 2010a and b).

3.9.4 Impacts

3.9.4.1 Proposed Action

Any hazardous materials or wastes generated during construction or operation would be stored and disposed of according to federal and local regulations. A spill-prevention plan would be implemented during the construction process to address potential for leaks of fuels required by heavy construction equipment.

No hazardous or regulated materials are likely to be used at the site in large quantities during operations. The organic thermal oil is an FDA approved organic mineral oil and is not reportable under 40 CFR Part 302.4 Designation of Hazardous Substances. No significant health hazards were identified in the event that the thermal oil was put in contact with eyes or skin, or if it was inhaled or ingested (Radco Industries, Inc., 2007). The thermal oil and minor quantities of lubricants would be managed and stored in accordance with federal and local regulations. The storage tank area where the thermal oil would be stored is a concrete pad with a curb, to act as a secondary containment.

With implementation of the proper storage, disposal and handling procedures described above, there would be no significant direct, indirect or cumulative impacts from hazardous materials and waste.

3.9.4.2 No-Action Alternative

Under the No-Action Alternative, proposed construction activities would not occur. Therefore, there would be no significant impacts from hazardous materials and wastes with implementation of the No-Action Alternative.

3.10 VISUAL RESOURCES

3.10.1 Existing Conditions

There are no special scenic vistas or views in the Kalaeloa area. The topography of the area is relatively flat and there are no ocean views or views of other special land or architectural features from the proposed site. The project area is relatively flat and undistinguished with no discernible gradient. Being entirely within an industrial park, there are no scenic resources in the immediate area.

The Ewa Development Plan's list of visual landmarks and significant vistas in the Ewa area includes the following:

- Distant vistas of the shoreline from the H-1 Freeway above the Ewa Plain,
- Views of the ocean from Farrington Highway between Kahe Point and the boundary of the Waiʻanae Development Plan Area,
- Views of the Waiʻanae Range from H-1 Freeway between Kunia Road and Kaloʻi Gulch and from Kunia Road,
- Views of napuʻu at Kapolei, Pālailai, and Makakilo,
- *Mauka* and *makai* views, and
- Views of central Honolulu and Diamond Head.

3.10.2 Impacts

In accordance with HAR 11-200-12, impacts would be significant if the proposed project "substantially affects scenic vistas and view planes identified in county or State plans or studies."

3.10.2.1 Proposed Action

The Ewa Development Plan's visual landmarks are upland of the proposed action and there would be no impact from the project during construction or operation. No scenic vistas or view planes have been identified in the area of the proposed action. No existing landmarks, mountains, buildings, or shorelines would be altered.

During construction, there would likely be temporary obstruction of views by construction fencing and dust control fabric. There is very little traffic in the area that might be affected by a change in view. Exceptions are traffic associated with the Barbers Point elementary school to the north of the site and various warehouse buildings in the vicinity.

Development of the property is consistent with the Kalaeloa Master Plan (HCDA 2006). Buildings planned would not exceed the height limitations specified in the Kalaeloa Master Plan and would be in

accordance with architectural guidelines and preferences for the area if they are identified and finalized during the project development. The project development would be visible from adjacent roadways; however it would be low to the ground and not obstruct views through the site, except for the support/generator building.

Based on this analysis, there would be no significant direct, indirect or cumulative impacts to visual resources during operation or construction of the proposed action.

3.10.2.2 No-Action Alternative

Under the No-Action Alternative, the proposed construction would not occur, thus there would be no impact to visual resources.

3.11 UTILITIES AND PUBLIC SERVICES

3.11.1 Utilities: Affected Environment and Impacts

Potential impacts to utilities and public services would be deemed significant if substantial changes are required to current systems to support the proposed action.

The infrastructure in the vicinity of the site is owned by the Navy. The Navy no longer needs the utility systems (i.e., potable water source, storage and transmission infrastructure, wastewater, electrical distribution and telecommunications systems) and associated easements. Installation roadways have already been conveyed to the State of Hawaii and County; Commander Navy Region Hawaii prepared an EA for the *Conveyance of Navy Retained Land and Utility Systems, Kalaeloa, Oahu, Hawaii,* dated July 2008. The affected environment information in this section is based on that Navy 2008 EA and comments received in response to the Draft EA. HCDA is preparing an infrastructure master plan that would address roadways and utility service for the area.

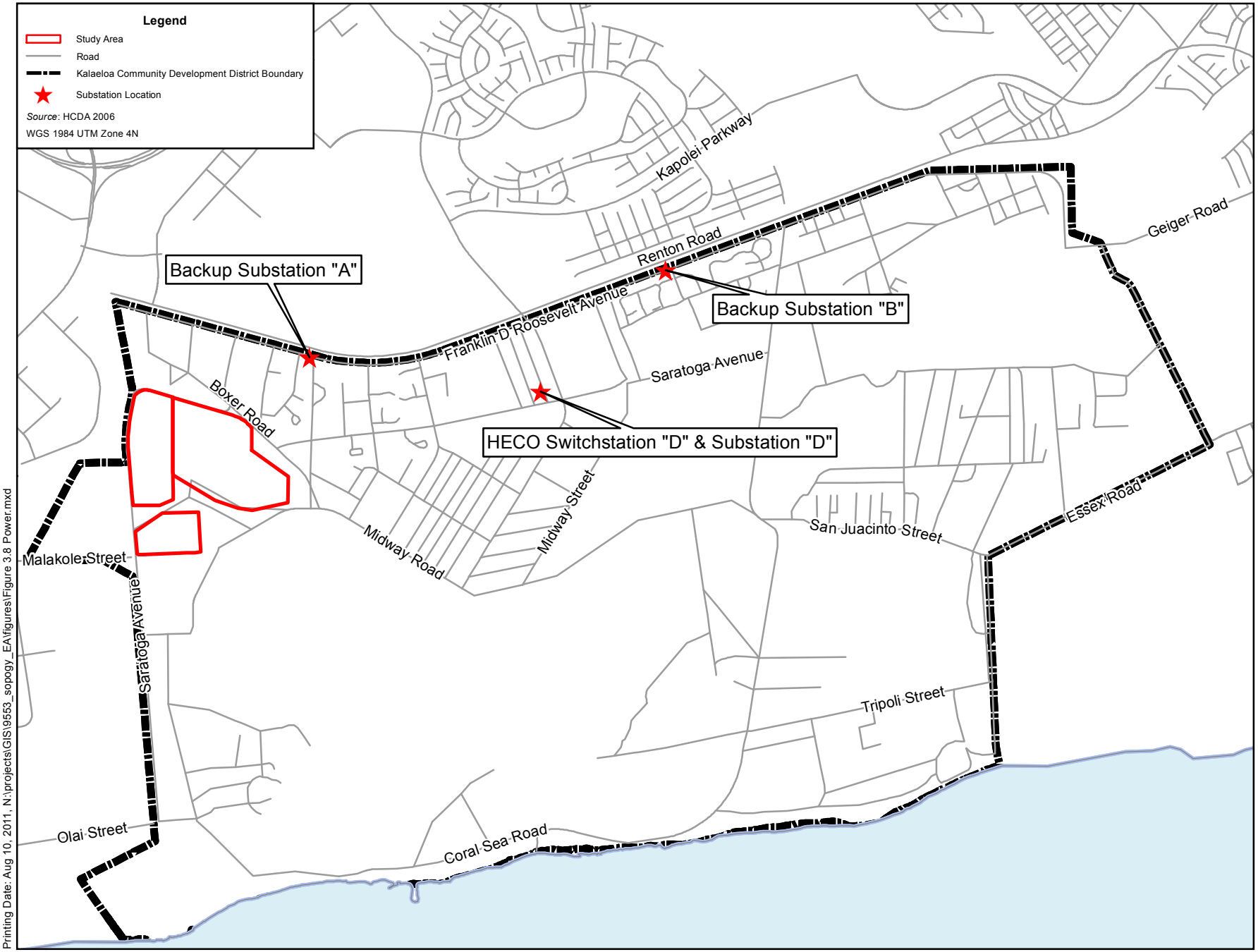
3.11.1.1 Electricity

The existing electrical distribution system at Kalaeloa is owned and operated by the Navy. Electrical power to Kalaeloa is provided through a HECO substation located along the northern property line near the Kalaeloa Community Development District main gate. The substation is listed as "Backup Substation A" on Figure 3.8. Secondary substations reduce the 46-kilovolt (kV) power for local distribution stations. Substation A is closest to the project site and steps the power down to 11.5 kV. It is a backup substation for emergency use (Navy Region Hawaii 2008).

Power distribution occurs through a combination of 11.5 kV and 46 kV overhead and underground power lines. The Kahe Power Plant is the primary power-generating facility for the island of Oahu and is located approximately four miles northwest of Kalaeloa (Navy Region Hawaii 2008).

The Kalaeloa Master Plan (HCDA 2006) acknowledges that the electrical system would need to be upgraded. HCDA is developing an infrastructure master plan and an installation charge for improvements would be assessed to the developer.

Under the proposed action, operation of the two power-generating facilities would provide a total of 10 MW of electricity to the existing power grid. This electricity would provide a renewable source of energy to supplement the Kahe Power Plant. The proposed action would beneficially impact electric supply.



Feet
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0 325 650
Meters

Figure 3.8
Existing Electrical Substations
Kalaeloa Solar One and Two

N
W E
S

3.11.1.2 Telecommunications

Telephone systems in Kalaeloa are currently owned by the Navy. Telephone service is provided through an agreement with Hawaiian Telcom, using military telephone infrastructure (Navy Region Hawaii 2008). Both Hawaiian Telcom and the federal Oahu telephone system lines serve the existing infrastructure at in the Kalaeloa area. Hawaiian Telcom services all of the lines.

Telephone and computer service would be provided at the site. The proposed action would require only minimum telecommunications infrastructure to service the support/generator building, therefore no significant impact is anticipated.

3.11.1.3 Potable Water

Potable water source and distribution system at Kalaeloa is currently owned and operated by the Navy, and is not supplied by the County Board of Water Supply (Appendix A2, Department of Environmental Services Draft EA comment letter). The Navy water supply system was largely constructed in the WWII era and is in relatively poor condition. The system is comprised of (Figure 3.9):

- A Navy well, pumping station and two one million gallon underground concrete reservoir tanks, all located approximately two miles north of Kalaeloa near Makakilo; and
- The distribution system, including 24-inch, 18-inch, 12-inch and 8-inch water distribution mains (Navy Region Hawaii 2008).

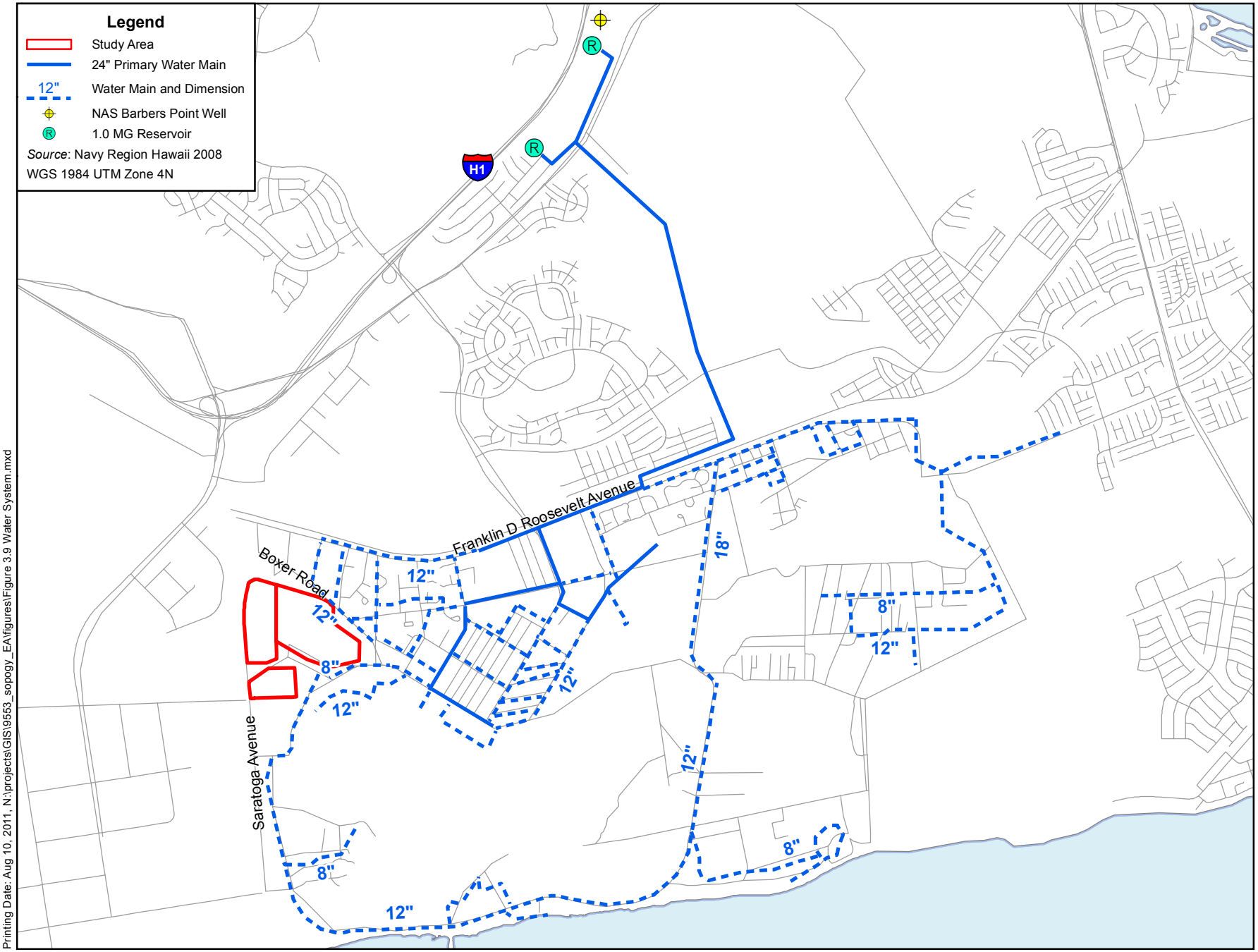
Non-potable water is available in the form of reclaimed water from the County's Honouliuli Wastewater Treatment Plant (WWTP). Distribution lines extend along the north and west boundaries of Kalaeloa and provide irrigation water to the Barbers Point Golf Course (Navy Region Hawaii 2008).

The Kalaeloa Master Plan identifies system improvements including two primary east-west 'backbone' water lines aligned along Roosevelt Road and Saratoga Avenue. In addition, there would be a loop line that is aligned along the eastern, southern and western lines. Developers would be required to pay connection charges.

Water supply designs for the project are in progress, will be reviewed during the wastewater permit process, and will conform to all applicable laws and regulations. The current conceptual plan for the CSP portion of the project is for potable water to be supplied by the Navy system via the existing 12 inch water line in Boxer Road (Figure 3.9). From a water meter at the north entrance to the CSP site, an 8 inch water line will be positioned through the middle of the site within the middle Access Way (Figure 2.3) to supply potable water to the generator/support building. Designs for the PV portion of the project are in progress and were not available for inclusion in this Final EA.

The proposed action's potable water requirements would be minimal. There would be only six employees required at the CSP site for operations, and none at the PV site. There would be no significant impact to potable water supply or distribution.

The developer will work with the County to use non-potable water, when practicable, in the form of reclaimed water for irrigation and other non-potable water purposes, such as dust control, open spaces, or landscaping areas.



Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.9 Water System.mxd

Feet
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0 450 900
Meters

Figure 3.9
Existing Potable Water System
Kalaeloa Solar One and Two

N
W E
S

3.11.1.4 Wastewater

The existing wastewater collection system is owned by the Navy. It is located in the Pass Zone within the critical wastewater disposal area as determined by the Oahu Wastewater Advisory Committee (Appendix A2, Department of Health Wastewater Division Draft EA comment letter). This means that the installation of waste disposal facilities in this area is permitted, as they are not expected to contaminate groundwater resources used or expected to be used for domestic water supplies. The current Navy system is old and the existing pumping stations do not meet County standards; it consists of (Figure 3.10):

- 15.3 miles of gravity sewers that range in size from 6 to 30 inches,
- 12 lift stations, and
- 7.3 miles of force mains ranging in size from 4 to 16 inches (Navy Region Hawaii 2008).

The Navy has issued a Request for Proposals for private providers of wastewater for transference of the existing wastewater collection system.

Currently, wastewater in the area would be conveyed to Honouliuli WWTP, where it would undergo treatment and disposal. The facility has a capacity of 38 million gallons per day (mgd), and its existing inflow is estimated at 25 mgd. Thirteen mgd is processed by secondary treatment and some of this is treated for beneficial use as recycled water. The remainder of secondary and primary treated waste is discharged to the ocean. The Navy purchased 2.66 mgd of the 38 mgd to serve Kalaeloa and other Navy land in the vicinity. The current allocation for Kalaeloa is 1.5 mgd.

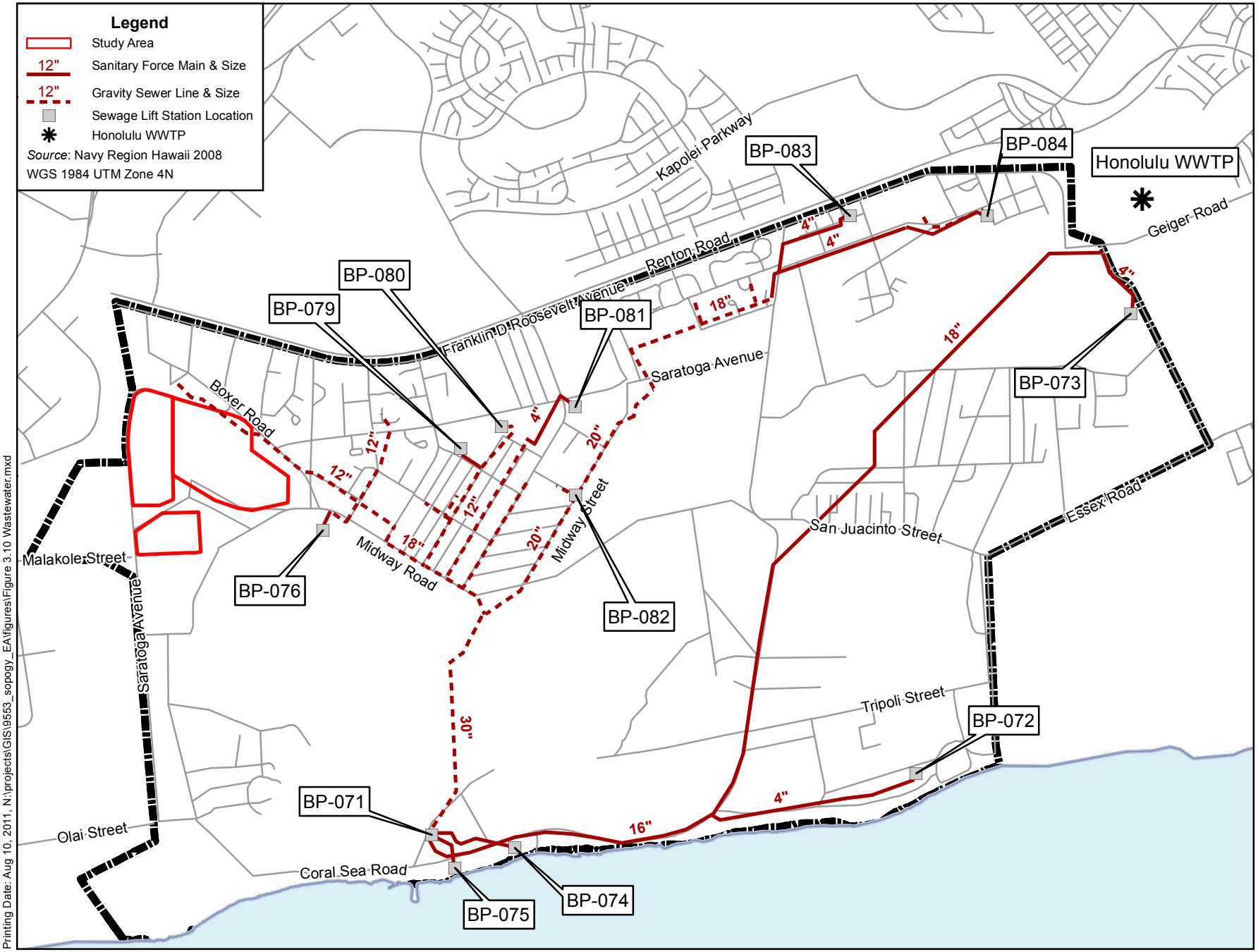
The Kalaeloa Master Plan (HCDA 2006) acknowledges the inadequacies of the existing system and is preparing an infrastructure master plan to outline improvements. Developers would be assessed wastewater facility charges by the County, should they propose new connections to the County's wastewater system.

Onsite wastewater management designs for the project are in progress, will be reviewed during the wastewater permit process, and will conform to all applicable laws and regulations. The current conceptual plan anticipates that sewer generation from one bathroom will be handled by an onsite septic system and 14'x30' leaching field just south of the support/generator building (Figure 2.3). The CSP site's cooling tower processes would rely on water from an onsite source well and cooling water would be disposed of through two injection wells located next to the towers (Figure 2.3).

The project action would have minimal impact on wastewater infrastructure. There would be one restroom for six employees required at the CSP site, and the PV site would require no full-time onsite employees.

3.11.1.5 Solid Waste

The County Department of Public Works (DPW) has two main disposal facilities: the 1,800 ton/day H-POWER refuse to energy plant at Campbell Industrial Park and the Waimanalo Gulch Landfill in Ewa. There are no existing landfills at Kalaeloa (U.S. Navy 1999). There is currently no solid waste service at the site.



Printing Date: Aug 10, 2011, N:\projects\GIS\9553_sopogy_EA\figures\Figure 3.10 Wastewater.mxd

Feet 0 1,250 2,500
Meters 0 325 650

Figure 3.10
Existing Wastewater System
Kalaeloa Solar One and Two

Construction debris would be generated and disposed of in accordance with state and county requirements. Whenever possible, materials would go to a recycler. When not possible, materials generated would go to a debris landfill such as the PVT Landfill in Nanakuli, Hawaii.

Operation under the proposed action would not generate significant amounts of solid waste. A private waste contractor would provide solid waste collection and disposal services for the proposed action. Recycling would be implemented. Bins would be set up to recycle cardboard, aluminum cans, plastic, white paper, and newspaper. Waste and recycled materials would be delivered to, and disposed of properly, at a permitted county facility.

3.11.1.6 Drainage

There are two regional drainage basins that affect the Kalaeloa Community Development District: the Kapolei Drainage Basin and Kaloi Drainage Basin. There is a coral pit near the intersections of Franklin D. Roosevelt Road and Fort Barrette Road that collects water from an infiltration canal located parallel to the northern boundary of Kalaeloa and the railroad tracks. During heavy rains, there is potential for the capacity of the canal to be exceeded and there have been overflow events onto Roosevelt Road resulting in localized flooding within the Kalaeloa boundary. The Kalaeloa Master Plan suggests the regional drainage system is inadequate to handle runoff from a modeled 100-year storm event (HCDA 2010).

Stormwater runoff within the Kalaeloa District is discharged to numerous Navy dry wells, none of which are located at the site. These drywells do not conform to County standards. The Kalaeloa Master Plan suggests establishment of a special drainage district subject to County approval that would allow the use of drywells, swales, and retention basins. There are no stormwater controls at the site and rain percolates through the soil. There is zero discharge of surface water to any drainage way or open water (Section 3.5.1.4)

Temporary BMPs would be implemented during construction to contain surface flows within the project site (Section 3.5.2.1). During operations, stormwater would be managed on site, and regional stormwater issues would be considered in the preparation of stormwater management plans. The proposed action would increase impervious surfaces at the site by approximately 48,000 ft^2, a minor amount of new impervious surface relative to the acreage at the site (approximately 80 acres). A stormwater management plan for the CSP location includes the construction of a retention basin that enables the full retention and infiltration of stormwater runoff during operations, including any additional runoff that would result from an increase in impervious surfaces (Section 3.5.2.1). Specific storm management controls have not been developed for the PV site, but they may include berms along the southern edge of the site. The proposed action would not have a significant impact on stormwater drainage at the site or the vicinity.

3.11.2 Public Services: Affected Environment and Impacts

3.11.2.1 Schools

Currently, there are four elementary schools (Mauka Lani, Makakilo, Kapolei and Barbers Point), and Kapolei Middle and High Schools in the Kalaeloa area. All are part of the DOE's Leeward District Kapolei Complex. Due to rapid residential growth in the area, the DOE is planning eight new elementary schools, three middle schools, and one high school for the area by 2030 (DPP 2008).

In comments to the Draft EA, DOE expressed concern regarding electric and magnetic fields (EMF) associated with the project and their impact on public health (Appendix A2). Electric fields are produced by voltage and are measured in volts per meter. Magnetic fields are produced by the flow of current through wires or electrical devices and are measured in tesla or gauss. EMF fields weaken exponentially as distance is placed between the source and the receiver. Common materials (such as building walls and trees etc.) also weaken the strength of electric fields, but do not usually decrease magnetic fields.

Scientific and medical literature and studies have found no conclusive evidence for a causal relationship between exposure to EMFs and health impacts (Oregon Department of Transportation, 2008). There are no federal standards for exposure to EMF. The State of Hawaii Department of Health, in its January 19 1994 statement "DOH Policy Relating to Electric and Magnetic Fields from Power-Frequency Sources" states:

> "The Department of Health, in response to continuing but inconclusive scientific investigation concerning electric and magnetic fields (EMF) from low-frequency power sources, recommends a "prudent avoidance" policy. *Prudent avoidance* means that reasonable, practical, simple, and relatively inexpensive actions should be considered to reduce exposure."

Example avoidance strategies that have been adopted include buffer zones along the right-of-ways (ROW) for high voltage transmission lines, and siting guidelines for such lines to minimize exposure to the sensitive receptor areas such as schools. Florida, Minnesota, Montana, New Jersey, New York and Oregon have all established standards for electric fields associated with power lines (the lowest threshold being Montana's 1kV/m threshold along the edge of a ROW, which can be waived by a landowner). Florida and New York have also placed limits on magnetic fields associated with power lines (the lowest threshold being Florida's 150 milligaus for lines of 69-230 kV along the edge of a ROW).

The CSP system itself directs solar energy purely as a heat source to drive a generator set that will produce AC power, and no EMF would be produced.

Sources of EMF from the proposed project could include:

- Power frequency magnetic fields emitted by the PV system power inverters (which convert DC generated by the systems into AC, to be used within the electricity distribution grid);
- EMF fields from power transmission lines; and
- power frequency magnetic fields produced within the substation, where voltage is transformed into a useable format for domestic and commercial consumption. This substation is also the connection point with the HECO power grid.

However, there would be no significant impact from these sources of EMF for the following reasons:

- Potential EMF levels from the project would weaken exponentially as distance from the project site was increased. Barbers Point Elementary School is located over 1,300 ft. from the nearest point of the project site and potential EMF fields that students would encounter would be minimal.

- EMF from the PV system power inverters would have no significant impact. The PV system will be using 125kW inverters. In a past project utilizing 100kW inverters, EMF measurements were taken at 1 and 2 meter intervals and it was determined that the measurement fell to nominal levels

at approximately 10 feet from the inverter. The project plans indicate that PV inverters will be located at equipment pads on the east side of the PV array (Figure 2.3), hundreds of feet away from Barbers Point Elementary School. The highest voltage that would be found at the facility would be 46kV, from which the Los Angeles Unified School District policy recommends a separation of 100 ft.

- Similarly, EMF from the power lines within the facility would have no significant impact. The maximum amount of electricity transmitted via the project's power lines would be 12.47 kV. Studies have found that at a distance of 300 feet, the electric field created by a 115 kV line would be 0.003 kV/m and the mean magnetic field would measure 0.2 milligaus. Thus any EMF from the power lines associated with the project will fall far below the threshold for exposure of the general public recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP is a multinational organization of scientists specializing in protection against radiation exposure. The organization guidelines for EMF exposure recommend a maximum of 833 milligaus of magnetic field exposure for the general public.

- Finally, EMF from the substation would not have significant impact. The Barber's Point Elementary School is over 1,300 ft. from the proposed substation. The National Institute of Environmental Health Sciences (2002) provides the following statement regarding EMF and power substations:

  "In general, the strongest EMF around the outside of a substation comes from the power lines entering and leaving the substation. The strength of the EMF form equipment within the substations … decreases rapidly with increasing distance. Beyond the substation fence or wall, the EMF produced by the substation equipment is typically indistinguishable from background levels"

The proposed action would not induce population growth into the area and would not result in an increase in attendance at existing schools. The Kalaeloa Master Plan (HCDA 2006) has designated an area for instructional/school/cultural center land use at the Barbers Point Elementary School site. Furthermore the project is not expected to result in operational hazards due to EMF and high voltage hazards.

3.11.2.2 Police, Fire, and Emergency

Kalaeloa law enforcement falls under the jurisdiction of the County Police Department's Kapolei office. County Fire Department Stations in the area servicing the Kalaeloa area include the Kapolei and Makakilo Stations of Battalion 4, West Oahu. Additional fire services for Navy and Coast Guard facilities in the area are provided by Federal Fire Department Station 12.

Emergency services are provided by ambulance located at both the Kapolei and Makakilo Fire Stations. Hawaii Medical Center West, located on Fort Weaver Road northeast of the project site, is the only hospital in the Kalaeloa area.

During construction, standard safety and security precautions (e.g., security fencing) would be implemented. During both construction and operation, security as necessary would be provided by the developer so that the County Police Department would only be needed in an emergency. During pre-

assessment consultation and after the publication of the Draft EA, the County Police Department indicated there would be no anticipated impact to their services due to the project (Appendix A).

Existing and planned Honolulu Fire Department capabilities are adequate for the area. Project plans will conform to all Honolulu Fire Department regulations, including Uniform Fire Code Section 902.2.1, and Section 903.2 as amended. Unpaved compacted access roads would circulate throughout the site, to allow easy access to the panels and facilities (Figure 2.3), and adequate water supply will be available at the site for fire protection. Civil drawings will be submitted to the Honolulu Fire Department for approval prior to commencement of the project. The project site will not impede vehicular access on Mumba Street (Figure 2.3). This street serves as the ingress and egress route for tenants in the area and an emergency route to evacuate the public from Campbell Industrial Park in a natural or industrial emergency (Appendix A2, HCDA Draft EA comment letter).

3.11.2.3 Roadways and Traffic

Kalaeloa has 20 miles of existing roadways (HCDA 2006). The two major thoroughfares in the vicinity are H-1 and Farrington Highway (State Route 93). H-1 is located north of the proposed site, and runs east-west. H-1 is used to reach the Ewa Plain from Honolulu. Farrington Highway runs parallel to H-1 and merges with H-1 directly north of the proposed site. Kalaeloa Boulevard runs north-south and connects H-1 and Farrington Highway with the proposed site (Figure 3.11).

Due to the rapid residential development of the Kalaeloa area, traffic problems have increased. Roadways have not been modified, nor have new roads been created quickly enough to keep up with increased population. Studies have been conducted to provide a solution to traffic problems in the Ewa region. Regional roadway improvements are in various stages of completion (Figure 3.11), and the studies have identified projects that will improve travel within Kalaeloa. Long-term plans, including increased bus services linking to a planned mass-transit rail system, will also improve access to Kalaeloa and the project site.

HCDA is preparing an infrastructure master plan and a preliminary plan is included in the Kalaeloa Master Plan (Figure 3.12). The Kalaeloa Master Plan proposes a major east-west spine road that would realign and connect the existing portions of Saratoga Avenue along the northern boundary of the project site. There is a proposed extension of Kamokila Boulevard south through the project site and an extension of Midway Street through the site approximately east-west. These plans would not be compatible with the proposed development and were likely based on planned smaller lease areas. The infrastructure plans continue to be developed and may be influenced by the proposed action. The project site will not impede vehicular access on Mumba Street (Figure 2.3). This street serves as the ingress and egress route for tenants in the area and an emergency route to evacuate the public from Campbell Industrial Park in a natural or industrial emergency (Appendix A2, HCDA Draft EA comment letter).

The construction of the CSP and PV facilities would likely overlap for a duration of 5 months, and would occur during daylight hours, Monday through Friday. Construction would require a peak of 135 workers onsite for the PV facility and approximately 60 for the CSP facility. Construction traffic would likely use Kamokila Boulevard leading to Roosevelt Avenue and adjacent unpaved roadways to access the site. During the construction phase, there would be increased traffic to the area, including privately-owned vehicles of construction workers, trucks, and heavy equipment. However, the increase would be temporary and would present a marginal increase in the regional traffic.

Construction traffic to the site and traffic to Barber's Point Elementary School north of the site would likely utilize the same Kamokila Boulevard access to the Kalaeloa district. Delivery of construction materials and equipment would avoid peak morning and afternoon traffic periods, including student drop-off and pick-up times at Barbers Point Elementary School. In addition, if there is sufficient storage and security in the area, equipment to support construction would remain onsite, decreasing construction traffic. Finally, Police Department coordination will occur during the building permit process. Construction contractors are expected to coordinate with the Police Department prior to initiating activities that could potentially impact Police services or disrupt traffic in the vicinity.

If construction truck traffic were causing traffic problems, construction trucks could be required to access the site from the west, utilizing Fort Barrette Road as an alternative access route to the site. Fort Barrette Road is a north-south roadway that provides direct access from Farrington Highway and the H-1 Freeway to the Kalaeloa district. South of the Roosevelt Avenue intersection, it extends as Enterprise Street, a three-lane roadway, which connects with Saratoga Avenue. Another potential measure to reduce construction impacts could include providing a park and ride lot for construction workers.

Operation under the proposed action will be seven days per week and would require approximately 6 full-time employees for the CSP facility. The PV site is operated remotely and would not contribute to local traffic.

No significant adverse impact to traffic was identified. There would be no significant adverse direct or indirect impacts to existing roadways and traffic during operations. Regionally, there would be a slight additive cumulative impact on regional traffic during construction, but the impact would not be significant.

3.11.2.4 Proposed Action

Although there are unknowns with respect to the area's potable water service provider and site access, the project would be consistent with the Kalaeloa infrastructure master plan and would be subject to service provider approval. Therefore no significant adverse impact on utilities is anticipated. The proposed action would not have an impact on public services during construction or operations.

3.11.2.5 No-Action Alternative

Under the No-Action Alternative, the proposed construction would not occur. No significant impacts to utilities and public services would occur with the No-Action Alternative.

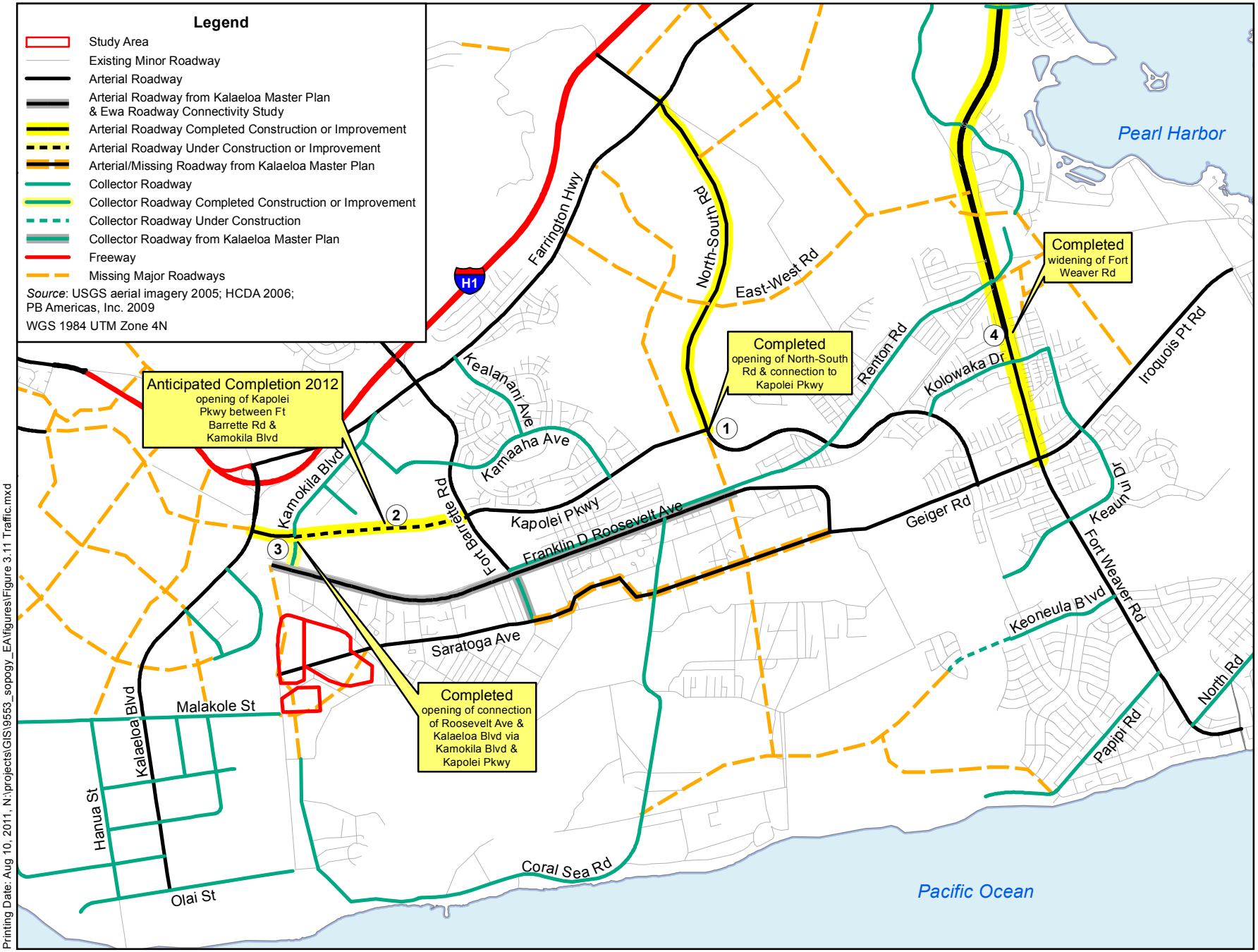


Figure 3.11
Regional Traffic Improvements
Kalaeloa Solar One and Two

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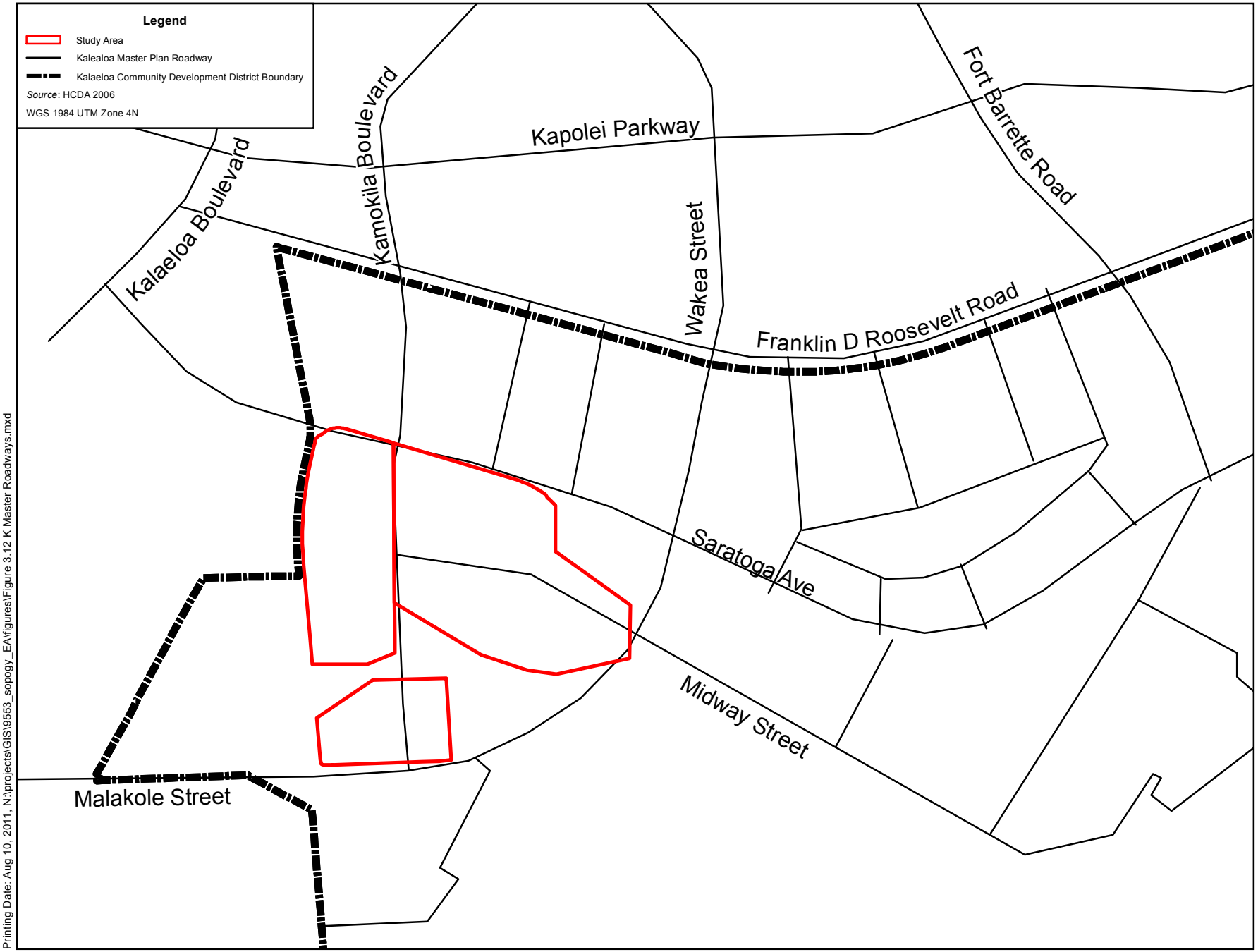

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Meters

Figure 3.12
Kalaeloa Master Plan Roadways
Kalaeloa Solar One and Two

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3.12 CUMULATIVE IMPACTS

Cumulative impacts can result from incremental impacts of an action when added to other past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (HAR 11-200). Analysis of cumulative impacts was conducted on a qualitative basis, and included an assessment of known activities and developments occurring within the Kalaeloa Area. The projects listed in Sections 3.12.1 and 3.12.2 that improve infrastructure and public services and provide housing would have a net beneficial impact on the environment. New or expanded businesses that are sited in locations consistent with community plans and that provide jobs in the region would also have a net beneficial impact on the environment. Cumulatively, there could be an additive impact on air quality if all projects were constructed concurrently, but that is highly unlikely.

3.12.1 Recent Past, Present, and Future Projects at Kalaeloa

Since the closure of NASBP, there have been substantial changes in the area due to the development of the entire Ewa region of Oahu. As of 2006, 25 percent (929 acres) of the former Barbers Point was retained by the Navy, 44 percent (1,621 acres) was conveyed to government or private owners, and 31 percent (1,146 acres) remained pending conveyance (HCDA 2006). Several projects have occurred on the former NASBP, now called Kalaeloa, and several more are currently underway or planned, as follows:

- *Conveyance of Navy-retained Lands at Kalaeloa – Completed 2008*. Commander, Navy Region Hawaii conveyed 499 acres of land and utilities at Kalaeloa that had been retained by the Navy following the closure of NASBP. The conveyance included former NASBP utility systems (i.e., water, wastewater, electrical distribution and telecommunication systems and corresponding easements) to a private developer for potential reuse and development (Navy Region Hawaii 2008). According to the EA, foreseeable development of the subject parcels was intended to be compatible with the Kalaeloa Master Plan (HCDA 2006). Over a twenty year period, these include approximately 5,000 homes in a mixed use/transit-oriented setting, industrial and commercial uses, and public uses such as schools, parks and a public transit system.
- *Relocation of Hawaii Army National Guard to Kalaeloa – In progress and future planned*. Hawaii Army National Guard is planning to relocate and consolidate to its currently only partially-used 150-acre parcel north of the Kalaeloa Airport runway. The consolidation includes construction and renovation of existing buildings and an increase in personnel onsite by nearly 300.
- *Ke Kama Pono Building – Completed 2009*. Construction of five approximately 2,000 square-foot residential units on Yorktown Road in Kalaeloa, Oahu to serve as facilities for the Ke Kama Pono program which provides services and programs for at-risk youth.
- *Kalaeloa Airport Aircraft Hangers – In progress and future planned*. DOT is in the process of constructing 10 T-hangars to accommodate 10 general aviation aircraft. DOT plans to construct an additional eight banks of T-hangars for 144 general aviation aircraft. They also plan to develop eight lease lots and related access roads for use by lessees on about 54 acres of previously cleared and paved land. These projects provide for housing of aircraft at the airport which is projected to result in greater usage (increased aircraft operations at Kalaeloa airport).
- *New Housing – Present to 2025*. The Kalaeloa Master Plan projected 6,352 new housing units in three phases (2007 to 2025) (HCDA 2006).
- *New Commercial Space - Present to 2025*. The Kalaeloa Master Plan (HCDA 2006) estimates a total construction of 116,583 ft^2 (2.67 acres) of commercial space, 725,028 ft^2 (16.64 acres) of

office space, 1,819,388 ft^2 (41.76 acres) of light industrial space, and 470,436 ft^2 (10.79. acres) of light industrial mixed use space over the three phases of development (2007 to 2025) for a total of 3,131,435 ft^2 (71.88 acres) of projected buildings.

- *Enterprise Energy Corridor – Planned for construction by 2013*. There are plans to construct a 12kV energy corridor on Enterprise Street between Roosevelt Avenue and Midway Street.
- *FBI Complex - In progress* – A new building complex is planned on a 10-acre plot near Enterprise Street and Saratoga Avenue.
- *Widening of Fort Barrette Road – Unknown construction date*. This DOT road widening project has been planned for several years. An EA was conducted for the expansion in 2006. This project has been on hold for a number of years.
- *Desalination Project – Unknown construction date***.** The Board of Water Supply has plans to construct a 5 mgd desalination plant on a 20-acre parcel at Kalaeloa (DPP 2008). Capacity could be increased to 15 mgd in a second phase and even further up to 35 mgd at a later date.
- *U.S. Coast Guard at Kalaeloa Airport Aircraft Hanger – Unknown construction date*. The Coast Guard plans to construct an additional hanger at the airport.
- *Fire Department Training Facility – Unknown construction date*. The Honolulu Fire Department has plans to establish an island-wide training facility at Kalaeloa (DPP 2008).
- *Kalaeloa Regional Park – Unknown construction date***.** A new park utilizing vacant land at Kalaeloa is envisioned (DPP 2008). The park is intended to be a major nucleus of community activity. The park would include sports and recreation facilities, including ocean recreation, and cover 468 acres (Honolulu Star Bulletin 2005).
- *Drainage System Improvements – Unknown construction date*. The drainage system for the Villages of Kapolei currently consists of a golf course retention and disposal system where stormwater is discharged into large pits and a large ditch near the Kalaeloa boundary (DPP 2008). The stormwater drainage into a coral pit at Fort Barrette Road and Roosevelt Avenue is inadequate to handle the runoff from a 100-year storm (HCDA 2006). A new system to handle stormwater runoff may be required in the future for areas within Kalaeloa.

3.12.2 Other Projects in the Region

Other projects in the region are as follows:

- *New Housing – Present to 2011*. Housing in the Ewa area has been rapidly increasing. Numerous housing developments are proposed within approximately 1.5 miles of Kalaeloa. These developments are located to the north and east of Kalaeloa and include City of Kapolei and Villages of Kapolei to the North, ‘Ewa Villages, ‘Ewa Gentry Makai, and Ocean Pointe to the east. The developments, on over 1,000 acres of land, have a total of 7,200 residential units as of 2008 and are projected to have 14,400 units when built out sometime after 2011 (PB Americas 2009).
- *Schools – Present to 2030*. DOE has projected a need for eight new elementary schools, three new intermediate schools, and at least one new high school in the Ewa region (DPP 2008).
- *University of Hawaii West Oahu – In progress and future planned*. The University of Hawaii west campus is projected to have 800 faculty and staff and 7,600 students (DPP 2008).
- *Resort Development – Present to 2030*. Ko‘Olina Resort to the west and the Hoakalei Resort at Ocean Pointe (under construction) to the east are projected to include almost 9,200 visitor units by 2030 (DPP 2008). The marina at Ocean Pointe would be the region's principal recreational marina destination for local residents and visitors with over 1,100 acres (DPP 2008).
- *HECO Campbell Industrial Park Generating Station Expansion – Construction complete*. The plan is for one 110-megawatt combustion turbine generator and auxiliary systems to be used as a

peaking unit. Construction is complete and preliminary performance testing is underway (HECO 2009).

- *H-Power Campbell Industrial Park Station Expansion – Unknown construction date*. H-Power proposes to expand the existing 28 acre H-Power power plant. The current processing capability of the plant is 2,160 tons-per-day of municipal solid waste which is turned into refuse-derived fuel for combustion to generate up to 57 megawatts of energy. The plan is to expand capacity of 900 tons-per-day burn and to add a new turbine generator, which would provide an additional source of renewable energy to the County (County 2009b).
- *New Fire Stations – Unknown construction date*. To meet projected population and economic growth by 2030, the Fire Department estimates 'Ewa would need four new fire stations (DPP 2008).
- *Road Development – Various construction dates*. Numerous projects to improve or construct new roads are planned (DPP 2008; Figure 3.10-2).
- *Rapid Transit System – In progress and future planned*. An elevated rapid transit system is planned for the area and there are plans to start at a point near North-South Road and continue east. Plans further into the future allow extension of the system through Kalaeloa to the City of Kapolei, with a planned ending near the intersection of Kapolei Parkway and an extension of Hanua Street.

3.12.3 Proposed Action

Numerous projects are planned that would construct new facilities in the Kalaeloa region. The Kalaeloa Master Plan and pending development rules would guide the redevelopment of the area and serve to minimize the potential cumulative adverse impacts. Land use plans guide development to minimize cumulative impacts of individual development projects. The proposed action and other projects approved within the Kalaeloa area would be consistent with the Kalaeloa Special Area Plan and Kalaeloa Master Plan. The proposed actions would not have an additive adverse impact on air quality, ambient noise, geology and soils, water resources, biological resources, cultural resources, socioeconomics, hazardous materials and wastes, visual resources, and utilities and public services relative to the impacts of the cumulative projects.

3.12.4 No-Action Alternative

Under the No-Action Alternative, the proposed construction activities would not occur. No adverse cumulative impacts would occur under the No-Action Alternative.

3.13 IRRETRIEVABLE AND IRREVERSIBLE COMMITMENT OF RESOURCES

Resources that are committed irreversibly or irretrievably are those that cannot be recovered if the proposed action is implemented. The proposed action includes construction that would alter the landscape of approximately 80 acres of currently undeveloped land. The land is subject to a limited-term lease (20 years anticipated), and it could revert to vegetated open space. However, the Kalaeloa Master Plan designates the acreage for eco-industrial uses and the site would likely be developed in the future. The production of the CSP and PV units would result in a commitment of resources.

The proposed action is a renewable energy project that would minimize the State's use of non-renewable resources to generate electricity. The proposed action has a net beneficial impact on resources.

SECTION 4
CONSISTENCY WITH EXISTING PLANS, POLICIES AND CONTROLS

4.1 REGULATORY OVERVIEW

The following is a discussion of the federal, State of Hawaii, and County laws and consultations that are relevant to implementing the Proposed Action.

4.1.1 Federal Regulations

4.1.1.1 Public Utilities Regulatory Policy Act of 1978

The Public Utility Regulatory Policies Act (PURPA) (16 U.S.C. Sections 2601-2645) was passed in 1978 by Congress as part of the National Energy Act. It was written to promote greater use of renewable energy. Before PURPA, only utilities could own and operate electric generating plants. PURPA required utilities to buy power from independent companies that could produce power for less than what it would have cost for the utility to generate the power, called the "avoided cost." PURPA has been effective in promoting renewable energy. The proposed action is consistent with this act.

4.1.1.2 National Historic Preservation Act

The NHPA of 1966, as amended (16 USC §470), recognized the nation's historic heritage and established a national policy for the preservation of historic properties as well as the NRHP. Section 106 of the NHPA requires agencies to take into account the effects of undertakings on historic properties, and affords the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. The project will comply with NHPA and known archaeological resources would be avoided.

4.1.1.3 Endangered Species Act

The ESA as amended (16 USC §1531 *et seq*.) establishes a process for identifying and listing plant and wildlife species determined to be in danger of extinction and providing specific legal protections to conserve them. The DLNR is responsible for enforcement of endangered species law. Threatened and endangered plants were recorded within the eastern area of the study area. The site design is flexible and the plants would be protected during construction and operations.

4.1.1.4 Clean Air Act

The CAA sets NAAQS for SO_2, CO, PM_{10} and $PM_{2.5}$, NO_2, Pb, and O_3. The CAA regulates construction and operation of new stationary sources and modifications of existing stationary sources in its New Source Review program. This program is divided further into non-attainment and attainment area permitting requirements. Non-attainment areas require permitting of all major pollution sources. Attainment areas require the installation of the best available control technology for all major sources and must fall within the next increment of degradation. Major pollution sources require an air quality permit before construction. Under the proposed action, no emissions are anticipated, except steam.

4.1.1.5 Clean Water Act

The CWA of 1972 is the primary federal law that protects the nation's waters, including lakes, rivers, wetlands and coastal areas. The primary objective of the CWA is to restore and maintain the integrity of the nation's waters. In Hawaii, oversight responsibilities lie with the DOH. The DOH reviews and certifies NPDES permit applications and the USEPA coordinates, drafts, and issues NPDES permits for storm water and point source pollution discharges.

The nearest surface water is a drainage canal approximately 0.33 miles from the western boundary of the site. The surface flow across the site is to the south. The annual rainfall is low. An NPDES permit for construction would be acquired. The NPDES Permit process requires submittal of a stormwater management plan prior to commencement of construction that would include a list of BMPs to be implemented and any additional plans to prevent an increase in runoff. During operations, rainfall would be allowed to infiltrate the site through an impervious surface. Stormwater would be retained on sited during construction and operations. NPDES permits would be acquired.

4.1.1.6 Coastal Zone Management Act

The Federal Coastal Zone Management Act (CZMA) was created in 1972 to protect coastal resources in the U.S. Federal consistency (codified at 15 CFR 930) is the CZMA requirement that federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources, or coastal effects) must be consistent with the enforceable policies of a coastal state's federally-approved Coastal Zone Management Program (CZMP). The proposed action is not a federal action and a consistency determination is not required. See Section 4.1.2 for a discussion of the State of Hawaii CZMP.

4.1.2 State of Hawaii

4.1.2.1 Hawaii Endangered Species Law

Under HRS 195D-1 – 32, Hawaii endangered species law any species of aquatic life, wildlife, or land plant that has been determined to be an endangered species pursuant to the federal ESA shall be deemed to be an endangered species in the State of Hawaii. Also, any indigenous species of aquatic life, wildlife, or land plant that has been determined to be a threatened species shall be deemed to be a threatened species in the State of Hawaii. In addition to species that have been determined to be endangered or threatened pursuant to the ESA, the State of Hawaii may determine any indigenous species of aquatic life, wildlife, or land plant to be an endangered species or a threatened species in order to further protect Hawaii's unique ecosystem. Hawaii's endangered species law prevents removal, possession, or sale of endangered or threatened species. DLNR is responsible for enforcement of endangered species law. No impacts to threatened or endangered species were identified.

4.1.2.2 Hawaii Coastal Zone Management Program

In 1977, the Hawaii CZMP was enacted as Chapter 205A HRS in response to the federal CZMA of 1972 described in an earlier section of this EA. The State CZMP area encompasses all the land including the project site. The proposed action is consistent with the 10 policy objectives (*italics*) of the State CZMP as noted below:

1. *Recreational Resources. To provide coastal recreational opportunities accessible to the public and protect coastal resources uniquely suited for recreational activities that cannot be provided*

elsewhere. The project site is more than a mile from coastal areas and would not impact coastal recreational resources.

2. *Historic Resources. To protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture*. Historic resources have been identified in the vicinity of the site and the project would avoid those sites.

3. *Scenic and Open Space Resources. To protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources*. The proposed action is not on the coast and would not impact scenic coastal views. The site development would represent a loss of vegetated open space but construction would be low to the ground with the exception of a support/generator building.

4. *Coastal Ecosystems. To protect valuable coastal ecosystems, including reefs, from disruption and to minimize adverse impacts on all coastal ecosystems*. The proposed action is not on the coast and would have no adverse impact on coastal ecosystems.

5. *Economic Uses. To provide public or private facilities and improvements important to the State's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone area*. There would be economic benefits associated with construction and operation of the new power generating facility. The renewable energy project is appropriately sited at the eco-industrial area of the Kalaeloa Community Development District.

6. *Coastal Hazards. To reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution*. The proposed action would not increase the environmental risk associated with the hazards listed.

7. *Managing Development. To improve the development review process, communication, and public participation in the management of coastal resources and hazards*. This EA supports the managing development objective and policies by providing opportunity for public and agency review and comment on the Draft EA.

8. *Public Participation. To stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZMP*. This EA supports this objective by providing opportunity for public and agency review and comment on the Draft EA.

9. *Beach Protection. To protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion*. The proposed action is more than a mile from the nearest beach and would have no impact on beaches.

10. *Marine Resources. To implement the State's ocean resources management plan*. The proposed action would have no impact on ocean resources.

The CZMP also establishes a permit/approval system to control development in SMAs that are managed by each county and the State Office of Planning. The proposed action is located more than a mile inland of the SMA (Figure 2.1). The program has a federal consistency provision that requires federal activities, permits and financial assistance would be consistent with the Hawaii CZMP. The proposed action does not require federal permits or financial assistance and does not require a federal consistency determination. The project is consistent with the CZMP objectives. The Office of Planning was provided a copy of the Draft EA for review and comment.

4.1.2.3 Hawaii Clean Energy Initiative

The U.S. Department of Energy and the State of Hawaii signed a Memorandum of Understanding in 2008 establishing the HCEI. The purpose of the Memorandum of Understanding was to increase Hawaii's renewable energy production capabilities and to transition exclusively to renewable energy use on the smaller islands.

Hawaii established a renewable energy goal in 2001, which was later replaced with an enforceable Renewable Portfolio Standard (RPS) under Senate Bill 2474 in June 2004. Hawaii's RPS was expanded when HB 1464 was signed in 2009, increasing renewable electrical energy generation required by utilities to reach 40 percent by 2030 (State of Hawaii HB 1464).

The RPS schedule requires that each company that sells electricity in Hawaii must sell the following percentages of renewable electrical energy:

- 10 percent of its net electricity sales by December 31, 2010,
- 15 percent of its net electricity sales by December 31, 2015,
- 25 percent of its net electricity sales by December 31, 2020, and
- 40 percent of its net electricity sales by December 31, 2030.

Under the HCEI, renewable energy is defined as:

- wind,
- sun,
- falling water,
- biogas, including landfill and sewage digester gas,
- geothermal,
- ocean water, currents, and waves, including ocean thermal energy,
- biomass, including crops, agricultural and animal wastes and municipal solid waste,
- biofuels, and
- hydrogen produced by renewable sources.

Renewable electrical energy is any electricity generated using renewable energy, or electrical energy savings brought on by use of renewable displacement or off-set technologies (State of Hawaii HB 1464).

<u>Hawaii Public Utilities Commission</u>

The PUC establishes the standards determining the percentage of the RPS that should be met by each type of renewable electrical energy source. By January 1, 2015, a minimum of 50 percent of the RPS must be met with electricity generated using renewable energy. The PUC would enforce the standards by penalizing the utilities that fail to reach them. The PUC works with the Hawaii Natural Energy Institute to conduct a peer-reviewed study each five years. The standard would be evaluated in 2013, with the

findings reported to the legislature before the 2014 legislative session. The PUC created a rate system that sets price guarantees for electricity generated from solar, wind and hydroelectric sources that acts as an incentive to investors to pursue renewable energy development.

Healthy Community Design Smart Growth Checklist

The State of Hawaii has developed a *Healthy Community Design Smart Growth Checklist* of principles to apply to development (http://hawaii.gov/health/environmental/env-planning/landuse/hcdchecklist.pdf). The checklist items are more relevant to the entire Kalaeloa Community Development District than to this one development proposal. The proposed action is consistent with those items that are relevant. One of the four principles is relevant to the proposed action: *Promote clean air by making transit convenient and comfortable, minimizing petroleum fueled car and truck use and minimizing fossil energy use*. The proposed action would minimize fossil fuel use for energy production.

4.2 PERMITS AND APPROVALS REQUIRED

4.2.1 Permits

The permits that may be required before implementation of the project are listed below.

State of Hawaii Permits

- NPDES Notice of Intent, Appendix C (NOI-C) Permit, DOH. Stormwater associated with construction activities.
- Community Noise Control, DOH. A noise variance permit would also be required if work is required during evenings and weekends.
- Sanitary wastewater permit.

County Permits

- Building and renovation permits from DPP.
- Minor conditional use permit for utility installation Type B from DPP, per pre-assessment consultation letter (Appendix A1).
- Grading permit from DPP.

4.2.2 Approvals

Plan review and approval would be required by the following agencies:

- County Department of Environmental Services – for solid waste management.
- FAA – Determination of No Hazard for Air Navigation
- SHPD – per HRS §6E-8, DHHL shall consult with SHPD regarding the effect of the project upon historic property or a burial site.
- DHHL – as land owner, is the approving agency for this EA and has determined the project would have no significant impact.

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SECTION 5
DETERMINATION

5.1 COMPARISON OF THE ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

The proposed action would construct two 5 MW renewable power-generating facilities in Kalaeloa. A summary of potential impacts and mitigation measures are listed in Table 5.1. Environmental protection measures that are required by law or as conditions to permits are not considered mitigation but are considered part of the proposed action.

Table 5.1. Summary of Impacts and Potential Mitigation

Resource	*Proposed Action Potential Impacts*	*Mitigation Proposed for Consideration*	*No Action*
Land Use	No significant adverse impact. Consistent and compatible with existing and planned land uses for overall beneficial impact.	Not applicable.	No impact.
Air Quality	No significant adverse impact with construction BMPs.	Not applicable.	No impact.
Noise	No significant adverse impact.	Not applicable.	No impact.
Geology and Soils	No significant adverse impact with BMPs and adherence to permit conditions to control erosion.	Not applicable.	No impact.
Water Resources	No significant adverse impact with BMPs to control stormwater onsite and adherence to permit conditions.	Not applicable.	No impact.
Biological Resources	No adverse impact identified within the proposed development area.	Not applicable.	No impact.
Archaeological Resources	No negative impacts to NRHP and HRHP eligible archaeological resources are anticipated under the proposed action. The four eligible sites will be preserved through a combination of preservation and interpretation. There is potential for construction phase impacts to known archaeological sites and for inadvertent discovery of burials.	Implementation and maintenance of HPP and AMP.	Potential for inadvertent disturbance or vandalism of sites.
Socioeconomics and Cultural Environment	Beneficial impact on DHHL mission through collection of lease fees. No significant adverse impact on socioeconomics and cultural environment.	Not applicable.	Lost economic and social opportunity to collect lease revenue.
Hazardous Materials and Wastes	No significant impact with adherence to applicable laws and regulations.	Not applicable.	No impact.
Visual Resources	No significant impact.	Not applicable.	No impact.
Utilities and Public Services	No significant impact.	Not applicable.	No impact.

5.2 SIGNIFICANCE CRITERIA

The Significance Criteria in HAR Title 11, 200-12 for environmental impacts were reviewed and the proposed project was assessed for significant impacts. The evaluation included all phases of the proposed action, both direct and indirect impacts and short-term and long-term effects, and the cumulative effects. Short-term is considered to be construction phase and long-term is the operational phase in the discussion below. Each of the significance criteria listed below is followed by the evaluation.

1. Involves an irrevocable commitment or loss or destruction of any natural or cultural resource.

The proposed action would not result in an irrevocable commitment, loss or destruction of any protected natural resource. No threatened or endangered species were identified within the development area or proposed final lease area (See Section 3.6). Negotiations with DHHL for the lease boundaries are ongoing.

There are four cultural sites within the development area and the proposed final lease area considered significant under NRHP and HRHP (See Section 3.7). KSP proposes to preserve those four sites because together they have the highest integrity for interpretation of the range of traditional Hawaiian activities once pursued in this portion of the `Ewa Plain. Those sites that remain in the lease area would be preserved according to the terms of the HPP and AMP approved by SHPD. Preservation measures may include routine maintenance, establishment of a protective buffer around the site, and opportunity for community access for cultural or education purposes.

No negative impacts to NRHP/HRHP eligible archaeological resources are anticipated under the proposed action.

During operation, there would be no irrevocable commitment, loss or destruction of any identified natural or cultural resource. There would be a commitment to protect those resources within the lease area resulting in a net beneficial impact. There would be no significant cumulative adverse impact on natural and cultural resources.

2. Curtails the range of beneficial uses of the environment.

The proposed action would not affect the range of beneficial uses of the environment. The land that would be used is currently vacant; however, the site is designated for development and eco-industrial use in the Kalaeloa Master plan. The proposed renewable energy project is an eco-industrial use. The Master Plan is a roadmap to guide development that collectively meets community goals for land use. The site is not suitable for developments greater than 180 ft. in height because of proximity to Kalaeloa Airport. The proposed action would not curtail the range of beneficial uses of the environment in the short or long-term.

3. Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The proposed action supports the State's long term environmental policies or goals in Ch 344, HRS. Specifically:

HRS §344-3 *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which would foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.*

The renewable energy project would indirectly reduce Hawaii's reliance on fossil fuels to produce energy and reduce the amount of greenhouse gases generated from energy production. It would not have direct adverse impacts land, water, mineral, visual, air and other natural resources.

The HRS §344-4 guidelines are generally not relevant to the proposed action; however, the proposed action is consistent with those that are relevant, as listed below:

HRS §344-4 *Guidelines*

(2) Land, water, mineral, visual, air, and other natural resources.

(A) Encourage management practices which conserve and fully utilize all natural resources;

(3) Flora and fauna.

(A) Protect endangered species of indigenous plants and animals and introduce new plants or animals only upon assurance of negligible ecological hazard;

(5) Economic development.

(A) Encourage industries in Hawaii which would be in harmony with our environment;

(7) Energy.

(A) Encourage the efficient use of energy resources.

The proposed action would not have a significant adverse impact on the environment. It would be consistent with the State of Hawaii's long-term environmental policies, goals, and guidelines. Additionally, the proposed action contributes to statewide goals to increase energy produced by renewable sources.

4. Substantially affects the economic or social welfare of the community or State.

The proposed action has beneficial impacts on socioeconomics during construction related to employment opportunities and purchase of materials. During operations, the benefit to the social welfare of the community and State would be realized cumulatively as other renewable energy projects are developed, decreasing the State's reliability on fossil fuels for energy production. There would be new fulltime jobs created. There would be a beneficial indirect impact on the Hawaiian community through the collection of lease fees by the DHHL. In addition, there would a provision in the lease agreement for a portion of the net annual profits to go to renewable energy projects and education to benefit the Hawaiian community.

5. Substantially affects public health.

During both construction and operation of the proposed facility, no adverse impacts to public health are anticipated. Construction and operation would be compliance with all federal, state, and county regulations. Beneficial impacts to public health would be realized cumulatively as other renewable energy projects are developed, reducing dependence on power generated with fossil fuel and associated air emissions.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities.

The proposed action would not induce population growth or adversely impact public infrastructure. There would be minimal increase in commuter traffic associated with the work force at the site.

7. Involves a substantial degradation of environmental quality.

During construction, there would be short-term air quality and noise impacts. The BMPs required as permit conditions would be implemented to minimize construction impacts. During operations, there would be minimal adverse impact on environmental quality. The minimal amounts of hazardous and regulated materials used onsite would be managed in accordance with applicable regulations. The decreased dependence on fossil fuel would be an indirect beneficial impact on environmental quality. Therefore, no substantial degradation of environmental quality is anticipated.

8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

The cumulative impacts associated with the proposed action would be beneficial to the environment. As an eco-industrial use, the project is consistent with the Kalaeloa Master Plan. A value of Master Plans is that they guide future development to minimize adverse cumulative impacts and to meet community goals for land use.

9. Substantially affects a rare, threatened, or endangered species or its habitat.

No rare, threatened or endangered species were identified in the proposed development area (Figure 3.6, Section 3.6). The lease agreement for the proposed site boundary has not been finalized, but it will likely approximate the exterior fenceline shown on Figure 2.3. No direct, indirect or cumulative impacts to species or habitats were identified.

10. Detrimentally affects air or water quality or ambient noise levels.

During the construction phase, there would be short-term air quality and ambient noise impacts. To minimize air quality impacts during construction, dust control measures would be implemented to minimize wind-blown emissions. Noise impacts from construction would be minimized by limiting construction activities to daylight hours and by following all applicable regulations. During operations, there would be minimal impacts to air and noise and these impacts are unlikely to be unnoticeable beyond the property boundary.

No stormwater would leave the site during construction or operation. BMPs would be implemented as part of permit conditions to protect water resources. The nearest water body is an unnamed channel west of the site. Stormwater would be retained onsite.

While there are a number of construction projects proposed in Kalaeloa, it is unlikely they would occur concurrently in the same vicinity. No detrimental construction phase cumulative impacts on air, water or noise are anticipated. The proposed action would have no additive adverse cumulative impacts during the operational phase. See Sections 3.2, 3.5 and 3.3 for more discussion on the potential impact to air, water quality and ambient noise, respectively.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The proposed action is not located in any of the environmentally sensitive areas listed. No increased risk to or from the development is anticipated. No indirect or cumulative impacts are anticipated on environmentally sensitive areas.

12. Substantially affects scenic vistas and view planes identified in county or state plans or studies.

The proposed action would not directly or indirectly affect any identified scenic views or view planes as described in Section 3.10. No cumulative impacts to visual resources are anticipated.

13. Requires substantial energy consumption.

The proposed action would require energy during construction, but would generate energy during operation. The proposed action would have a beneficial impact on energy supply by providing electricity to HECO.

5.3 DETERMINATION

Based on analysis of the 13 significance criteria listed in Section 5.3, the proposed action would not result in significant adverse environmental impacts. DHHL has determined an Environmental Impact Statement is not required and issued a FONSI.

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SECTION 6
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APPENDIX A

PUBLIC INVOLVEMENT

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APPENDIX A1
PRE-ASSESSMENT CONSULTATION

In preparation of the Draft EA, a pre-assessment consultation letter was sent to agencies and organizations on August 6, 2010. The distribution list and correspondence received is included in this Appendix A1 and summarized in Table A.1. Key issues included:

- presence of threatened and endangered plants, and anchaline pools;
- presence archaeological resources and burials;
- impact of reflectivity and thermal currents on air navigation;
- potential impacts to navigable waters of the U.S.; and
- prevailing land use zoning.

If a date is not noted in that column, then TEC did not receive a reply from that party during the pre-assessment comment period. Response letters to the pre-assessment consultation letter are included in this Appendix A1 following Table A-1. The comments were considered during preparation of the Draft EA.

Table A.1. Distribution List for Pre-Assessment Consultation Letter

Date of Response - If Any	*Addressees*
Federal Parties	
	Manager Honolulu Airports District Office Federal Aviation Administration 300 Ala Moana Blvd., Box 50244 Honolulu, HI 96850-0001
	Commander Naval Facilities Engineering Command Pacific 258 Makalapa Drive, Suite 100 Pearl Harbor, Hawaii 96860-3134
August 31,2010	U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office 300 Ala Moana Blvd., Room 3-122 Box 50088 Honolulu, HI 96813
August 18, 2010	Commander and Division Engineer U.S. Army Corps of Engineers Pacific Ocean Division, Building 230 Fort Shafter, HI 96858-5440
September 8, 2010	Commander U.S. Coast Guard 14th Coast Guard District 300 Ala Moana Blvd. Honolulu, HI 96850
	Director of Water Programs U.S. Geological Survey 677 Ala Moana Blvd. #415 Honolulu, HI 96813
	Region 9, Pacific Islands Office U.S. Environmental Protection Agency P.O. Box 50003 Honolulu, HI 96850

Date of Response - If Any	***Addressees***
State Parties	
	Governor Linda Lingle Office of the Governor State Capitol Honolulu, HI 96813
	Hawaii Community Development Authority 677 Ala Moana Blvd., Suite 1001 Honolulu, Hawaii 96813
	Hawaii Coastal Zone Management Program Office of Planning P.O. Box 2359 Honolulu, HI 96804
	Hawaii State Department of Health Office of Environmental Quality Control 235 S. Beretania Street, Suite 702 Honolulu, HI 96813
	State of Hawaii Dept. of Business, Economic, Development & Tourism Land Use Commission PO Box 2359 Honolulu, HI 96804
	State of Hawaii Department of Health Hazard Evaluation and Emergency Response Office 919 Ala Moana Blvd., Room 206 Honolulu, HI 96814
	Headquarters Hawaii Air National Guard 3949 Diamond Head Road Honolulu, HI 96816
August 18, 2010	State of Hawaii Department of Health, Environmental Planning Office PO Box 3378 Honolulu, HI 96801
August 12, 2010 from Commission of Water Resources Management	State of Hawaii Department of Land and Natural Resources, Land Division 1151 Punchbowl St, Room 220 Honolulu, HI 96813
	State Historic Preservation Division Department of Land & Natural Resources 601 Kamokila Blvd. Kapolei, HI 96707
	State of Hawaii Department of Planning 235 S. Beretania Street, #600 Honolulu, HI 96813
September 14, 2010	State of Hawaii Department of Transportation 869 Punchbowl Street Honolulu, HI 96813
	Director UH Manoa Environmental Center 2500 Dole, Krauss Annex 19 Honolulu, HI 96822

Date of Response - If Any	*Addressees*
City and County Parties	
	Mayor Mufi Hannemann 530 S. King Street Honolulu, HI 96813
August 16, 2010	Police Chief City and County of Honolulu Police Department 801 South Beretania Street Honolulu, HI 96813
September 14, 2010	City & County of Honolulu Department of Planning and Permitting 650 South King Street Honolulu, HI 96813
	Department of Parks and Recreation 1000 Uluohia Street, Suite 309 Kapolei, Hawaii 96707
Utilities and Services	
August 23, 2010	Chief Engineer Board of Water Supply 630 South Beretania Street Honolulu, HI 96813
	Hawaiian Electric Company PO Box 2750 Honolulu, HI 96740
	Honolulu Department of Environmental Services 1000 Uluohia Street, Suite 308 Kapolei, HI 96707
Local Organizations	
	Ahahui Siwila Hawaii O Kapolei Hawaiian Civic Club PO Box 700007 Kapolei HI 96709-007
	Hawaiian Homes Commission Department of Hawaiian Home Lands PO Box 1879 Honolulu, HI 96801
	Historic Hawaii Foundation Dole Cannery Dole Office Building Tower, Suite 690 680 Iwilei Road Honolulu, HI 96817
	Office of Hawaiian Affairs 711 Kapiolani Blvd., Suite 500 Honolulu, HI 96813
August 30, 2010	Oahu Island Burial Council Department of Land & Natural Resources P.O. Box 621 Honolulu, HI 96809
	Housing and Community Development Corporation of Hawaii 1002 North School Street Honolulu, Hawaii 96817

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2010-TA-0436

AUG 3 1 2010

Ms. Rachael Ross
TEC Incorporated
Pauahi Tower
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Subject: Preparation of an Environmental Assessment for the Kalaeloa Solar One Power Generating Facility, Kalaeloa, Oahu [TMK (1) 9-1-013:028 portion]

Dear Ms. Ross:

This letter acknowledges the U.S. Fish and Wildlife Service's (Service) receipt of your letter on August 10, 2010, in which you requested assistance regarding the preparation of a draft Environmental Assessment (DEA) for the proposed Kalaeloa Solar One four megawatt solar power generating facility on the island of Oahu. The facility is proposed to be built on undeveloped land on the former Barbers Point Naval Air Station [TMK (1) 9-1-013:028 portion] managed by the Hawaii Community Development Authority.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP Program. Two federally endangered plants, Ewa hinahina (*Achyranthes splendens* var. *rotundata*) and Ewa plains akoko (*Chamaesyce skottsbergii* var. *kalaeloana*) are known to occur near the proposed project location. In addition, this area also has a high concentration of unique limestone anchaline pool communities. The anchaline pools support opae ula (*Halocaridina rubra*) at risk anchialine pool shrimp and *Metabetaeus lohena* an anchialine pool shrimp that is a candidate for listing under the Endangered Species Act (ESA). Additionally, there are restored pools near your location that have begun translocation of the orangeblack damselfly (*Megalagrion xanthomelas*), also a candidate species.

We offer the following recommendations to assist you with your environmental review. We recommend that a knowledgeable botanist survey for federally listed plant species during the wettest portion of the year (November to April) within your proposed project area. The project location should also be surveyed for the presence of anchaline pools.

TAKE PRIDE IN AMERICA

Ms. Rachael Ross 2

If it is determined that the proposed project may affect federally listed species, we recommend you contact our office early in the planning process so that we may assist you with the ESA compliance. If the proposed project is funded, authorized, or permitted by a Federal agency, then that agency should consult with us pursuant to section 7(a)(2) of the ESA. If no Federal agency is involved with the proposed project, the applicant should apply for an incidental take permit under section 10(a)(1)(B) of the ESA. A section 10 permit application must include a habitat conservation plan that identifies the effects of the action on listed species and their habitats, and defines measures to minimize and mitigate those adverse effects.

If you have questions, please contact Aaron Nadig, Fish and Wildlife Biologist, Consultation and Habitat Conservation Program (phone: 808-792-9466; fax: 808-792-9581).

Sincerely,

for Loyal Mehrhoff
Field Supervisor

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

August 18, 2010

Regulatory Branch File Number POH-2010-0211

TEC Inc.
Attention: Rachel Ross
1003 Bishop Street
Suite 1550, Pauahi Tower
Honolulu, Hawaii 96813

Dear Ms. Ross:

We have you applicant's letter dated July 26, 2010 requesting the Department of the Army review and comment on the proposed Kalaeloa Solar One Facility at TMK (1) 9-1-013:028, Kalaeloa, Island of Oahu, Hawaii. We have assigned the project the reference number **POH-2010-0211**. Please cite the reference number in any future correspondence concerning this project. We completed our review of the submitted document pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404).

Section 10 requires that a Department of the Army (DA) permit be obtained from the U.S. Army Corps of Engineers (Corps) prior to undertaking any construction, dredging and other activities occurring in, over, or under navigable waters of the U.S. The line of jurisdiction extends to the Mean High Water Mark (MHWM) for tidal waters. Section 404 requires that a DA permit be obtained for the discharge (placement) of dredge and/or fill material into waters of the U.S., including wetlands. The line of jurisdiction extends to the Mean Higher High Water Mark (MHHWM) for tidally influenced waters, the Ordinary High Water Mark (OHWM) for non-tidal waters and the approved delineated boundary for wetlands.

Based on the information the applicant provided, the project site appears to be absent of navigable waters subject to Corps jurisdiction. Therefore, Section 10 authorization may not be required. It appears the project site is also absent of waters of the U.S., subject to Corps jurisdiction, therefore, it appears a **DA permit is not required**. Be advised, the project site abuts an unnamed drainage canal with end terminus in the Pacific Ocean, a traditionally navigable water, and as such, is a water of the U.S. subject to Corps jurisdiction. To avoid unintentional violation to federal regulation and law, we advise the applicant contact our office prior to conducting any activity that may result in the discharge of dredged and/or fill material into this water body, as Section 404 authorization may be required for this action. Also be advised that any tributaries discharging into this drainage canal may also be subject to Corps jurisdiction. The Corps does not have sufficient information to determine if the project site encompasses additional unidentified waters of the U.S. or whether such waters are proposed for impact, which may also require authorization under Section 404.

Only the Corps of Engineers has the authority to determine if any of these aquatic features are or are not waters of the U.S., potentially subject to regulations under Section 10 and/or Section 404. To avoid unintentional violation to Federal law and regulations, we encourage the landowner to submit a request for an approved jurisdictional determination (JD) for these water bodies. Your request to the Corps should include descriptions of aquatic features, including any wetlands, drainage ditches, gulches, gullies, streams, etc., on-site, especially those that may be impacted by any of the proposed project components, flow duration of each feature and the flow path of each feature into navigable waters. For instance: "the unnamed ditch contains flow for two consecutive weeks annually and, from the project impact site, flows for 700 linear feet prior to discharge into X Stream. X Stream flows year-round and flows 1,200 feet prior to discharge into the Pacific Ocean." For wetlands, you should submit a wetland delineation conducted in accordance with the Corps of Engineers 1987 Wetland Delineation Manual and the Hawai'i and Pacific Islands Regional Supplement. In addition, include sufficient information concerning the scope of work, including the use of Best Management Practices, i.e. silt fences and sandbag berms within the vicinity and in close proximity to potentially regulated bodies of water. We recommend the applicant also include a vicinity map, map of the water bodies and flow paths and on-site photographs so the Corps may conduct an approved JD, if necessary.

If any water bodies are determined to be waters of the U.S., the applicant must obtain authorization from the Corps prior to discharge of dredged or fill material into these water bodies. Fill material, permanent or temporary, may include, but is not limited to: rock, dirt, sand, sandbags, silt fences or concrete. The applicant should contact the Corps to determine if any of the proposed work constitutes a "discharge of fill" and submit an application and associated drawings that meet our drawing recommendations found at *http://poh.usace.army.mil/EC-R/EC-R.htm*. The Corps will then review the application to ensure it complies with all necessary federal laws and regulations. Note that if the fill results in the loss of waters of the U.S. and/or associated functions, the applicant may be required to provide compensatory mitigation for any unavoidable impacts. A request for an approved JD can be submitted prior to, or concurrently with, an application for the proposed work.

Thank you for contacting us regarding this project and providing us with the opportunity to comment. Should you have any questions, please contact Ms. Jessie Pa'ahana at *808.438.0391* or via email at *Jessie.K.Paahana@usace.army.mil*. Please be advised you can provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at *http://per2.nwp.usace.army.mil/survey.html*.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

U.S. Department of Homeland Security
United States Coast Guard

Commander
Fourteenth Coast Guard District

300 Ala Moana Boulevard, #9116
Honolulu, HI 96850-4982
Staff Symbol: dm
Phone: (808) 535-3255
Fax: (808) 535-3284
Email: john.k.lee@uscg.mil

11000
September 8, 2010

TEC, Inc.
ATTN: Rachel Ross
1003 Bishop Street, Suite 1550, Pauahi Tower
Honolulu, HI 96813

SUBJECT: PRE-ASSESSMENT CONSULTATION, POWER-GENERATING FACILITY, KALAELOA, HAWAII

Dear Ms. Ross,

The Coast Guard's main concern with the proposed Kalaeloa power-generating facility is how it will affect our operations at Kalaeloa Airport:

The proposed site is in close proximity to the traffic patterns for runways 4L/22R and 11/29. Reflected sunlight from solar panels may affect Coast Guard aircrew visibility and create a potential for runway closures and operating restrictions.

Coast Guard Air Station Barbers Point (ASBP) is the primary aviation Search and Rescue (SAR) facility for more than 12 million square miles of the Central Pacific region. Our aircraft must be able to respond to emergencies, at any moment to render assistance. If the proposed facility results in interrupted use of runways at Kalaeloa Airport, the outcome of SAR missions may be adversely affected

The potential for the production of thermal currents near the site could create hazardous turbulence and compromise the safety of aircrews.

Ms. Ross, we look forward to participation in the Environmental Assessment and thank you for the opportunity to provide preliminary comments. If you have any questions, please contact Mr. John Lee at the phone number or addresses shown above.

Sincerely,

J.M. BROCKUS
Commander, U.S. Coast Guard
Chief, Resource Management Staff
By Direction

Copy: USCG Air Station Barbers Point

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:
EPO-I-3300

August 18, 2010

TEC Inc.
Ms. Rachel Ross
1003 Bishop Street, Suite 1550
Pauahi Tower
Honolulu, Hawaii 96813

Dear Ms. Ross:

SUBJECT: Pre-Assessment Consultation and Notice of Preparation of an Environmental Assessment for Kalaeloa Solar One proposal to construct a 4 MW power generating facility at Kalaeloa, Oahu, Hawaii

Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have no comments at this time, but reserve the right to future comments. We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

The same website also features a Healthy Community Design Smart Growth Checklist (Checklist). The Hawaii State Department of Health, Built Environment Working Group, recommends that State and county planning departments, developers, planners, engineers and other interested parties apply the healthy built environment principles in the Checklist whenever they plan or review new developments or redevelopments projects. We also ask you to share this list with others to increase community awareness on healthy community design.

If there are any questions about these comments please contact the Environmental Planning Office at 586-4337.

Sincerely,

GENEVIEVE SALMONSON, Acting Manager
Environmental Planning Office

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED SEP 0 2 2010

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 30, 2010

TEC Inc.
1003 Bishop Street Suite 1550
Pauahi Tower
Honolulu, Hawaii 96813

Attention: Ms. Rachel Ross

Ladies and Gentlemen:

Subject: Pre-Assessment Consultation and Notice of Preparation of an Environmental for 4 MW power generating facility

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Commission on Water Resource Management, Land Division-Oahu District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

for Morris M. Atta
Acting Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 12, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division –Oahu District
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation and Notice of Preparation of an Environmental Assessment for 4 MW power generating facility
LOCATION: Island of Oahu
APPLICANT: Kalaeloa Solar One

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by August 30, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed:
Date: August 13th, 2010

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION
2010 AUG 13 P 3:00
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 12, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division –Oahu District
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation and Notice of Preparation of an Environmental Assessment for 4 MW power generating facility
LOCATION: Island of Oahu
APPLICANT: Kalaeloa Solar One

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by August 30, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

RECEIVED
COMMISSION ON WATER
RESOURCE MANAGEMENT
2010 AUG 13 AM 11:51

(✓) We have no objections.
( ) We have no comments.
( ) Comments are attached.

Signed: RK Chang
Date: 8/13/10

FILE ID: RFD. 27123
DOC ID: F 7821 v
6185v

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
JIRO A. SUMADA

IN REPLY REFER TO:

STP 8.0231

September 14, 2010

Ms. Rachel Ross
TEC Inc.
1003 Bishop Street, Suite 1550
Pauahi Tower
Honolulu, Hawaii 96813

Dear Ms. Ross:

Subject: Kalaeloa Solar One
Pre-Assessment Consultation for Draft Environmental Assessment (DEA)

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project, which proposes to construct and operate a 4 MW power generating facility consisting of the solar array and field control buildings. The project will include 13,824 collectors aligned in 192 rows of 72 collectors per row. Other operating equipment includes an expansion tank, pumps, flow meters, temperature sensors, and a cooling tower. The subject project is located on lands under the jurisdiction of the Hawaii Community Development Authority (HCDA).

Given the project location, DOT's nearby State airport (Kalaeloa Airport) and highway facilities will be impacted. DOT offers the following comments:

1. The DEA should evaluate impacts to the State highways facilities in the area. If the evaluation findings indicate that the subject project will create any significant impacts, then a traffic assessment will be required. The traffic assessment, if warranted, shall address the impacts and identify required mitigation measures.

2. The DEA should address any reflectivity impacts from the collectors to aircraft operations at Kalaeloa Airport and Honolulu International Airport.

3. Because of the close proximity of the facility to Kalaeloa Airport, DOT recommends that the applicant file Federal Aviation Administration (FAA) Form 7460-1: Notice of Proposed Construction or Alteration. This is the website for filing FAA Form 7460-1: https://www.oeaaa.faa.gov/oeaaa/external/portal.jsp.

4. The DEA should provide information about the height of the structures. The horizontal zone above the property is 180 feet above sea level. Further, the total land area to be occupied should be addressed.

Ms. Rachel Ross STP 8.0231
Page 2
September 14, 2010

DOT appreciates the opportunity to provide comments. If there are any questions, including the need to meet with DOT Airports Division or Highways Division staffs, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at telephone number (808) 587-2356.

Very truly yours,

BRENNON T. MORIOKA, Ph.D., P.E.
Director of Transportation

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

LOUIS M. KEALOHA
CHIEF

DELBERT T. TATSUYAMA
RANDAL K. MAGADANGDANG
DEPUTY CHIEFS

OUR REFERENCE DMK-DK

August 16, 2010

Ms. Rachel Ross
TEC Inc.
Pauahi Tower, Suite 1550
1003 Bishop Street
Honolulu, Hawaii 96813

Dear Ms. Ross:

This is in response to a letter from Kalaeloa Solar One requesting comments on a Pre-Consultation and Notice of Preparation of an Environmental Assessment regarding their proposal to construct a 4 MW power-generating facility in Kalaeloa.

This project should have no significant impact on the facilities or operations of the Honolulu Police Department.

If there are any questions, please call Major Michael Moses of District 8 (Kapolei/ Waianae) at 692-4253.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By
DAVE M. KAJIHIRO
Assistant Chief of Police
Support Services Bureau

Serving and Protecting With Aloha

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

KIRK W. CALDWELL
ACTING MAYOR

DAVID K. TANOUE
DIRECTOR

ROBERT M. SUMITOMO
DEPUTY DIRECTOR

September 14, 2010

Ms. Rachel Ross
TEC Inc.
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Ross:

Subject: Pre-Assessment Consultation and Notice of Preparation of Environmental Assessment
Kalaeloa Solar One Facility
Kalaeloa Community Development District
Tax Map Key 9-1-13: Portion 028, Honouliuli, Ewa, Oahu, Hawaii

This is in response to your letter of July 26, 2010 requesting comments on the subject project.

Kalaeloa Community Development District is under the jurisdiction of the Hawaii Community Development Authority (HCDA), State of Hawaii. As such, the Department of Planning and Permitting (DPP) will defer to HCDA regarding planning requirements. However, we understand that the DPP permits are required, including a Conditional Use Permit-Minor (CUPm), grading, grubbing, and building permits, if applicable.

For your information, we offer the following additional comments:

1. The project area is outside of the Special Management Area.

2. According to the City's adopted Kalaeloa Special Area Plan (SAP), the site is identified as Parcel No. 4 and is intended for limited industrial uses and should conform to the City's I-1 Light Industrial District zoning classification. The SAP also indicates that the project area contains archaeological sites. We suggest that the State Department of Land and Natural Resources be consulted.

3. The site was formerly a part of Naval Air Station Barber Point (NASBP). NASBP was closed under the federal base re-alignment and closure process and the project area was released from federal jurisdiction. Since the HCDA has not adopted rules governing development in the Kalaeloa Community Development District, under the City's zoning code, the project area is subject to P-2 General Preservation

Ms. Rachel Ross
TEC Inc.
September 14, 2010
Page 2

development standards. Under the Land Use Ordinance, power generation projects with potential major impacts including visual, noise, and traffic impacts, are considered "Utility Installations, Type B," and subject to obtaining a (CUPm). We find that the proposed use falls under this use and permit.

Our guideline for preparing the required CUPm is available online at:

http://www.honoluludpp.org/download/permits/permitlistings.asp?p_TypeID=2

Thank you for the opportunity to comment. If you have any questions, please contact Raymond Young of our staff at 768-8049.

Very truly yours,

David K. Tanoue, Director
Department of Planning and Permitting

DKT:lh

cc: Kirk W. Caldwell, Acting Mayor

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

August 23, 2010

KIRK W. CALDWELL, Acting Mayor

RANDALL Y. S. CHUNG, Chairman
WILLIAM K. MAHOE
THERESIA C. McMURDO
ADAM C. WONG

JEOFFREY S. CUDIAMAT, Ex-Officio
BRIENNON T. MORIOKA, Ex-Officio

WAYNE M. HASHIRO, P.E.
Manager and Chief Engineer

DEAN A. NAKANO
Deputy Manager

Ms. Rachel Ross
TEC, Incorporated
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Ross:

Subject: Letter Dated July 26, 2010 Requesting Comments for the Environmental Assessment for the Proposed Kalaeloa Solar One 4 MW Power Generating Facility In Kalaeloa

This site is served by a private water system. Water service for this development should be coordinated with the U.S. Navy who is providing water to this area.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

PAUL S. KIKUCHI
Chief Financial Officer
Customer Care Division

Water for Life . . . Ka Wai Ola

From: Ross, Rachel S.
To: Caplan, Faith R.
Subject: FW: OIBC: Kalaeloa Solar One
Date: Wednesday, September 29, 2010 3:27:39 PM

Rachel Ross
TEC Inc.
808.528.1445

From: Kawika McKeague [mailto:kmckeague@group70int.com]
Sent: Monday, August 30, 2010 10:39 AM
To: Ross, Rachel S.
Cc: shad kane
Subject: OIBC: Kalaeloa Solar One

Aloha Ms. Rachel Ross-

I received a notice letter from Darren Kimura for the Kalaeloa Solar One project. As the OIBC Chair and one of two OIBC representatives from the 'Ewa moku district, I'm interested to learn more about the project and specifically understanding the nature and extent of proposed land use activities that will possibly require extensive grading/excavation. Subsequently, what then is your planned approach for identifying and investigating the project's impacts to archaeological and cultural resources, including potential for iwi kupuna encounters?

If you feel it may be beneficial to do a presentation before the OIBC, I welcome your attendance. I am setting the agenda for our monthly scheduled meeting that occurs every 2nd Wednesday of the month. I'll have to set the agenda for the upcoming meeting on 9/8 by this Wed. (9/1). If you feel that a presentation to full Council is not necessary at this time, I would recommend that perhaps you consider a meeting/presentation with Mr. Shad Kane and I as the 'Ewa representatives. Mahalo nui for your time and consideration.

Ola na iwi,
Kawika

Kawika McKeague
Senior Planner
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813
(808) 523-5866 phone
(808) 523-5874 fax
www.group70int.com

Hi'ialoākuapapa Sustainable Marketplace of the Pacific
www.sustainablemarketplacepacific.com/

Please consider the environment before printing this message.

This message, including any attachments, is intended solely for the addressee(s) and is confidential. It may also contain information that is legally privileged. Any person other than an intended recipient, or other party expressly authorized by the sender, is prohibited from using, copying, distributing, or otherwise disclosing the information contained herein. If you received this message in error, please immediately delete it and all copies, and promptly notify the sender. Thank you.

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APPENDIX A2
DRAFT EA COMMENTS AND RESPONSES

The Hawaii Office of Environmental Quality Control (OEQC) published DHHL's anticipated Finding of No Significant Impact (FONSI) as a Draft EA in *The Environmental Notice,* which was available online and initiated a 30-day comment period. Comments were sent to TEC Inc., as the applicant's representative.

The DEA was available on the OEQC website, at the Kapolei Library, and was provided to the entities listed in Table A.2 below. This table lists the entities contacted and any response received. If no response date is noted, then TEC, Inc. did not receive a comment letter from that party. Comment and response letters are included following Table A.2.

Comments were considered during preparation of this Final EA. Key issues included:

- ownership of and coordination of water service to project site,
- ownership of the wastewater system at the site and disposal methods of wastewater from the site,
- impact of reflectivity and thermal currents on air navigation, and
- presence of archaeological resources and burials.

Table A.2. Distribution List for Draft EA

Date of Response - If Any	*Addressees*
Federal Parties	
See Appendix D for FAA Determination Letters	Federal Aviation Administration Honolulu Airports District Office 300 Ala Moana Blvd., Box 50244 Honolulu, HI 96850-0001
	U.S. Department of the Army Regulatory Branch Fort Shafter, HI 96858-5440
	Naval Facilities Engineering Command Hawaii 400 Marshall Road Pearl Harbor, HI 96860-3139
	U.S. Fish and Wildlife Service Pacific Islands Office PO Box 580003 300 Ala Moana Blvd., Room 3-122 Box 50003 Honolulu, HI 96813
	U.S. Coast Guard 14th Coast Guard District 300 Ala Moana Blvd., #9116 Honolulu, HI 96850
State Parties	
	State of Hawaii Department of Agriculture 1428 S. King Street Honolulu, HI 96814
February 10, 2011	State of Hawaii Department of Accounting and General Services PO Box 119 Honolulu, HI 96813

Date of Response - If Any	***Addressees***
	State of Hawaii DBEDT Office of Planning PO Box 2359 Honolulu, HI 96804
February 4, 2011	State of Hawaii DBEDT Hawaii State Energy Office PO Box 2359 Honolulu, HI 96804
	State of Hawaii Department of Defense 3949 Diamond Head Road Honolulu, HI 96816-4495
January 31, 2011	State of Hawaii Department of Education PO Box 2360 Honolulu, HI 96804
	Department of Hawaiian Home Lands 91-5420 Kapolei Parkway Kapolei, HI 96707
	Department of Hawaiian Homes Lands Hawaiian Homes Commission PO Box 1879 Honolulu, HI 96801
	State of Hawaii Department of Health Environmental Planning Office PO Box 3378 Honolulu, HI 96801
January 31, 2011	State of Hawaii Department of Health Indoor and Radiological Health Branch PO Box 3378 Honolulu, HI 96801
January 6, 2011	State of Hawaii Department of Health Hazard Evaluation and Emergency Response Office 919 Ala Moana Blvd., Room 206 Honolulu, HI 96814
January 11, 2011	State of Hawaii Department of Health Wastewater Branch PO Box 3378 Honolulu, HI 96801
February 3, 2011	Hawaii Community Development Authority 461 Cooke Street Honolulu, HI 96813
	State of Hawaii Department of Human Services 1390 Miller Street, Room 209 Honolulu, HI 96813
	State of Hawaii Department of Labor and Industrial Relations 830 Punchbowl Street Honolulu, HI 96813
February 3, 2011	State of Hawaii Department of Land and Natural Resources Land Division 1151 Punchbowl St., Room 220 Honolulu, HI 96813
February 24, 2011	State of Hawaii Department of Land and Natural Resources Division of Aquatic Resources
February 16, 2011	State of Hawaii Department of Land and Natural Resources State Historic Preservation Division

Date of Response - If Any	***Addressees***
	601 Kamokila Boulevard Kapolei, HI 96707
January 27, 2011	State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife 1151 Punchbowl Street, Room 325 Honolulu, HI 96813
	State of Hawaii Department of Land and Natural Resources Oahu Island Burial Council PO Box 621 Honolulu, HI 96809
February 15, 2011	State of Hawaii Department of Transportation 869 Punchbowl Street Honolulu, HI 96813
	State of Hawaii Department of Transportation Airports Division 400 Rodgers Blvd., Suite 700 Honolulu, HI 96819
	University of Hawaii at Manoa Environmental Center 2500 Dole, Krauss Annex 19 Honolulu, HI 96822
	Housing Finance and Community Development Corporation 677 Queen St. Honolulu, HI 96813
January 14, 2011	State of Hawaii Office of Hawaiian Affairs 711 Kapiolani Blvd., Suite 500 Honolulu, HI 96813
City and County Parties	
February 2, 2011	City and County of Honolulu Fire Department 636 South Street Honolulu, HI 96813-5007
January 6, 2011	City and County of Honolulu Police Department 801 South Beretania Street Honolulu, HI 96813
January 4, 2011	Board of Water Supply 630 South Beretania Street Honolulu, HI 96813
	City and County of Honolulu Department of Planning and Permitting 650 South King Street, 7th Floor Honolulu, HI 96813
January 25, 2011	City and County of Honolulu Department of Design and Construction 650 South King Street, 11th Floor Honolulu, HI 96813
January 7, 2011	City and County of Honolulu Department of Environmental Services 1000 Uluohia Street, Suite 308 Kapolei, HI 96707
January 18, 2011	City and County of Honolulu Department of Facility Maintenance 1000 Uluohia Street, Suite 215 Kapolei, HI 96707

Date of Response - If Any	***Addressees***
January 21, 2011	City and County of Honolulu Department of Parks and Recreation 1000 Uluohia Street, Suite 309 Kapolei, HI 96707
January 5, 2011	City and County of Honolulu Department of Community Services 715 South King Street, Rm. 311 Honolulu, HI 96813
Utilities and Services	
	Hawaiian Electric Company PO Box 2750 Honolulu, HI 96740
	Hawaiian Telcom 1177 Bishop Street Honolulu, HI 96813
Local Organizations	
	Ahahui Siwila Hawaii O Kapolei Hawaiian Civic Club PO Box 700007 Kapolei HI 96709-007
	Makakilo/Kapolei/Honokai Hale Neighborhood Board #34 92-684 Nohona Street Honolulu, HI 96707
	Kapolei Community Development Corporation P.O. Box 700911 Kapolei, HI 96707
	Malu'ohai Residents Association P.O. Box 700911 Kapolei, HI 96707
	Kaupea Homestead Association 91-1036 Kahanalei St. Kapolei, HI 96707

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

January 4, 2011

PETER B. CARLISLE, MAYOR

RANDALL Y. S. CHUNG, Chairman
ANTHONY R. GUERRERO, JR
WILLIAM K. MAHOE
THERESIA C. McMURDO
ADAM C. WONG

GEORGE "KEOKI" MIYAMOTO, Ex-Officio
JEFFREY CHANG, Ex-Officio

WAYNE M. HASHIRO, P.E.
Manager and Chief Engineer

DEAN A. NAKANO
Deputy Manager

Ms. Faith Caplan, AICP
TEC, Incorporated
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Your Letter Requesting Comments on the Draft Environmental Assessment for the Proposed Kalaeloa Solar One and Two Power Generating Facility In Kalaeloa, TMK: 9-1-13:28

These sites are served by a private water system. Water service for this development should be coordinated with the U.S. Navy who is providing water to this area.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

PAUL S. KIKUCHI
Chief Financial Officer
Customer Care Division

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Paul S. Kikuchi
Chief Financial Officer – Customer Care Division
City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Kikuchi,

Thank you for your January 4, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment.

The Final Environmental Assessment has been clarified to state that the Board of Water Supply does not provide water service for this area. Water service for this area will be coordinated with the U.S. Navy, who owns the infrastructure.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF COMMUNITY SERVICES
CITY AND COUNTY OF HONOLULU
715 SOUTH KING STREET, SUITE 311 • HONOLULU, HAWAII 96813 • AREA CODE 808 • PHONE: 768-7762 • FAX: 768-7792

PETER B. CARLISLE
MAYOR

SAMUEL E. H. MOKU
ACTING DIRECTOR

BRIDGET HOLTHUS
DEPUTY DIRECTOR

January 5, 2011

Faith Caplan, AICP
Senior Associate
TEC Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment
Kalaeloa Solar Power, One and Two
Island of Oahu, Ewa District
TMK: 9-1-013: 028 (portion)

We have received your letter with no date regarding the subject project and wish to thank you for providing the opportunity to comment on the proposal.

Our review of the material provided indicates that the proposed project will have no adverse impacts on any Department of Community Services' activities or projects in the area at this time. We have noted that the project supports the State of Hawaii Clean Energy Initiative, will create thirty (30) full time jobs, and will provide additional power to the Ewa District.

Thank you again for providing us this opportunity to comment on this matter.

Sincerely,

Samuel E.H. Moku
Acting Director

SEHM:sk

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Samuel E.H. Moku
Acting Director
City and County of Honolulu
Department of Community Services
715 South King Street, Suite 311
Honolulu, Hawaii 96813

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Moku,

Thank you for your January 5, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment.

We note that the Department of Community Services (Department) has reviewed the Draft Environmental Assessment and determined that the proposed project will have no adverse impacts on the Department's activities or projects.

Please note that the proposed action is expected to create approximately six full time positions and the Final EA text has been edited to reflect this change.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

PETER B. CARLISLE
MAYOR

COLLINS D LAM, P.E.
ACTING DIRECTOR

LORITA M. KAHIKINA, P.E.
DEPUTY DIRECTOR

January 25, 2011

Ms. Faith Caplan, AICP
TEC Inc 1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment -Kalaeloa Solar One and Two
Island of Oahu, Ewa District TMK: 9-1-013:026 (portion)

Thank you for inviting us to review the above Draft Environmental Assessment. The Department of Design and Construction does not have any comments to offer at this time.

Should you have any questions, please contact me at 768-8480.

Very truly yours,

Collins D. Lam, P.E.
Acting Director

CL:pg(398161)

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Collins D. Lam, P.E.
Acting Director
City and County of Honolulu
Department of Design and Construction
650 South King Street, 11th Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Lam,

Thank you for your January 25, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Department of Design and Construction has reviewed the Draft EA and had no comment.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3486 • FAX: (808) 768-3487 • WEBSITE: http://envhonolulu.org

PETER B. CARLISLE
MAYOR

TIMOTHY E. STEINBERGER, P.E.
DIRECTOR

MANUEL S. LANUEVO, P.E., LEED AP
DEPUTY DIRECTOR

ROSS S. TANIMOTO, P.E.
DEPUTY DIRECTOR

IN REPLY REFER TO:
PRO 11-001

January 7, 2011

Ms. Faith Caplan, AICP
TEC, Inc.
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Kalaeloa Solar One and Two, Island of Oahu, Ewa District
TMK: 9-1-013:028 (portion), Draft Environmental Assessment

We have reviewed the subject document as transmitted to us by your letter which we received on December 30, 2010, and have the following comments:

1. The City and County of Honolulu is no longer considering accepting a conveyance of the wastewater system from the Navy. On page 3-37, in the second paragraph under Section 3.11.1, please delete the phrase "...and the wastewater system is being conveyed to the County" from the third sentence.

2. We suggest revisions to the first three paragraphs in Section 3.11.1.4 on page 3-41 as follows:

   The existing wastewater collection system is owned by the Navy ~~and operated under license by the County department of Environmental Service and is in the process of being transferred to the County as a public benefit conveyance.~~ The system is old and the existing pumping stations do not meet County standards; it consists of (Figure 3.10):

   - 15.3 miles of gravity sewers that range in size from 6 to 30 inches
   - 12 lift stations, and
   - 7.3 miles of force mains ranging in size from 4 to 16 inches (Navy Region Hawaii 2008).

The wastewater is conveyed to Honouliuli WWTP, which has a capacity of 38 million gallons per day (mgd). The existing inflow is estimated at 25 mgd, 13 mgd is processed by ~~advanced primary~~ secondary treatment and some of this is further treated for beneficial use as recycled water ~~for non potable use~~. The remainder of secondary and primary treated waste is discharged to the ocean. The Navy purchased 2.66 mgd of the 38 mgd to serve Kalaeloa and other Navy land in the vicinity. The current allocation for Kalaeloa is 1.5 mgd.

The Kalaeloa Master Plan (HCDA 2006) acknowledges the inadequacies of the existing system and is preparing an infrastructure master plan to outline improvements ~~that are subject to County approval.~~ Developers would be assessed ~~sewer fees~~ wastewater facility charges by the County, should they propose new connections to the County's wastewater system.

Should you have any questions, please call Jack Pobuk, Program Coordinator, at 768-3464.

Sincerely,

David I. Nagamine
Executive Assistant

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. David I. Nagamine
Executive Assistant
City and County of Honolulu
Department of Environmental Services
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Nagamine,

Thank you for your January 7, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We made the edits you recommended in the Final EA as follows:

- Deleted the phrase "and the wastewater system is being conveyed to the County" from Section 3.11.1 of the EA;
- Deleted the phrase "and operated under license by the County Department of Environmental Services and is in the process of being transferred to the County as a public benefit conveyance" from Section 3.11.1.4 of the EA;
- Added "secondary treatment" and "further treatment for beneficial use as recycled water" to the description of Honouliuli Wastewater Treatment Plant's wastewater treatment activities;
- Indicated wastewater facility charges would be assessed the developer by the County, should the developer propose new connections to the County's wastewater system.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax (808) 768-3381
Website: www.honolulu.gov

PETER B. CARLISLE
MAYOR

GEORGE "KEOKI" MIYAMOTO
ACTING DIRECTOR

IN REPLY REFER TO:
DRM 11-25

January 18, 2011

Ms. Faith Caplan, AICP
TEC, Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment (DEA)
Kalaeloa Solar One and Two
Island of Oahu, Ewa District
TMK: 9-1-013:028 (Portion)

Thank you for the opportunity to review and comment on the DEA dated January 2011 for the proposed two 5 megawatt solar power generating facilities at the Kalaeloa Community Development District.

We have no comments to offer as the solar power generating facilities will be within Department of Hawaiian Homelands' property and will have negligible impact on our facilities and operations.

Should you have any questions, please call Charles Pignataro of the Division of Road Maintenance, at 768-3697.

Sincerely,

George "Keoki" Miyamoto
Acting Director

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. George "Keoki" Miyamoto
Acting Director
City and County of Honolulu
Department of Facility Maintenance
1000 Uluohia Street, Suite 215
Kapolei, Hawaii 96707

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Miyamoto,

Thank you for your January 18, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Department of Facility Maintenance (Department) has reviewed the Draft EA and confirms that the proposed project will have negligible impacts on the Department's facilities or operations.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

PETER B. CARLISLE
MAYOR

GARY B. CABATO
ACTING DIRECTOR

RICHARD HARU
DEPUTY DIRECTOR

January 21, 2011

Ms. Faith Caplan, AICP
TEC Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment
Kalaeloa Solar One and Two
TMK: 9-1-013:028 (portion)

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Kalaeloa Solar One and Two project.

The Department of Parks and Recreation has no comment, as the proposed action will not impact any program or facility of the department. You may remove us as a consulted party to the balance of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner, at 768-3017.

Sincerely,

GARY B. CABATO
Acting Director

GBC:jr
(397453)

TEC inc.

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Gary B. Cabato
Acting Director
City and County of Honolulu
Department of Parks and Recreation
1000 Uluohia Street, Suite 309
Kapolei, Hawaii 96707

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Cabato,

Thank you for your January 21, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Department of Parks and Recreation (Department) has reviewed the Draft EA and determined that the proposed project will have no adverse impacts on the Department's programs or facilities.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

PETER B. CARLISLE
MAYOR

KENNETH G. SILVA
FIRE CHIEF

ROLLAND J. HARVEST
DEPUTY FIRE CHIEF

February 2, 2011

Ms. Faith Caplan, AICP
Senior Associate
TEC Inc.
Pauahi Tower
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment
Kalaeloa Solar One and Two
Ewa District, Oahu, Hawaii
Tax Map Key: 9-1-013: 028 (Portion)

In response to your letter received on December 30, 2010, regarding the above-mentioned subject, the Honolulu Fire Department (HFD) reviewed the material provided and requires that the following requirements be met:

1. Provide a fire apparatus access road for every facility, building, or portion of a building hereafter constructed or moved into or within the jurisdiction when any portion of the facility or any portion of an exterior wall of the first story of the building is located more than 150 feet (45 720 mm) from a fire apparatus access road as measured by an approved route around the exterior of the building or facility. (1997 Uniform Fire Code, Section 902.2.1.)

2. Provide a water supply, approved by the county, capable of supplying the required fire flow for fire protection to all premises upon which facilities or buildings, or portions thereof, are hereafter constructed or moved into or within the county.

   On-site fire hydrants and mains capable of supplying the required fire flow shall be provided when any portion of the facility or building is in

excess of 150 feet (45 720 mm) from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building. (1997 Uniform Fire Code, Section 903.2, as amended.)

3. Submit civil drawings to the HFD for review and approval.

Should you have any questions, please call Acting Battalion Chief Gary Lum of our Fire Prevention Bureau at 723-7152.

Sincerely,

KENNETH G. SILVA
Fire Chief

KGS/SY:bh

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Kenneth G. Silva
Fire Chief
City and County of Honolulu
Honolulu Fire Department
636 South Street
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Silva,

Thank you for your February 2, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Honolulu Fire Department has reviewed the Draft EA and listed the following requirements for the project:

1. Conformity with Uniform Fire Code, Section 902.2.1, regarding a fire apparatus access road.
2. Conformity with Uniform Fire Code, Section 903.2 as amended, regarding a water supply capable of supplying the required fire flow to protect the premises.
3. Submission civil drawings to the Honolulu Fire Department for review and approval.

The project will meet these requirements, which are listed in the Final EA.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

PETER B. CARLISLE
MAYOR

LOUIS M. KEALOHA
CHIEF

DELBERT T. TATSUYAMA
RANDAL K. MACADANGDANG
DEPUTY CHIEFS

OUR REFERENCE DMK-DK

January 6, 2011

Ms. Faith Caplan, AICP
Senior Associate
TEC Inc.
Pauahi Tower, Suite 1550
1003 Bishop Street
Honolulu, Hawaii 96813

Dear Ms. Caplan:

This is in response to your letter requesting comments on a Draft Environmental Assessment for the Kalaeloa Solar One and Two project in Kapolei.

The Honolulu Police Department has no comments to offer at this time.

If there are any questions, please call Major Michael Moses of District 8 (Kapolei) at 723-8488.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By
DAVE M. KAJIHIRO
Assistant Chief of Police
Support Services Bureau

Serving and Protecting With Aloha

TEC inc.

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Dave M. Kajihiro
Assistant Chief of Police
Support Services Bureau
City and County of Honolulu Police Department
801 South Beretania Street, Suite 1550
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Kajihiro,

Thank you for your January 6, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Honolulu Police Department has reviewed the Draft EA and had no comment.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR

BRUCE A. COPPA
COMPTROLLER

RYAN T. OKAHARA
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1016.1

FEB 10 2011

Ms. Faith Caplan, AICP
Senior Associate
TEC Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawai'i 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment (EA)
Kalaeloa Solar One and Two
Kalaeloa, Oahu, Hawai'i
TMK: (1) 9-1-013: 028

Thank you for the opportunity to provide comments for the subject Draft EA. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Ms. Gayle Takasaki of the Public Works Division at 586-0584.

Sincerely,

BRUCE A. COPPA
State Comptroller

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Bruce A. Coppa
State Comptroller
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Coppa,

Thank you for your February 10, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA). We note that the Department of Accounting and General Services had no comment.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

NEIL ABERCROMBIE
GOVERNOR

RICHARD LIM
INTERIM DIRECTOR

No. 1 Capitol District Building, 250 South Hotel Street, 5th Floor, Honolulu, Hawai'i 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawai'i 96804
Web site: www.Hawai'i.gov/dbedt

Telephone: (808) 586-2355
Fax: (808) 586-2377

February 4, 2011

Faith Caplan, AICP
Senior Associate
TEC Inc.
Pauahi Tower, Suite 1550
Honolulu, Hawai'i 96813

Re: Draft Environmental Assessment for the Keahole Solar One and Two; Island of Oah'u, Ewa District; TMK: 9-1-013:028 (portion)

Dear Ms. Caplan:

In response to your notice, thank you for the opportunity to provide comments on the Draft Environmental Assessment (DEA) for the proposed Keahole Solar One and Two solar project (Project). This project proposes to develop two on-grid 5 megawatt (MW) solar power generating facilities: Kalealoa Solar One, using Sopogy™ concentrating solar power thermal (CSP) technology; and, Kalaeloa Solar Two, using alternating current SunPower™ photovoltaic (PV) technology. Chapter 343, Hawai'i Revised Statutes (HRS), environmental review is required because this Project is located on land owned by the State of Hawai'i, under the control of the Department of Hawaiian Home Lands (DHHL)

At this time, the Hawai'i State Energy Office within the Department of Business, Economic Development and Tourism (DBEDT) provides the following comments.

1. **Hawai'i Clean Energy Initiative.** We commend developer Keahole Solar Power, LLC (KSP) and DHHL for their contributions towards our state's ambitious clean energy goals. The Project demonstrates one method a state landowner can generate direct revenue via renewable energy generation. The Project also provides the unique opportunity to compare the energy output of two different utility-scale solar technologies – CSP and PV – in identical environments.

2. **Permitting.** On p. 3-7, we note the DEIS says, "Airports have not established zones or guidelines for siting solar farms and FAA makes its determination on a case by case basis." We would like to bring to your attention a technical guidance document released by the Federal Aviation Administration (FAA) in November 2010, "Technical Guidance for Evaluating Selected Solar Technologies on Airport." Please refer to this document to ensure compliance with all FAA requirements pertaining to solar facilities.

3. **Washwater Management.** Please describe how you intend to manage the water needed to wash the CSP and PV units (p. 2-8).

Sincerely,

Joshua B.Y. Strickler
Renewable Energy Facilitator, Hawai'i State Energy Office

JBYS/cbb

c: OEQC
Mr. Todd Gray, Hawai'i Department of Hawaiian Home Lands

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Joshua B.Y. Strickler
Renewable Energy Facilitator
Hawaii State Energy Office
Department of Business, Economic Development and Tourism
No. 1 Capitol District Building
250 South Hotel Street, 5th Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Strickler,

Thank you for your February 4, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Hawaii State Energy Office, within the Department of Business, Economic Development and Tourism, has reviewed the Draft EA and acknowledges that the project would contribute toward the goals of the Hawaii Clean Energy Initiative.

Thank you for referring us to the November 2010 document "Technical Guidance for Evaluating Selected Solar Technologies on Airports", released by the Federal Aviation Administration (FAA). Twenty-three forms 7460-1: Notice of Proposed Construction or Alteration were submitted to the FAA for PV and CSP facilities associated with the proposed action.

In response to the information submitted, FAA conducted a series of twenty-three aeronautical studies (study numbers 2010-AWP-6926-OE, 2010-AWP-6927-OE, 2010-AWP-6928-OE, 2010-AWP-6929-OE, 2010-AWP-6930-OE, 2011-AWP-694-OE, 2011-AWP-695-OE, 2011-AWP-696-OE, 2011-AWP-697-OE, 2011-AWP-698-OE, 2011-AWP-699-OE, 2011-AWP-700-OE, 2011-AWP-701-OE, 2011-AWP-1093-OE, 2011-AWP-1088-OE, 2011-AWP-1091-OE, 2011-AWP-1089-OE, 2011-AWP-1087-OE, 2011-AWP-1090-0E, 2011-AWP-1092-OE, 2011-AWP-702-OE, 2011-AWP-703-OE, 2011-AWP-204-OE). Each study resulted in a Determination of No Hazard to Air Navigation. FAA determinations are provided in Appendix D of the Final EA.

The project will continue to work with DOT Airports to pursue an agreement so that appropriate procedures may be followed in the event that flight operations are impacted. We would also like to note that at any time, the operator of the CSP facilities can manual override any programming to rotate collectors so the mirrors are upside-down, or in "stow" position. Recommended PV panels associated with this project will be non-reflective and light absorbing, to eliminate the potential for glare.

Onsite water supply and wastewater management designs are in their conceptual phases. More detail on the designs for the CSP portion of the project is provided in Section 3.11 of the Final EA. All designs will be reviewed during the wastewater permit process and will conform to all applicable laws and regulations.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL ST., ROOM 325
HONOLULU, HAWAII 96813
TEL (808) 587-0166 FAX (808) 587-0160

January 27, 2011

Ms. Faith Caplan, AICP
Senior Associate
TEC Inc
1003 Bishop St
Pauhai Tower, Suite 1550
Honolulu, HI 96813

Subject: Request for Comments of Draft Environmental Assessment for Kalaeloa Solar One and Two, Island of Oahu, Ewa District, TMK:9-1-013:028

Dear Ms. Caplan:

Thank you for the opportunity to comment on the Draft EA as noted in the subject line above. Please accept our apologies in providing these comments past your indicated deadline.

The botanical staff of the Department of Land and Natural Resources, Division of Forestry and Wildlife has reviewed the botanical section of the EA and provided the following comments for your consideration. The Appendix Botanical Survey Report noted the historical existence of an Endangered plant species, *Chamaesyce skottsbergii* var. *kalaeloana*, at this location. When considering the survey was conducted "in the dry season (of a drought year) when the '*akoko* plants are often leafless", DLNR Division of Forestry and Wildlife cannot concur with the finding of no Endangered species on the project site. However, page 3-22 of the draft EA mentions the same consultant conducting a survey of the proposed site during the wet season (December 18, 2007 to February 10, 2008) which found no listed plant species. We would suggest adding the results of these surveys to the final EA would strengthen the finding of no listed species at this site.

Please call Vickie Caraway, State Botanist, at 587-0165, for questions regarding our review of this project.

Sincerely,

Paul Conry
Administrator

Cc: Vickie Caraway

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Paul Conry
Administrator
State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Conry,

Thank you for your January 27, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA). We note that the botanical staff at Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) has reviewed the Biological Resources Special Status Species section of the EA.

We have edited the EA as you recommended by adding specific results of the historical botanical survey of the proposed site conducted during a wet season (December 18, 2007 to February 10, 2008). These edits can be found in the Biological Resources Section 3.6 of the Final EA. As you suggest, this edit strengthens the EA's stated finding of no listed plant species. Your comment letter did not recommend for further action. With this change, we infer from the letter that DLNR DOFAW would concur with the Finding of No Significant Impact.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 3, 2011

Ms. Faith Caplan
TEC Inc.
1003 Bishop Street Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment for Kalaeloa Solar One and Two

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Engineering Division, Office of Conservation & Coastal Lands, Land Division- Oahu District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Historic Preservation will be submitting comments through a separate letter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809
Phone: (808) 587-0433
Fax: (808) 587-0455

January 8, 2011

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District
__Historic Preservation

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Draft Environmental Assessment for Kalaeloa Solar One and Two
LOCATION: Island of Oahu
APPLICANT: TEC Inc on behalf of Keahole Solar Power, LLC

'11 JAN 12 PM01:45 ENGINEERING

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 4, 2011.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed:
Date: 1/31/11

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/CharleneUnoki
RE:DEAKalaeloaSolarOne&Two
Oahu.820

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) **Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone D. The Flood Insurance Program does not have any regulations for developments within Flood Zone X.**

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tynu-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
( ) Mr. Carter Romero at (808) 961-8943 of the County of Hawaii, Department of Public Works.
( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
( ) Ms. Wynne Ushigome at (808) 241-4890 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

( ) Other: _____

Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 1/31/11

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION
2011 JAN 31 A 10:52
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809
Phone: (808) 587-0433
Fax: (808) 587-0455

January 8, 2011

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District
__Historic Preservation

DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII
2011 JAN 11 P 3:39
RECEIVED OFFICE OF CONSERVATION & COASTAL LANDS

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Draft Environmental Assessment for Kalaeloa Solar One and Two
LOCATION: Island of Oahu
APPLICANT: TEC Inc on behalf of Keahole Solar Power, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 4, 2011.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

(1) 9-1-13:28

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: _____
Date: 1-31-2011

DHHL Landowner Not in the Conservation District

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809
Phone: (808) 587-0433
Fax: (808) 587-0455

January 8, 2011

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District
Historic Preservation

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Draft Environmental Assessment for Kalaeloa Solar One and Two
LOCATION: Island of Oahu
APPLICANT: TEC Inc on behalf of Keahole Solar Power, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 4, 2011.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: _____
Date: 1/12/11

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Russell Y. Tsuji
Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Tusji,

Thank you for your February 3, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

Thank you for making the Draft EA available to Department of Land and Natural Resources (DLNR) Divisions for review. We note that the Office of Conservation & Coastal Lands and the Land Division - Oahu District had no comments.

Per comments provided by the Engineering Division, we note that the project site is located in Flood Zone D of the Flood Insurance Rate Map, and that there are no Flood Insurance Program regulations that apply to developments within Flood Zone D. This information is reflected in the Final EA.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 24, 2011

Ms. Faith Caplan
TEC Inc.
1003 Bishop Street Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment for Kalaeloa Solar One and Two

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to Division of Aquatic Resources for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Charlene Unoki
Assistant Administrator

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

AM ✓
GH ✓

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809
Phone: (808) 587-0433
Fax: (808) 587-0455

DAR3605

January 8, 2011

RECEIVED
LAND DIVISION
2011 FEB 22 P 3:45
DLNR
NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District
__Historic Preservation

RECEIVED
JAN 1 2011
DLNR RESOURCES

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Draft Environmental Assessment for Kalaeloa Solar One and Two
LOCATION: Island of Oahu
APPLICANT: TEC Inc on behalf of Keahole Solar Power, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 4, 2011.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(x) Comments are attached.

Signed: Francis Oishi
Date: 2-22-11

STATE OF HAWAII
Department of Land and Natural Resources
DIVISION OF AQUATIC RESOURCES

MEMORANDUM

TO: Robert T. Nishimoto, Environmental Program Manager
FROM: Glenn R. Higashi, Aquatic Biologist GRH
SUBJECT: Draft Environmental Assessment for Kalaeloa Solar One and Two
Comments Requested By: Charlene Unoki, Assistant Administrator
Land Division
Date of Request: 1/8/11 Date Received: 1/12/11

Summary of Project

Title: Draft Environmental Assessment for Kalaeloa Solar One and Two
Project By: **TEC Inc. on behalf of Keahole Solar Power, LLC**
Location: **Kalaeloa, Honouliuli, O'ahu – TMK: (1) 9-1-013:028 (portion)**

Brief Description:

The applicant, Kalaeloa Solar Power, LLC (KSP) is proposing to develop two 5 megawatt (MW) solar power generating facilities in Kalaeloa, Oahu, Hawaii. The two facilities would be independently owned and operated. The Kalaeloa Solar One would be owned and operated by Kalaeloa Solar One LLC utilizing Sopogy™ concentrating solar power (CSP) thermal technology. Kalaeloa Solar Two would be owned and operated by SunPower Corporation and utilize SunPower™ photovoltaic (PV) systems. The two facilities would each generate 5 MW to be sold to Hawaii Electric Company (HECO) through two power purchase agreements approved by the Public Utilities Commission.

The CSP collectors use mirrors and optics to concentrate the energy from the sun. The thermal energy heats organic oil in a pipe at the center of each CSP collector that is conveyed through other units and ultimately drives an engine to generate electricity.

The PV panels covert solar radiation into direct current electricity using solar panels with modules of polycrystalline. The modules are protected by tempered glass. The direct current is ultimately converted onsite to alternating current. The CSP and PV collectors follow the sun east to west throughout the day.

The proposed action includes vegetation removal and minor grading, assembling and mounting the CSP collectors and PV modules, and constructing two CSP support buildings, concrete pads for equipment, perimeter fencing and a substation on site.

Comments:

The proposed project is not expected to have any significant impact on the aquatic resource values in the area. BMPs would be implemented during construction to contain surface flows within the project site and the National Pollution Discharge Elimination System (NPDES) Permit process requires the submittal of a stormwater management plan prior to commencement of construction. There are no activities proposed at the site that would result in the discharge of dredged or fill material into the drainage canal located west of the site. No tributaries were identified that might feed into the canal from the site.

TEC inc.
1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Ms. Charlene Unoki
Assistant Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Ms. Unoki,

Thank you for your February 24, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

Thank you for making the Draft EA available to Department of Land and Natural Resources (DLNR) Division of Aquatic Resources for review. We note that the Division of Aquatic Resources does not expect that the proposed project will have any significant impact on the aquatic resource values in the area.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

January 31, 2011

Ms. Faith Caplan, Senior Associate
TEC Inc.
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

SUBJECT: Kalaeloa Solar One and Two
Island of Oahu, Ewa District TMK: 9-1-013:028 (portion)

The Department of Education (DOE) appreciates the opportunity to comment on the draft Environmental Assessment (EA) for this project. The DOE has reviewed the draft EA and offers the following comments:

Air Quality
As noted in the draft EA, Barbers Point Elementary School is located just north of the project site. The DOE is concerned about exhaust and dust emissions that will be generated during construction and operation of this project. The DOE requests that the draft EA provide detailed information on the extent of airborne emissions that will be generated and what mitigation measures will be proposed to address these emissions.

Reflective Impacts
The DOE is concerned about the possibility of reflective emissions (glare and heat) from the photovoltaic and concentrating solar power (CSP) equipment that will be installed on the proposed site. The DOE requests that the draft EA provide detailed information on whether there will be any reflective emissions; and if so, how impacts from these emissions will be mitigated.

Traffic
The DOE is concerned about how construction and operation of this project will impact school operations, especially during peak periods of student drop-off and pick-up. The DOE requests that the draft EA address the extent to which school-related traffic will be impacted and how these impacts will be mitigated.

Noise
The DOE is concerned about noise being generated during construction and operation of this project, especially with regard to operation of the CSP engines. The DOE requests that the draft EA provide detailed information on how noise will be mitigated.

Hazardous Materials
The DOE is concerned about how hazardous materials (HAZMAT) will be managed. The DOE requests that the draft EA specifically address how the organic thermal oil and lubricants used in the CSP collectors will be managed.

Site Improvements
The DOE understands that the project will involve removal of vegetation and minor grading, construction of two (2) support buildings, concrete pads for equipment, perimeter fencing, and a substation on site. The DOE would appreciate in-person consultation on these improvements.

Operational Hazards
The DOE is concerned about electric magnetic fields (EMF) and high voltage hazards associated with the operation of this project. The DOE requests that the draft EA address whether operation of this project will create these hazards and what measures will be taken to protect public health and safety.

Archaeological Findings
The DOE would appreciate consultation on any archaeological findings discussed with State Historic Preservation Division.

Should you have any questions, please do not hesitate to call Roy Ikeda of the Facilities Development Branch at 377-8301.

Very truly yours,

Kathryn S. Matayoshi
Superintendent

KSM:jmb

c: Randolph Moore, Assistant Superintendent, OSFSS
Annette Nishikawa, Acting CAS, Campbell/Kapolei Complex Areas

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Ms. Kathryn S. Matayoshi
Superintendent
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Ms. Matayoshi,

Thank you for your January 31, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment.

Air Quality
Emissions due to the proposed action are not expected to significantly impact the neighboring environment, including Barbers Point Elementary School. Emissions due to the construction and operational phases of the proposed action are not expected to exceed National or Hawaii State Ambient Air Quality Standards. Construction emissions would be temporary and would be mitigated through the use of Best Management Practices, including the use of dust control fences and watering the site to minimize dust production and prohibit visible fugitive dust beyond the property line. Operational emissions would be limited to employee vehicular traffic at the CSP project area, and would be negligible, due to the few (less than six at any one time) personnel required to maintain the CSP system. Please see Section 3.2 of the Final EA for additional information.

Reflective Impacts
No adverse impacts to the neighboring environment (including Barbers Point Elementary School) are expected due to reflective impacts (glare and heat) from the CSP or PV panels at the project site. Discussions with Federal Aviation Administration (FAA) and State Department of Transportation - Airports have resulted in the project receiving a Determination of No Hazard to Air Navigation from the FAA for all components of the project, and no impact is expected. Please see Section 3.11 of the Final EA for more information. In addition, the FAA determination letters are provided as Appendix D to the Final EA.

Traffic Impacts
Overall impacts to traffic and transportation from construction would be temporary and not significantly impact operations at Barbers Point Elementary School, including during peak hours of student drop-off and pick-up. Additional information regarding construction phase traffic impacts to Barbers Point Elementary School has been added to Section 3.11 of the Final EA.

Noise
As stated in the Draft EA, there would be no significant construction impacts from noise on the nearest sensitive receptors, namely the Barbers Point Elementary School to the north or the church to the west of the project site in the Kapolei Business Park area. The Final EA has been amended to include the statement that project activities would comply with the Administrative Rules of the State of Hawaii Department of Health, Chapter 11-46 Community Noise Control.

Operations at the site would not generate noise that exceeds the acceptable noise levels beyond the site boundaries. The CSP engine would generate noise but would be housed in a building, thus mitigating any noise impacts to any neighboring locations, including Barbers Point Elementary School. Please see Section 3.3 of the Final EA for additional information.

Hazardous Materials
The organic thermal oil used by the CSP system is a Food and Drug Administration (FDA) approved organic mineral oil and is not reportable under 40 CFR Part 302.4 Designation of Hazardous Substances. Furthermore, it will be used in a closed system. The thermal oil and minor quantities of lubricants would be managed and stored in accordance with federal and local regulations. Please see Section 3.9 of the Final EA for additional information.

Site Improvements
Development of the property is consistent with the Kalaeloa Master Plan. Project support structures would not exceed the height limitations specified in the Kalaeloa Master Plan and would be in accordance with architectural guidelines and preferences for the area if they are identified and finalized during the project development. The project's final design and layout would adopt building heights, streetscape frontages, building setbacks and other zoning and development requirements. Although the project development would be visible from adjacent roadways; it would be low to the ground and not obstruct views through the site, except for the support structures. Please refer to Figure 2.3 of the Final EA, which shows a change in the notional siting of project support structures to the southern side of the CSP facility, where they would not be visible from Boxer Street.

Operational Hazards
The project is not expected to result in operational hazards due to electric and magnetic fields (EMF) and high voltage hazards. Additional information has been added to Section 3.11 of the Final EA regarding federal and state guidance regarding EMF and solar installations, as well as project particulars.

Archeological Findings
Keahole Solar LLC is working closely with the State Historic Preservation Division (SHPD) regarding archaeological findings on the project site. A *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* has been conducted pursuant to HAR 13§276 for the project area. A draft report of the survey is available as Appendix B to the Final EA and was submitted to SHPD for official review and approval. Archaeological sites were identified within the proposed development area. Preservation and avoidances are recommended for those sites that are considered eligible for the National Register of Historic Places under Criterion D for sites which have yielded, or may be likely to yield, information important in prehistory or history. One site is also considered eligible for the Hawaii Register of Historic Places under Criterion (e) because isolated, disarticulated human burials and skeletal remains were found. The AIS recommends preparation of an Archaeological Monitoring Plan (AMP) and a Historic Preservation Plan (HPP). Construction will not commence until the AIS is reviewed and accepted by SHPD, and until SHPD approves an AMP and HPP. Please see Section 3.7 of the Final EA for more information.

There is no opportunity to include DOE staff in the consultation on archeological findings discussed with SHPD. Project construction will not commence until SHPD approves the results of the updated survey and an updated Plan. The final approved Plan should be available at SHPD for public access.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

Neil Abercrombie
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

Keith R. Ridley
Acting Director of Health

In reply, please refer to:
File:

2011-012-RP

January 6, 2011

Faith Caplan
TEC Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Facility/Site: Kalaeloa Solar One and Two, Island of Oahu, Ewa District, TMK: 1-9-1-013:028 (portion)

Subject: Review of Draft Environmental Assessment
Kalaeloa Solar One and Two
Tax Map Key [1]-9-1-13: Parcel 28
Kapolei, Hawaii

Dear Ms. Caplan,

The Hawaii Department of Health Hazard Evaluation and Emergency Response Office (HEER) has reviewed the "Draft Environmental Assessment for the proposed Kalaeloa Solar One and Two project, Tax Map Key [1]-9-13: Parcel 28, Kapolei, Hawaii", and has no comments at this time. I look forward to reviewing the final Environmental Assessment for this project.

If you have any questions, please contact me at 586-0957.

Sincerely,

Richard Palmer, Ph.D.

Richard Palmer, Ph.D.
Environmental Health Specialist
Hazard Evaluation and Emergency Response Office
State of Hawaii Department of Health
919 Ala Moana Boulevard, Room 206
Honolulu, Hawaii 96814

TEC inc.
1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Dr. Richard Palmer
Environmental Health Specialist
Hazard Evaluation and Emergency Response Office
State of Hawaii Department of Health
919 Ala Moana Boulevard, Room 206
Honolulu, Hawaii 96814

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Dr. Palmer,

Thank you for your January 6, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Hawaii Department of Health Hazard Response and Emergency Response Office (Department) has reviewed the Draft EA and had no comment. We will provide the Department a copy of the Final EA, as requested.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

LORETTA J. FUDDY, A.C.S.W., M.P.H.
ACTING DIRECTOR OF HEALTH

In reply, please refer to:
File:

January 31, 2011

TO: Faith Caplan
TEC, Inc.

FROM: Jeffrey M. Eckerd, Acting Program Manager
Indoor and Radiological Health Branch

SUBJECT: Kalaeloa Solar One and Two
Island of Oahu, Ewa District
TMK: 9-1-013:028 (portion)

Our comments should be printed as follows:

"Project activities shall comply with the Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control

Should there be any questions, please contact me at 586-4701.

TEC inc.

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Jeffrey M. Eckerd
Acting Program Manager
State of Hawaii
Department of Health
Indoor and Radiological Health Branch
P.O. Box 3378
Honolulu, Hawaii 96801

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Mr. Eckerd,

Thank you for your January 31, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

The project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46 Community Noise Control. This is stated in Sections 3.3 and 4.4 of the Final EA.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

KEITH R. RIDLEY
ACTING DIRECTOR OF HEALTH

In reply, please refer to:
File:

LUD 1 9 1 013 028 – ID582
Draft Env Asmnt Kalaeloa Solar

January 11, 2011

Ms. Faith Caplan, AICP
Senior Associate
TEC Inc.
1003 Bishop Street
Pauahi Tower Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Draft Environmental Assessment Kalaeloa Solar One and Two, Kalaeloa Boulevard, Kalaeloa, Honouliuli, Ewa District, Kapolei, Oahu 96707 TMK (1) 9-1-013: 028 137 acres

Thank you for allowing us the opportunity to review the above subject project which requests comments on the Draft Environmental Assessment for Kalaeloa Solar One and Two in the Honouliuli, Ewa District.

The subject project is located in the critical wastewater disposal area as determined by the Oahu Wastewater Advisory Committee. It is located in the Pass Zone. We offer our approval for the proposed development as domestic wastewater will be conveyed to the City and County of Honolulu's Honouliuli Wastewater Treatment Plant for treatment and disposal.

We further encourage the developer to work with the County and utilize recycled water for irrigation and other non-potable water purposes such as dust control, open spaces or landscaping areas.

Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at 586-4294 or fax to 586-4300.

Sincerely,

SINA PRUDER, P.E., ACTING CHIEF
Wastewater Branch

LM:cle

c: DOH's Environmental Planning Office (EPO I-3496)
Sheldon Char, Keahole Solar Power, LLC
Todd Gray, State Department of Hawaiian Home Lands

TEC inc

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Sina Pruder, P.E.
Acting Chief
Wastewater Branch
State of Hawaii Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Subject: Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment

Dear Sina Pruder,

Thank you for your January 11, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Hawaii Department of Health Wastewater Branch has reviewed the Draft EA. Section 3.11 of the Final EA states that the proposed development is located within the Pass Zone in the critical wastewater disposal area as determined by the Oahu Wastewater Advisory Committee.

The wastewater generation of the proposed development is limited to a single restroom. Onsite water supply and wastewater management designs are in their conceptual phases, and more detail is provided in Section 3.11 of the Final EA. All designs will be reviewed during the wastewater permit process and will conform to all applicable laws and regulations.

As recommended, the developer will work with the County to utilize recycled water for non-potable water purposes, when necessary and possible.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
Ford N. Fuchigami
Jan S. Gouveia
Randy Grune
Jadine Urasaki

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

STP 8.0352

February 15, 2011

Ms. Faith Caplan
TEC Inc.
1003 Bishop Street, Suite 1550
Honolulu, Hawaii 96813

Dear Ms. Caplan:

Subject: Kalaeloa Solar One and Two
Draft Environmental Assessment (DEA)

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project. In its letter, STP 8.0231 dated September 14, 2010 (see Attachment A of the DEA), DOT previously expressed concerns during the pre-consultation period regarding the development of the proposed 4 MW power generating facility, Kalaeloa Solar One. DOT notes that the DEA includes a second power generating facility (Kalaeloa Solar Two), located adjacent to the first one. Keahole Solar Power, LLC is now proposing to develop two 5-megawatt (MW) solar power generating facilities. The two facilities would be independently owned and operated. Kalaeloa Solar One would be owned and operated by Kalaeloa One LLC utilizing Sopogy concentrating solar power (CSP) thermal technology. Kalaeloa Solar Two would be owned and operated by SunPower Corporation and utilize SunPower photovoltaic (PV) systems.

Although Keahole Solar Power met with the DOT Airports staff to address the airport impacts, DOT continues to have serious concerns regarding the interference to flights from the subject project. Both the PV and CSP facilities will be located directly in line with and under the standard downwind and base legs of the landing pattern to Honolulu International Airport runway 4L/22R and to some extent, Kalaeloa Airport runway 11/29. Since both types of systems are sun-tracking, there is a potential for glare, glint and distraction throughout the day for aircraft in the pattern. According to the FAA solar guide, "Technical Guidance for Evaluating Selected Solar Technologies on Airports," dated November 2010, an analyses needs to be done on this matter. The analysis and evaluation will need to be submitted for review by the DOT Airports Division and FAA, as part of the operator's FAA Form 7460-1 submittal.

Additionally an agreement between both operators of the solar facilities and the DOT Airports Division should be pursued to address any impacts to flight operations that may occur as a result of these solar facilities and to ensure that the appropriate mitigation measures are implemented, ranging from changing the angle of the arrays to shutting down the system at the expense of the operators

DOT appreciates the opportunity to provide comments. If there are any questions, including the need to meet with DOT airport staff, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Dr. Glenn M. Okimoto
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Dr. Okimoto,

Thank you for your February 15, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note the Department of Transportation's (DOT) concern that both the PV and CSP facilities would result in glare, glint and distraction to flights, which was expressed in both your September 14, 2010 letter as well as your most recent February 15, 2011 comment letter.

As recommended in your September 14, 2010 letter, the project filed Form 7460-1: Notice of Proposed Construction or Alteration to the FAA. Information was provided for the notional siting of all PV and CSP facilities associated with the proposed action.

In response to the information submitted, FAA conducted a series of twenty-three aeronautical studies (study numbers 2010-AWP-6926-OE, 2010-AWP-6927-OE, 2010-AWP-6928-OE, 2010-AWP-6929-OE, 2010-AWP-6930-OE, 2011-AWP-694-OE, 2011-AWP-695-OE, 2011-AWP-696-OE, 2011-AWP-697-OE, 2011-AWP-698-OE, 2011-AWP-699-OE, 2011-AWP-700-OE, 2011-AWP-701-OE, 2011-AWP-1093-OE, 2011-AWP-1088-OE, 2011-AWP-1091-OE, 2011-AWP-1089-OE, 2011-AWP-1087-OE, 2011-AWP-1090-0E, 2011-AWP-1092-OE, 2011-AWP-702-OE, 2011-AWP-703-OE, 2011-AWP-204-OE). Each study resulted in a Determination of No Hazard to Air Navigation. FAA determinations are provided in Appendix D of the Final EA.

Keahole Solar Power will continue to work with DOT Airports to pursue an agreement so that appropriate procedures may be followed in the event that flight operations are impacted. We would also like to note that at any time, the operator of the CSP facilities can manual override any programming to rotate collectors so the mirrors are upside-down, or in "stow" position. Recommended PV panels associated with this project will be non-reflective and light-absorbing, to eliminate the potential for glare.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

HAWAII COMMUNITY DEVELOPMENT AUTHORITY

KAKAAKO KALAELOA

Neil Abercrombie
Governor

C. Scott Bradley
Chairperson

Anthony J. H. Ching
Executive Director

461 Cooke Street
Honolulu, Hawaii
96813

Telephone
(808) 594-0300

Facsimile
(808) 594-

E-Mail
contact@hcdaweb.org

Web site
www.hcdaweb.org

Ref. No.: PL KALAELOA 17.2.1

February 3, 2011

Mr. Sheldon Char
Project Executive
Keahole Solar Power, LLC
2660 Waiwai Loop
Honolulu, Hawaii 96819

Dear Mr. Char:

Re: Kalaeloa Solar One and Two – Island of Oahu, Ewa District
TMK: 9-1-013:0 28 (portion)

Thank you for your request for comments on the Draft Environmental Assessment for the Kalaeloa Solar One and Two projects to be located on the Department of Hawaiian Home Lands ("DHHL") Parcel No. 4 adjacent to Saratoga Avenue in Kalaeloa, O'ahu. The Hawaii Community Development Authority ("HCDA") is responsible for the planning and development of the Kalaeloa Community Development District ("KCDD"). In 2006, the Kalaeloa Master Plan ("KMP") for the KCDD was adopted. Until the Kalaeloa administrative rules are adopted, the KMP is the primary resource available to guide activities in the KCDD.

The KMP designates this entire DHHL parcel as "eco-industrial" which allows for sustainable and renewable energy technology projects such as the Kalaeloa Solar One and Two projects. The draft Kalaeloa Administrative Rules, designed to execute the KMP, anticipates a "mixed-use" zoning for this particular parcel. Therefore this project would be an acceptable land use. The HCDA expects to have the rules adopted before summer 2011; therefore, we request that you incorporate building heights, streetscape frontages, building setbacks, and other zoning and development requirements that are detailed in the draft rules into the project's final building design and layout. In addition, the HCDA recommends a thorough review of the project eligibility requirements as it refers to public dedication and infrastructure.

Although the significance of archaeological sites, cultural sites, endangered species and historical sites does not fall within HCDA's purview, the HCDA encourages every project to work closely with the State Historic Preservation Division ("SHPD") to ensure significant resources are not negatively impacted. Please include in your packet request for a consistency review the final mitigation plan approved by SHPD. I have enclosed two reference maps that may provide you guidance on your plans and design.

We would like to encourage that your project design does not impede vehicular access on Mumba Street. Mumba Street currently serves as the ingress and egress for landowners along the western perimeter of the KCDD, including current DHHL tenants, the U.S. Navy bio-solids facility, U.S. Fish and Wildlife Service and the Kalaeloa airport. Additionally, it has been established that Federal, State and City and County of Honolulu emergency personnel will utilize Malakole Gate and Mumba Street to evacuate the public from Campbell Industrial Park in an industrial or natural emergency situation.

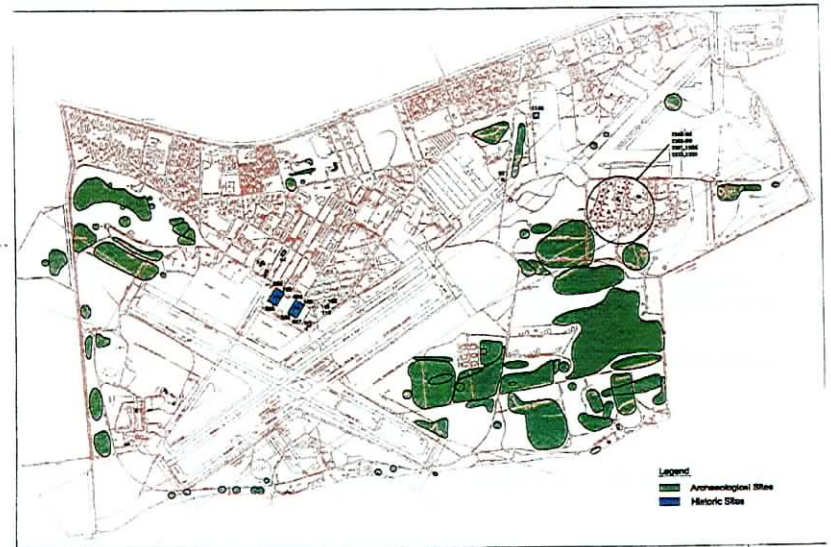
We envision that Kalaeloa Solar One and Two will be a valuable part of this community and our State's goal for renewable energy independence. It is also the community's vision that Kalaeloa be a *Wahi Ho'okela*, a Center for Excellence within the Ewa region and a model of achievement to surrounding communities, the island of Hawai'i and the world. In this spirit, we strongly encourage that your project blend as seamlessly as possible with the surrounding environment through creative design, landscape architecture and "green" buffer zones.

If you have any questions regarding this matter, please do not hesitate to contact Tesha Malama, Kalaeloa Director of Planning and Development, at 692-7245 or via email at: tesha@hcdaweb.org.

Sincerely,

Anthony J. H. Ching
Executive Director

AJHC/TM:ak
Encs.
c: Mr. David Tanoue, Director
(Department of Planning and Permitting)
Ms. Kathy Sokugawa, Division Chief for Planning Division
(Department of Planning and Permitting)
Mr. Alapaki Nahale-a, Chairperson
(Department of Hawaiian Home Lands)
Ms. Linda Chinn, Administrator for Land Management Division
(Department of Hawaiian Home Lands)



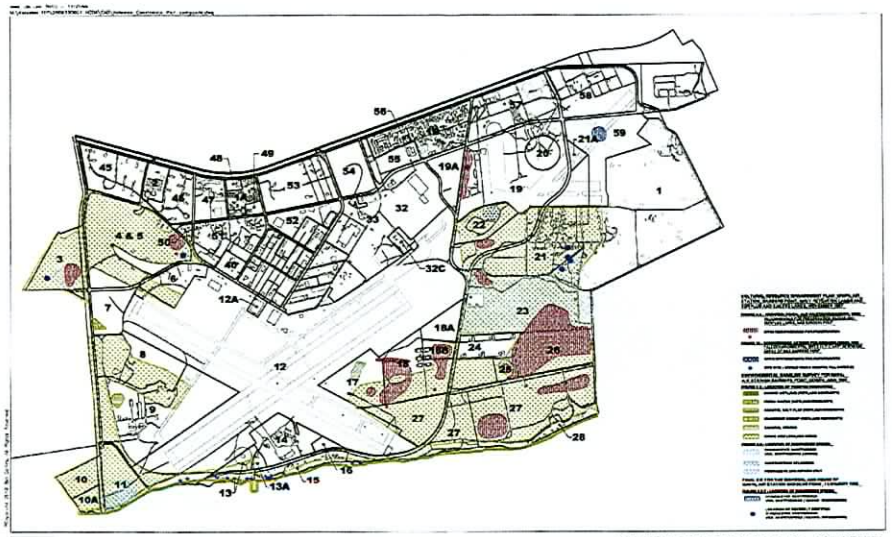
Archaeological and Historic Sites

Kalaeloa Redevelopment Plan

Plot to Scale

0 1000' 2000' 3000'

Figure 2-5



KALAELOA CONSTRAINTS PLAN - COMPOSITE

Ford Island Venture, LLC

January 8, 2010

NORTH

SCALE IN FEET

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Anthony J.H. Ching
Executive Director
Hawaii Community Development Authority
431 Cooke Street
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Ching,

Thank you for your January 27, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

We note that the Hawaii Community Development Authority (HCDA) has reviewed the Draft EA, and determined that the project would be an acceptable land use according to the Kalaeloa Master Plan (KMP).

The project's final design would be in accordance with the draft Administrative Rules that are designed to execute the KMP and expected to be adopted before summer 2011. Although the project development would be visible from adjacent roadways; it would be low to the ground and not obstruct views through the site, except for the minor support facilities. Please also refer to Figure 2.3 of the Final EA, which shows a change in the notional siting of project support structures to the southern side of the CSP facility, where they would not be visible from Boxer Street.

We appreciate the provision of the two reference maps "Archaeological and Historic Sites" and "Kalaeloa Constraints Plan – Composite" to assist in the management of archaeological sites, cultural sites, endangered species and historical sites. We have reviewed these maps and they will be referenced as necessary in planning and design of the project.

Keahole Solar LLC is working closely with the State Historic Preservation Division (SHPD) regarding archaeological findings on the project site. A *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* has been conducted pursuant to HAR 13§276 for the project area. A draft report of the survey is available as Appendix B to the Final EA and was submitted to SHPD for official review and approval. Archaeological sites were identified within the proposed development area. Preservation and avoidances are recommended for those sites that are considered eligible for the National Register of Historic Places under Criterion D for sites which have yielded, or may be likely to yield, information important in prehistory or history. One site is also considered eligible for the Hawaii Register of Historic Places under Criterion (e) because isolated, disarticulated human burials and skeletal remains were found. The AIS recommends preparation of an Archaeological Monitoring Plan (AMP) and a Historic Preservation Plan (HPP). Construction will not commence until the AIS is reviewed and accepted by SHPD, and until SHPD approves an AMP and HPP. Please see Section 3.7 of the Final EA for more information.

Figures in the Final EA have been modified to show that the perimeter fencing and development of the PV portion will not extend into Mumba Street and there will be no permanent gates installed at the Mumba Street side of the facility. Text was added to Section 3.11 to describe the importance of Mumba Street as 1) the ingress and egress route for tenants in the area and 2) an emergency route to evacuate the public from Campbell Industrial Park in a natural or industrial emergency.

The project will blend with the environment in that it would have a low profile with few structures and not interfere with view planes. No landscaping or green buffer is envisioned at this time.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD11/5177B

January 14, 2011

Faith Caplan, Senior Associate
TEC, Inc.
1003 Bishop Street
Pauahi Tower, Suite 1550
Honolulu, Hawaii 96813

RE: Draft Environmental Assessment
Kalaeloa Solar One and Two Project
Kalaeloa, island of O'ahu

Aloha e Faith Caplan,

The Office of Hawaiian Affairs (OHA) is in receipt of your letter seeking comments on a draft environmental assessment (DEA) prepared for Keahole Solar Power, LLC. The development of two independently owned and operated solar power generating facilities (project) is being proposed on approximately 80 acres parcel (lease parcel) leased from the State of Hawai'i-Department of Hawaiian Homelands (DHHL). The lease parcel is situated within the Kalaeloa Community Development District, which is under the jurisdiction of the Hawai'i Community Development Authority. The first facility, Kaleloa Solar One will be owned and operated by Kalaeloa One, LLC and the second, Kalaeloa Solar Two will be owned and operated by SunPower Corporation. DHHL will be the approving agency for the DEA.

The project intends to produce 10 megawatts of power which will be fed into the existing Hawaii Electric Company grid. Overall, OHA recognizes that the intent of this project is to reduce dependence on imported oil and contribute to reaching the Hawaii Clean Energy Initiative goal of having 70 percent of the State's energy coming from renewable sources by 2030. We applaud all parties involved in this effort.

Section 3.7 of the DEA details that archaeological inventory surveys have identified archaeological and cultural sites situated on the lease parcel. Consultation with the Department of Land and Natural Resources-State Historic Preservation Division on the development of appropriate mitigation plans is on going. It is our hope that appropriate short and long term mitigation measures can be finalized before the initiation of project activities.

OHA concurs with the anticipated "finding of no significant impact" determination contained within the DEA. Thank you for the opportunity to provide comments. Should you have any questions, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Mr. Clyde W. Nāmu'o
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Blvd. Suite 500
Honolulu, Hawaii 96813

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Mr. Nāmu'o,

Thank you for your January 14, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA). We note that the Office of Hawaiian Affairs has reviewed the Draft EA and concurs with the anticipated "finding of no significant impact" determination contained within the document.

Keahole Solar LLC is working closely with the State Historic Preservation Division (SHPD) regarding archaeological findings on the project site. A *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* has been conducted pursuant to HAR 13§276 for the project area. A draft report of the survey is available as Appendix B to the Final EA and was submitted to SHPD for official review and approval. Archaeological sites were identified within the proposed development area. Preservation and avoidances are recommended for those sites that are considered eligible for the National Register of Historic Places under Criterion D for sites which have yielded, or may be likely to yield, information important in prehistory or history. One site is also considered eligible for the Hawaii Register of Historic Places under Criterion (c) because isolated, disarticulated human burials and skeletal remains were found. The AIS recommends preparation of an Archaeological Monitoring Plan (AMP) and a Historic Preservation Plan (HPP). Construction will not commence until the AIS is reviewed and accepted by SHPD, and until SHPD approves an AMP and HPP. Please see Section 3.7 of the Final EA for more information.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY KAULIKUKUI
FIRST DEPUTY

WILLIAM M. TAM
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

February 16, 2011

Ms. Faith Kaplan
TEC Inc.
1003 Bishop Street
Honolulu, HI 96819

LOG NO: 2011.0108
DOC NO: 1102MV16
Archaeology

Dear Ms. Kaplan:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Draft Environmental Assessment (EA) for the Kalaeloa Solar One and Two Project
Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu
TMK: (1) 9-1-013:028

Thank you for the opportunity to review this draft EA that we received on January 10, 2011. The EA indicates that there will be a significant amount of ground disturbing activity, in the form of grading and vegetation removal, associated with this project. This project was included in two reconnaissance level archaeological surveys that focused on the Barbers Point Naval Air Station (Haun 1991 and Tuggle 1997). These surveys recorded 10 archaeological sites within this project area. In the initial survey, Haun (1991) determined that 7 of these 10 sites were possible burial sites. In order to further document the locations of the historic properties within the project area TEC Inc. archaeologist Boyd Dixon conducted a field inspection of the property. This inspection focused on recording the GPS location of the 10 known archaeological sites. However, Dixon noticed the possibility of additional undocumented karstic sinkholes within the project area. This indicates that this project has the potential to impact significant archaeological and cultural sites.

You have submitted an integrated archaeological mitigation plan to SHPD in order to lessen the impacts on the previously identified archaeological resources. We believe that this plan may eventually serve as the appropriate course of action for this project. However, at this point our main concern is that there are additional undocumented archaeological resources within this project area that will not receive protection under this proposed mitigation plan. The initial survey of this project area (Haun 1991) was conducted in 1984 and was part of a large 1230-acre project area. The survey employed higher spacing on survey transects then what would currently classify as an intensive AIS. Subsequently, Tuggle (1997) surveyed portions of the KPS project area in a larger survey, but only subjected areas east of the project area to "detailed" survey. The change in archaeological standards and lack of previous coverage indicate that additional undocumented archaeological resources may be present in this project area. Therefore, we request that an intensive archaeological inventory survey, pursuant to HAR 13§276 be conducted for this project area. We recommend that a report of the survey be submitted to SHPD for approval prior to commencement of construction.

Please contact Michael Vitousek at (808) 692-8029 or Michael.Vitousek@hawaii.gov if you have any questions regarding this letter.

Aloha,

Theresa K. Donham
Acting Archaeology Branch Chief
Historic Preservation Division

1003 Bishop Street,
Pauahi Tower, Suite 1550
Honolulu, HI 96813
(808) 528-1445 • fax (808) 528-0768
www.tecinc.com

September 26, 2011

Ms. Theresa K. Donham
Acting Archaeology Branch Chief
State of Hawaii
Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Boulevard, Room 555
Kapolei, Hawaii 96707

Subject: **Draft Environmental Assessment/Anticipated Finding of No Significant Impact (FONSI), Kalaeloa Solar One and Two Facility, Kalaeloa, Tax Map Key 9-1-13:28 Response to Comment**

Dear Ms. Donham,

Thank you for your February 16, 2011 comment letter regarding the Kalaeloa Solar One and Two Draft Environmental Assessment (EA).

As advised in your letter, a *Supplemental Archaeological Inventory Survey (AIS) for Kalaeloa Solar One and Two Projects* has been conducted pursuant to HAR 13§276 for the project area. A draft report of the survey is available as Appendix B to the Final EA and was submitted to SHPD for official review and approval. Archaeological sites were identified within the proposed development area. Preservation and avoidances are recommended for those sites that are considered eligible for the National Register of Historic Places under Criterion D for sites which have yielded, or may be likely to yield, information important in prehistory or history. One site is also considered eligible for the Hawaii Register of Historic Places under Criterion (e) because isolated, disarticulated human burials and skeletal remains were found. The AIS recommends preparation of an Archaeological Monitoring Plan (AMP) and a Historic Preservation Plan (HPP). Construction will not commence until the AIS is reviewed and accepted by SHPD, and until SHPD approves an AMP and HPP. Archeological resources information is located in Section 3.7 of the Final EA.

If you have any questions or concerns, please call me at 808-528-1445 or fax to 808-528-0768.

Sincerely,

Faith Caplan, AICP
Senior Associate

CC: Keahole Solar Power c/o Mr. Sheldon Char
DHHL c/o Mr. Todd Gray

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APPENDIX B

ARCHAEOLOGICAL INVENTORY SURVEY

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APPENDIX B: ARCHAEOLOGICAL INVENTORY SURVEY

The following Draft AIS is being reviewed by SHPD and its results are summarized in Section 3.7 (Archaeological Resources).

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DRAFT REPORT

A Supplemental Archaeological Inventory Survey for the Kalaeloa Solar One and Kalaeloa Solar Two Projects, Honouliuli Ahupua'a, District of 'Ewa, Island of O'ahu.

(TMK: [1] 9-1-013:28 (Por.)

Prepared for:

Kalaeloa Solar One, LLC
2800 Woodlawn Drive, Suite 234
Honolulu, HI 96822

and

SunPower Systems
1414 Harbour Way South
Richmond, CA 94804

August 2011

PACIFIC CONSULTING SERVICES, INC.

720 Iwilei Road, Suite 424, Honolulu, Hawaii 96817

DRAFT REPORT

A Supplemental Archaeological Inventory Survey for the Kalaeloa Solar One and Kalaeloa Solar Two Projects, Honouliuli Ahupuaʻa, District of ʻEwa, Island of Oʻahu (TMK: [1] 9-1-013:28 (Por.)

Prepared By:
Dennis Gosser, M.A., RPA
Paul Titchenal, M.A.
Sara Collins, Ph.D., RPA
Stephan D. Clark, B.S. and
Richard Nees, B.A.
with contributions by
Keola Nakamura, B.A.
Tae Watanabe, B.A.,
Yvette Osborne, M.A., and
Jackie Walden, B.A.

of

Pacific Consulting Services, Inc.
720 Iwilei Road, Suite 424
Honolulu, HI 96817

Prepared For:
Kalaeloa Solar One, LLC
2800 Woodlawn Drive, Suite 234
Honolulu, HI 96822

and

SunPower Systems
1414 Harbour Way South
Richmond, CA 94804

August 2011

ABSTRACT

Between March 18 and July 15, 2011, Pacific Consulting Services, Inc. (PCSI) conducted an Archaeological Inventory Survey (AIS) of approximately 80.5 acres within the *ahupua‘a* of Honouliuli, ‘Ewa District, Island of O‘ahu (TMK: (1) 9-1-013:028 [por]). The Area of Potential Effect (APE) is within a parcel located in the northwest corner of the former Naval Air Station Barbers Point (NASBARPT), and was acquired by the Department of Hawaiian Home Lands (DHHL) in 1999 when the US Navy decommissioned the station as part of the Base Realignment and Closure (BRAC) program; DHHL is the current landowner. Kalaeloa Solar One, LLC (KSO), a subsidiary of Keahole Solar Power, LLC, and SunPower Systems (SunPower) are leasing the property.

Two projects are proposed for different areas of the APE: a micro-CSP solar farm will be developed by KSO in Kalaeloa Solar One (KS1), while a photovoltaic system will be developed by SunPower in Kalaeloa Solar Two (KS2). Both projects will require extensive alteration to the landscape in the APE.

The AIS was conducted to identify and record archaeological resources within the APE that are on, or potentially eligible for inclusion on, the National Register of Historic Places (NRHP) and the Hawaii Register of Historic Places (HRHP). The survey was conducted in compliance with Section 106 of the National Historic Preservation Act of 1966 and the Advisory Council on Historic Preservation’s regulations for compliance with Section 106, codified as 36 CFR (Code of Federal Regulations) Part 800. The scope of the investigations was consistent with the Secretary of the Interior’s *Standards and Guidelines for Archaeology and Historic Preservation.* In addition, the project was conducted in compliance with Chapter 13-276 of the Hawaii Administrative Rules (HAR), which governs the standards for surveys and reports. Key project personnel meet or exceed the qualification standards established by the *Secretary of the Interior's Standards and Guidelines* published in 36 CFR Part 61.

Archaeological survey within the APE documented four previously recorded archaeological sites (Sites 50-80-12-1717, 1718, 1719, and 1721) as well as 12 previously undocumented sites (Sites 7176-7182 and Sites 7184-7188). Thirteen previously recorded sites (Sites 1720, 1722, 4554-4556, 4558-4562, and 4565-4567) were not relocated and are presumed destroyed by bulldozing or grubbing since the mid 1990s when the most recent archaeological survey was conducted. Two previously recorded sites (Sites 1727 and 4553) adjacent to but outside the APE were revisited but no additional work was undertaken. One site (Site 4552), also adjacent to but outside the APE, is presumed extant due to a lack of disturbance in the area, but was not relocated.

Four sites (Sites 1718, 1719, and 7185 in KS1 and Site 1721 in KS2) are recommended significant under Criterion D. In addition, Site 1721 is also recommended as significant under Criterion e of the HRHP because isolated, disarticulated human burials skeletal remains were found in the Feature A modified sinkhole. These remains were returned to the Navy under the authority of NAGPRA.

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SECTION 1 INTRODUCTION

Between March 18 and July 15, 2011, Pacific Consulting Services, Inc. (PCSI) conducted an Archaeological Inventory Survey (AIS) of approximately 80.5 acres within the *ahupua‘a* of Honouliuli, ‘Ewa District, Island of O‘ahu (TMK: (1) 9-1-013:028 [por]). The Area of Potential Effect (APE) is within a parcel located in the northwest corner of the former Naval Air Station Barbers Point (NASBARPT), and was acquired by the Department of Hawaiian Home Lands (DHHL) in 1999 when the US Navy decommissioned the station as part of the Base Realignment and Closure (BRAC) program (Figures 1-1 and 1-2); DHHL is the current landowner. Kalaeloa Solar One, LLC (KSO), a subsidiary of Keahole Solar Power, and SunPower Systems (SunPower) are leasing the property.

Two projects are proposed for different sections of the APE: a micro-CSP solar farm will be developed by KSO in Kalaeloa Solar One (KS1), while a photovoltaic system will be developed by SunPower in Kalaeloa Solar Two (KS2; see Figures 1-1 and 1-2).

The archaeological survey was conducted to identify and record archaeological resources within the APE that are on, or potentially eligible for inclusion on, the National Register of Historic Places (NRHP) and the Hawaii Register of Historic Places (HRHP). The survey was conducted in compliance with Section 106 of the National Historic Preservation Act of 1966 and the Advisory Council on Historic Preservation’s regulations for compliance with Section 106, codified as 36 CFR (Code of Federal Regulations) Part 800. The scope of the investigations was consistent with the Secretary of the Interior’s *Standards and Guidelines for Archaeology and Historic Preservation.* In addition, the project was conducted in compliance with Chapter 13-276 of the Hawaii Administrative Rules (HAR), which governs the standards for surveys and reports. Key project personnel meet or exceed the qualification standards established by the *Secretary of the Interior's Standards and Guidelines* published in 36 CFR Part 61.

In consultation with Mr. Mike Vitousek of the State Historic Preservation Division (SHPD) on May 25, 2011, it was agreed that the current study could be submitted as a supplemental report to a previous AIS of selected parts of NASBARPT that included test excavations at previously recorded sites (Beardsley 2001; Haun 1991) within the current APE. As a supplemental report, the current study does not include full environmental, previous archaeology, or historic context sections, but rather updates these sections as necessary and references more synthetic reports to which the reader can refer (e.g., Tuggle and Tomonari-Tuggle 1997b). Because multiple projects have been conducted at previously recorded archaeological sites within the APE (Beardsley 2001; Erkelens 1992; Haun 1991; Jones 1993), the supplemental report incorporates data from those studies into the discussion and analysis to provide more comprehensive resource evaluations and recommendations.

REPORT ORGANIZATION

As noted above, the current study is being reported as a supplemental to Beardsley (2001) and does not contain extensive background sections. As such, a generalized Background Section is presented that contains brief subsections reviewing the environment, historic context, and previous archaeology. Following the Background section, field and laboratory methods are discussed. Finally, the results of the survey and laboratory analyses, as well as an interpretive discussion, significance evaluations, and recommendations sections are presented. Report appendices follow the References Cited section.

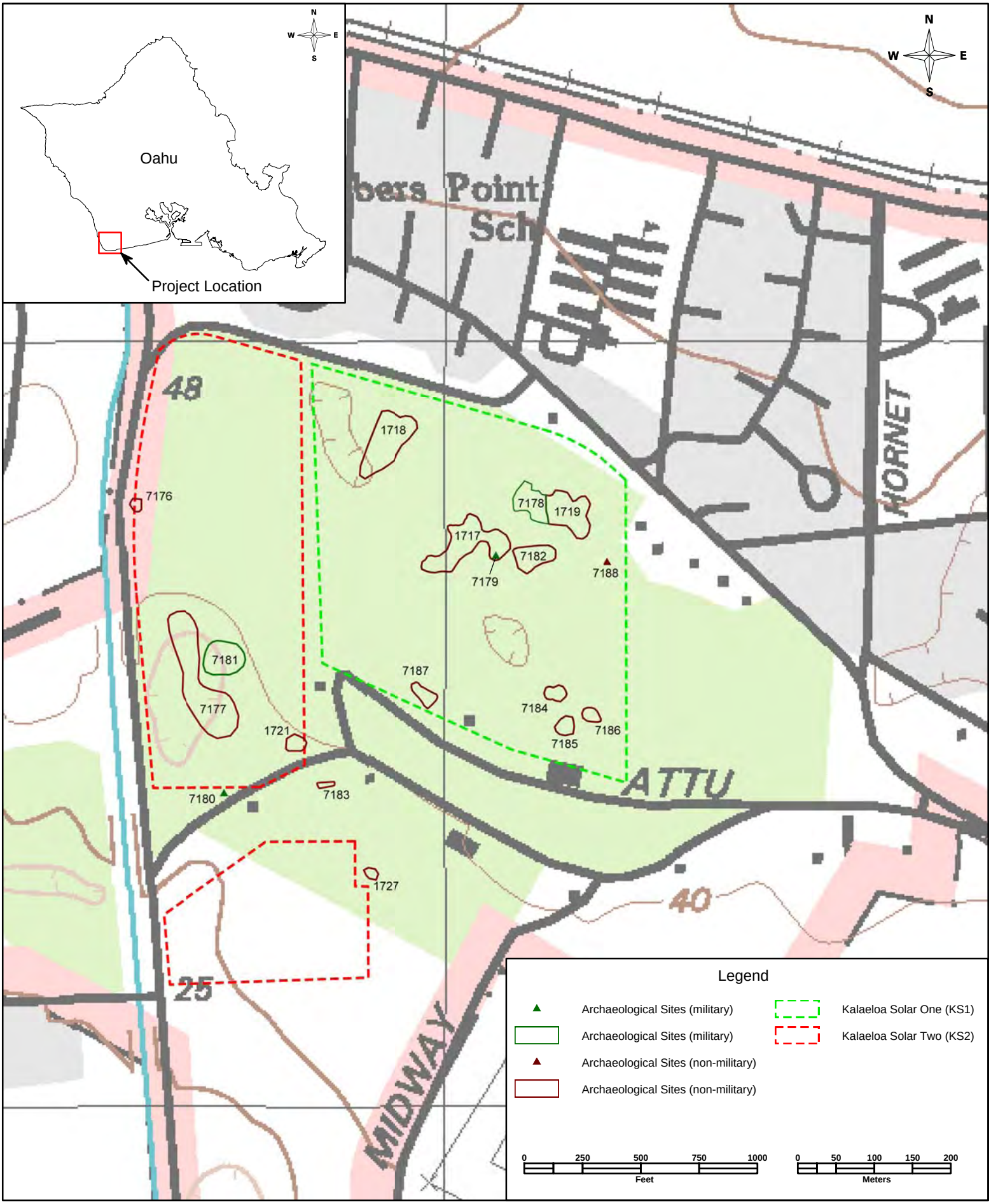
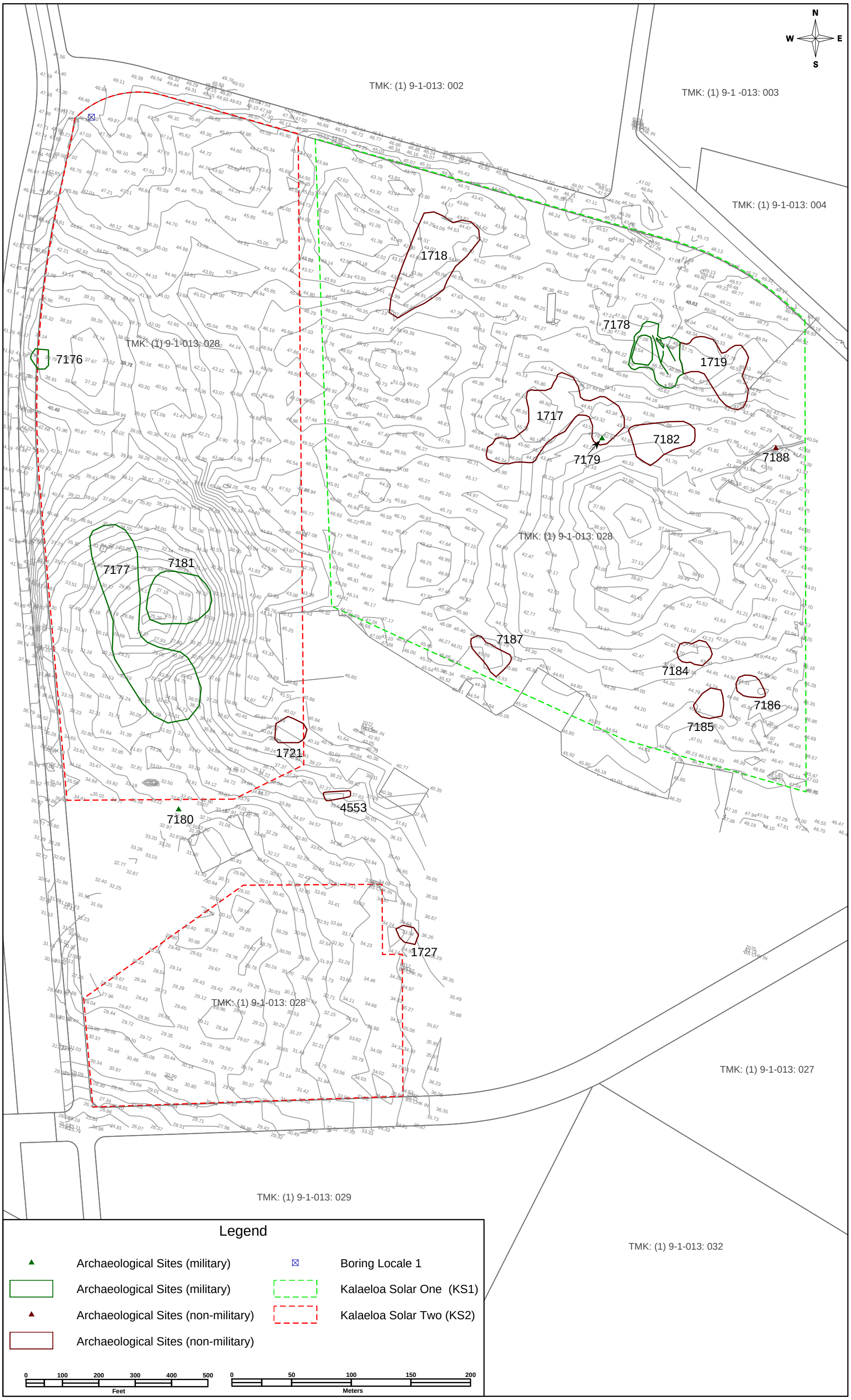


Figure 1-1. Project Area Location on U.S.G.S. Ewa Quad Map (2002).

Figure 1-2. Project Area Location on Tax Map Key.



PROJECT PERSONNEL

Sara Collins, PhD, RPA, and Paul Titchenal, MA served as the co-Principal Investigators for the project, while Dennis Gosser, MA, RPA served as the Project Director. Steve Clark was the Project Manager. Rich Nees, Keola Nakamura, Yvette Osborne, and Tae Watanabe served as field crew. In addition, Rich Nees supervised GPS data collection. Andrew Tomlinson compiled the GIS data and produced site location maps, while Ryan Nakamura produced the remaining report graphics. Jacqueline Pamerleau-Walden compiled and formatted the report. A total of 221.6 person days was expended in the field.

ACKNOWLEDGMENTS

PCSI would like to thank several people who have facilitated the completion of this project. Mr. Sheldon Char of Kalaeloa Solar One and Mr. Seth Sakamoto of SunPower Systems provided logistical support and base mapping of the project area, as well as survey-grade locations of cultural resources, and vegetation clearing of archaeological sites. At SHPD, Mike Vitousek provided input concerning how to report the results of a supplemental project. Mr. John Bennett provided information concerning World War II facilities and activities within the APE. Mr. Shad Kane consulted with us regarding archaeological sites in the project area and the potential for community educational opportunities associated with sites to be recommended for preservation.

SECTION 2 BACKGROUND

The environmental setting and historic background of the ‘Ewa Plain, Honouliuli Ahupua‘a, and NASBARPT have been extensively discussed in Beardsley (2001), Haun (1991), The Traverse Group (1988), Tuggle (1997), Tuggle and Tomonari-Tuggle (1994, 1997a, 1997b), and Yoklavich et al. (1995). These sections are only briefly summarized for the current study.

ENVIRONMENT

The ‘Ewa Plain consists primarily of a raised coral reef extending from West Loch (Pearl Harbor), west to the Wai‘anae Mountains. The predominant topographic features of the southern portion of the plain are the ubiquitous coralline sinkholes, which can be both culturally and paleontologically important (Tuggle and Tomonari-Tuggle 1997b); a wetland environment may have developed behind low coastal dunes inland of the coast near the former NASBARPT (Tuggle and Tomonari-Tuggle 1997b). In addition, the current study area is located near the transition zone between the alluvial sediment deposits of the Wai‘anae Mountains and the exposed karst of the coastal region (Tuggle and Tomonari-Tuggle 1997a: Figure 3).

Vegetation in the APE is comprised of introduced secondary growth and xerophytic species including *kiawe* (*Prosopis pallida*), *koa haole* (*Leucaena leucocephala*), grasses, and other invasive shrubs and vines. Sparse stands of native *‘ilima* (*sida fallax*) are also present. Rainfall on the coastal portions of the ‘Ewa Plain is minimal, with a median annual total of approximately 23.6 inches (Giambelluca et al. 1986).

LAND USE AND DISTURBANCE IN THE APE

Historically, the ‘Ewa plain supported ranching, sugarcane agriculture, and more localized agricultural pursuits such as sisal cultivation (Tuggle and Tomonari-Tuggle 1994, 1997b), activities that likely had wide-ranging impacts on the landscape and pre-existing cultural resources. However, the first clear evidence of large-scale disturbance in the project area can be related to military/industrial use associated with NASBARPT and its development. As early as 1942, north-south lines were systematically bulldozed or grubbed throughout the study area to support mapping for the base infrastructure (Tuggle and Tomonari-Tuggle 1994). Aerial photographs ranging between 1953 and 1968 show the bulldozed lines, but little additional large-scale land clearing in the APE (Figures 2-1 and 2-2).

Haun (1991:26) notes disturbance within the Bishop Museum’s larger NASBARPT project area, but does not specifically characterize the current study area. However, field notes from the 1985 project (BPBM 1985) indicate bulldozer disturbance at recorded sites investigated during the current study; it is unclear whether the noted bulldozing can be attributed to the 1942 NASBARPT construction or subsequent events (also, see Tuggle 1995). During 1995 fieldwork, Beardsley (2001) reported bulldozing that occurred sometime after Haun (1991) completed his fieldwork in the 1980s in the vicinity of Site 1722 that destroyed five or six features recorded by Haun. Prior to the current project, the study area was extensively grubbed along east-west lines, again to create sight-lines in support of topographical mapping. Before grubbing, known archaeological sites were revisited and delineated by GPS using flagging tape (personal communication, Boyd Dixon 2010). The two major ground-altering events have disturbed or destroyed known, yet undocumented features (Jones 1993) as well as previously recorded sites (Beardsley 2001; Haun 1991) within the study area. The extensive disturbance compromises the integrity of the remaining resources and diminishes their ability to contribute to broad research questions of intra- and intersite organization. Likewise, the lack of contextual integrity diminishes the comparative regional value and significance of the remaining resources.

Figure 2-1. NAS Barbers Point in October, 1953, Showing the Approximate Project Area Location. Source: Hawaii Aviation Preservation Society (HIAVPS 2011).

Figure 2-2. NAS Barbers Point in March, 1964, Showing the Approximate Project Area Location. Source: Hawaii Aviation Preservation Society (HIAVPS 2011).

HISTORIC CONTEXT

Beardsley (2001) and Tuggle and Tomonari-Tuggle (1997b) provide a comprehensive historic context for the APE, NASBARPT, the ‘Ewa Plain, and Honouliuli Ahupua‘a, including a discussion of traditional resources and land use, legends, and place names that draws upon earlier ethnohistoric and oral-traditional research such as Pukui, Elbert, and Mookini (1974), I‘i (1963), Beckwith (1970), Kamakau (1976), McAllister (1933), and Handy and Handy (1972). Below is a brief synopsis of the pre-Contact and post-Contact historic context of the APE.

Although the earliest colonization of the Hawaiian islands has been a long-standing debate among archaeologists in Hawai‘i (see Graves and Addison [1995] and Dye 2011 for a review), the accumulation of critically analyzed radiocarbon dates and other data has helped to refine the earliest date for the initial presence of humans to around AD 800 (Kirch 2007; but see Charvet-Pond and Davis 1992, Cordy 2002, Davis and Haun 1987, and Dunn et al. 1991 for possible earlier dates on the ‘Ewa Plain). Beardsley (2001:II.14) suggests that intensive occupation of the ‘Ewa Plain occurred by the 13th century with an increasing expansion into the marginal areas of Honouliuli (also see Davis 1990, Cleghorn and Davis 1990, and Tuggle 1997b).

By the 16th century, political unification by La‘akona consolidated northern and western O‘ahu authority in upland Honouliuli at Līhu‘e (Cordy 2002). By the late pre-Contact or early post-Contact period, a three- or four-tiered political organization that included a paramount chief, district chiefs, *ahupua‘a* chiefs, as well as lower chiefs and land mangers was in place. By the mid 18th century, most of the population of ‘Ewa was concentrated around Honouliuli Gulch, while the remainder of the ahupua‘a was awarded to Kekau‘onohi during the Great Mahele (LCA 11216).

With the increasing influence of foreign political, economic, and ideological systems throughout the 19th century, traditional settlement, subsistence, and religious institutions were abandoned in many areas of O‘ahu. By the late 19th century, Honouliuli had been sold off to a few large landowners and developed into cattle ranches, sugarcane fields, sisal farms, and other agricultural endeavors (Beardsley 2001, Tuggle and Tomonari-Tuggle 1997b). Military development of the region began in the late 19th century with the establishment of the Barbers Point Lighthouse and accelerated significantly in the first part of the 20th century with the development of several large bases including NASBARPT, Hickam Field, and Pearl Harbor. Small industry as well as commercial, government, and residential development have replaced military development in the region since the closing of NASBARPT.

PREVIOUS ARCHAEOLOGY

Cultural resources studies on the ‘Ewa Plain have increased significantly since 1970, primarily in response to Federal, State, and County laws and ordinances regulating historic preservation (Tuggle and Tomonari-Tuggle 1997b). As a result, the coastal and inland plain portion of Honouliuli Ahupua‘a is one of the most intensely studied areas on O‘ahu.

All or parts of the APE have been the subject of multiple archaeological studies, including four field surveys (Beardsley 2001; Haun 1991; Jones 1993; Tuggle 1997) and additional summary, overview, management, or interpretative reports (Tuggle and Tomonari-Tuggle 1994, 1997a, 1997b; The Traverse Group 1988; Yoklavich et al. 1995). Twenty archaeological sites have been recorded within the APE, 15 of which have been destroyed (Table 2-1).

Extant Previously Recorded Sites in the APE

Four extant previously recorded archaeological sites (Sites 1717, 1718, and 1719 in KS1, and 1721 in KS2) within the APE were originally described in Haun (1991) and subsequently revisited by Beardsley (2001); three additional sites (Sites 1727, 4552, and 4553) are adjacent to KS2 but outside the APE. While the two reports frequently vary in terms of metric information, formal types, and functional interpretations, they provide the most complete comparative data for sites and features within the APE. Jones (1993) surveyed a portion of the current study area at the reconnaissance level and provided cursory information concerning feature location and formal type, but does not include metric data. Erkelens (1992) mapped site 1719 in support of a planned interpretive program (The Traverse Group 1988).

Table 2-1. Summary of Beardsley's (2001) Sites and Features in KS1 and KS2.

Site	Fe.	Feature Type	Feature Function	EU*	Destroyed (Y/N)
KS1 Sites					
1717	A	L-shaped wall	Agriculture		N
	B	Linear wall	Agriculture		N
	C	Cairn	Agriculture	54	N
	D	Enclosure	Temp. Habitation	52	N
	E	L-shaped wall	Temp. Habitation		N
	F	Enclosure	Temp. Habitation	53	N
1718	A	Enclosure	Temp. Habitation	39	N
	B	Mound	Agriculture	36	N
	C	L-shaped wall	Temp. Habitation	37	N
	D	C-shaped wall	Temp. Habitation	38	N
	E	Mound	Agriculture	40	N
1719	A	C-shaped wall	Agriculture	29	N
	B	Enclosure	Temp. Habitation	28/33	N
	C	Enclosure	Temp. Habitation	31	N
	D	C-shaped wall	Agriculture	32	N
	E	Cairn	Temp. Habitation	30	N
1720	A	Cairn	Temp. Habitation	36	Y
	B	C-shaped wall	Temp. Habitation	34	Y
1722	B	Enclosure	Temp. Habitation	46	Y
	C/D	Enclosure	Agriculture	47	Y
	E	Linear wall	Agriculture	51	Y
	K	Cairn	Temp. Habitation	45	Y
	L	Cairn	Temp. Habitation	49	Y
	M	Cairn	Temp. Habitation	48	Y
	N	Cairn	Temp. Habitation		Y
	O	Cairn	Temp. Habitation	50	Y
	P	Cairn	Temp. Habitation		Y
	Q	Linear wall	Agriculture		Y
	R	Modified sinkhole	Agriculture		Y
	S	Cairn	Temp. Habitation		Y
KS2 Sites					
1721	A	Modified sinkhole	Temp. Habitation	44, SC	N
	B	Linear wall	Temp. Habitation		N
	C	L-shaped wall	Temp. Habitation	41	N

Site	Fe.	Feature Type	Feature Function	EU*	Destroyed (Y/N)
	D	L-shaped wall	Temp. Habitation	43	N
	E	Mound	Agriculture	42	N
	F	Linear wall	Agriculture		N
	G	Linear wall	Agriculture		N
	H	Modified sinkhole	Agriculture		N
4554		Modified sinkhole	Agriculture	18	Y
4555		Mound	Agriculture		Y
4556	A	Terrace	Agriculture	6	Y
	B	Modified sinkhole	Agriculture		Y
	C	Mound	Agriculture		Y
	D	Cairn	Agriculture		Y
	E	Terrace	Agriculture	5	Y
	F	Mound	Agriculture		Y
4558	A	L-shaped wall	Agriculture	7	Y
	B	Mound	Agriculture		Y
4559	A	Terrace	Agriculture		Y
	B	Linear wall	Agriculture		Y
	C	Mound complex	Agriculture	ST	Y
	D	Platform	Agriculture	15	Y
4560	A	Mound	Agriculture		Y
	B	Terrace	Agriculture	13	Y
	C	Modified sinkhole	Agriculture	14	Y
4561	A	Mound	Agriculture	12	Y
	B	Cairn	Agriculture	11	Y
	C	Alignment	Agriculture	ST	Y
4562	A	Terrace	Agriculture		Y
	B	Linear wall	Agriculture		Y
	C	Terrace	Agriculture		Y
	D	Mound	Agriculture		Y
	E	Modified sinkhole	Agriculture		Y
4566	A	Wall (L-shape)	Agriculture	9	Y
	B	Terrace	Agriculture	8	Y
4567	A	Modified sinkhole	Agriculture		Y
	B	Linear wall	Agriculture		Y
*EU = Excavation Unit SC= Surface Collection ST=Shovel Test					

Site 50-80-12-1717

Haun (1991:37) originally recorded Site 1717 as a small habitation complex of four features (Features A-D), with Feature C recorded as a possible human burial. However, the original Bishop Museum field maps (BPBM 1985:BA-1) indicate that “many mounds appear

throughout the area" and that "some mounds may be other feature types." No excavations were conducted at this site as part of the Haun (1991) study.

Beardsley (2001:IV.9) recorded six features at Site 1717, two of which (Features E and F) were not recorded by Haun (1991). Excavations were conducted at Feature C (cairn), Feature D (enclosure), and Feature F (enclosure). No cultural material or evidence of human interment was recorded within Feature C, while excavations at Feature D recovered mixed historic and traditional artifact types (limestone flakes and historic glass). Excavations at Feature F recovered sparse cultural material (three limestone flakes). In addition, charcoal from the cultural layer (Layer II) in Feature F produced a date of cal A.D. 1432-1664 (Beta No. 85056; radiocarbon dates from Beardsley [2001] have been recalibrated to facilitate comparison with radiocarbon dates from the current study—see Section 6).

It is possible that Jones (1993) recorded features of Site 1717 at the reconnaissance level (Jones 1993: Figure 6 and Table 1). However, Site 1717 appears to be near or just outside that project's study area where features were recorded but not correlated with existing site locations.

One soil sample from excavations at Feature F was submitted for pollen, phytolith, and macrofloral analysis. The samples contained a mix of native (e.g., *Antidesma* spp.*)* and introduced species (e.g., *Leucaena* spp*.* and *Prosopis* spp.) (Scott-Cummings and Puseman 2001 [in Beardsley 2001]).

Site 50-80-12-1718

Haun (1991:38) originally recorded Site 1718 as habitation complex of six features (Features A-F) that included habitation, agricultural, and possible burial structures (Feature E). The original Bishop Museum field maps (BPBM 1985:BA-2) indicate that more mounds as well as disturbed areas were present around the site area. No excavations were conducted at this site as part of the Haun (1991) study.

Site 1718 was originally included as part of an interpretive plan that included trails, signage, and possibly restoration efforts (The Traverse Group 1988). A more recent trail development study (Erkelens 1992) does not include Site 1718.

Beardsley (2001:IV.11) recorded five of the original features (excluding Feature F) at Site 1718. Excavation units of various sizes were excavated in each of the five extant features (Features A-E). Midden (predominantly marine shell) was recovered from all of the excavations and a historic lead pellet was recovered from Feature C (L-shape). The midden concentrations at Features A (enclosure) and D (C-shape) were described as dense, while the remainder were described as sparse. Excavations at Feature E (possible burial) recovered no evidence of human interment. Two charcoal samples from Feature A were submitted for radiocarbon dating. Beta No. 85052 from Layer III produced a date of calAD 1665-1952, while Beta No. 85053 from a hearth subfeature within the structure produced a date of calAD 1656-1953.

Jones (1993: Table 1) recorded 11 features as part of the Site 1718 complex but did not correlate any of the features with features recorded by Haun (1991). Most of the previously undocumented features recorded by Jones (1993) appear to be mounds, which is consistent with original field maps from the BPBM project (BPBM 1985: B-2; Haun 1991).

Site 50-80-12-1719

Haun (1991:38) originally recorded Site 1719 as a habitation complex of five features (Features A-E) that included habitation, agricultural, and possible burial structures (Feature E). The original Bishop Museum field maps (BPBM 1985:BA-3) indicate that bulldozer activity had

partially disturbed some of the site area. No excavations were conducted at this site as part of the Haun (1991) study.

Erkelens (1992) surveyed and mapped Site 1719 as part of a trail development study likely generated by the 1988 Natural Resources Management Plan for NASBARPT (The Traverse Group 1988). While no additional features were recorded during the project, Erkelens (1992:8) provided more detailed descriptions of the site and noted that "documentation and interpretation of Site 1719 will remain incomplete until the numerous other features to the north and west of the site are cleared and investigated." Erkelens (1992:4) also noted bulldozing disturbance northeast, west, and southwest of the site.

Beardsley (2001:IV.15) recorded the five original features at Site 1719. Single excavation units were placed in Features A (C-shape), C (enclosure), and E (cairn), while two excavation units were placed in Feature B (enclosure). Midden (predominantly marine shell) was recovered from all of the excavations and a historic lead pellet was recovered from Feature C. The midden concentration at Feature B was described as dense, while the concentrations from the other features were described as sparse. One charcoal sample from a hearth (HF-5) in Feature B was submitted for radiocarbon dating. Beta No. 85051 produced a date of calAD 1675-1942.

Site 50-80-12-1721

Haun (1991:43) originally recorded Site 1721 as a habitation complex of five features (Features A-E) that included a sinkhole with a possible platform in the interior. No excavations were conducted at this site as part of the Haun (1991) study.

Beardsley (2001:IV.20) recorded the five original features at Site 1721 as well as three additional features. Single excavation units were placed in Features A, C, D, and E. Faunal material was recovered from all of the excavations. In addition, 41 traditional artifacts including bone fishhooks, worked bone, and lithics were recovered from the surface and a single excavation unit in Feature A (sinkhole/cave). Excavations at Features C, D, and E recovered sparse faunal material. Two charcoal samples from Feature A were submitted for radiocarbon dating. Beta No. 85054 from Layer I produced a date of calAD 1521-1955, while Beta No. 85055 from Layer II produced a date of calAD 1468-1955.

Fragmentary human remains of two or three individuals (two probable infants) were recovered from Feature A (Beardsley 2001). Subsequent to analysis, the remains were returned to the US Navy (see Beardsley 2001: Appendix F). Two soil samples from excavations at Feature A (sinkhole) were submitted for pollen, phytolith, and macrofloral analysis to determine if there were possible vegetation differences between upper and lower layers. Scott-Cummings and Puseman (2001:D-5) note that:

> [t]he lower layer (Layer II) exhibited evidence of *Antidesma* trees, palm trees, some grasses and Cheno-ams, as well as *Sida*, *Canthium*, and members of the Asteraceae family. The upper layer (Layer I) contained large quantities of Cheno-am pollen and grass short cell phytoliths.

Beardsley did not relocate a series of cairns/cairn remnants recorded by Haun (1991: Site 1722, Features F, G, I, and J), which were interpreted as possible burial/storage features (Features F and G) or possible burial/agricultural mounds (Features I and J). She surmised that these features were destroyed by bulldozing sometime between the early 1980s and 1995.

Site 50-80-12-1727

Site 1727 was originally within the current APE, however, changes in the boundary of KS2 now exclude the site from the project area. Haun (1991) originally identified a cave feature, while Burgett and Rosendahl (1992) identified and tested (shovel probe) a sinkhole adjacent to the cave. The excavation of the sinkhole did not recover cultural material. However, the cave feature included paved areas, a small platform, as well as both historic and pre-Contact artifacts on the surface (e.g., a tapa beater, a possible gourd fragment, a piece of coral, midden, and cow, pig, and horse bone).

Site 50-80-12-4552

Site 4552 was originally recorded by Beardsley (2001:IV.37) as a complex of four potential agricultural features (two modified outcrops, a modified sinkhole, and a mound). A single excavation unit was placed in Feature C (modified sinkhole) but recovered no artifactual material. The site abuts the current APE, but was not relocated during the current study.

Site 50-80-12-4553

Site 4553 was originally recorded by Beardsley (2001:IV.38) as a complex of four agricultural and habitation features (two modified sinkholes, a wall, and a U-shaped wall). A single shovel probe and three test units were excavated. No artifactual material was recovered, although “architectural” material was noted. The site is outside the current APE, but was relocated while accessing the KS2 portion of the project area. Although the site was obstructed by vegetation cover, it appears to be intact.

Previously Recorded Sites in the APE that Have Been Destroyed

Twelve previously recorded sites (Sites 1720 and 1722 in KS1, and Sites 4554-4556, 4558-4562, and 4566-4567 in KS2) in the APE were destroyed prior to the current project (Figures 2-3 and 2-4). The following descriptions summarize the information provided in Haun (1991) and Beardsley (2001).

Site 50-80-12-1720

Site 1720 was destroyed prior to the current project (see Figure 2-3). Haun (1991:43) recorded the site as a habitation/agricultural complex of two features. Jones (1993: Figure 6, Table 4) described Site 1720 as having three features (C-shape, small enclosure, and collapsed platform), but provided no additional information. No excavations were conducted at this site as part of the Haun (1991) study.

Beardsley (2001:IV:19) returned to the site and excavated one test unit in Feature A (cairn) and one unit in Feature B (C-shape). Sparse faunal material was recovered from Feature A, while fauna along with mixed traditional and historic artifacts were recovered from Feature B.

Site 50-80-12-1722

Site 1722 was destroyed prior to the current project (see Figure 2-3). Haun (1991:45) originally recorded Site 1722 as a habitation complex of ten features (Features A-J) that included an L-shape (Feature A), an enclosure (Feature B), four possible burials (Features F, G, I, and J), as well as feature remnants of unknown function. The BPBM field notes and maps (BPBM 1985:BA-6) indicate minimal bulldozer disturbance as well as numerous undocumented mounds and mound remnants in the site area. No excavations were conducted as part of the Haun (1991) study.

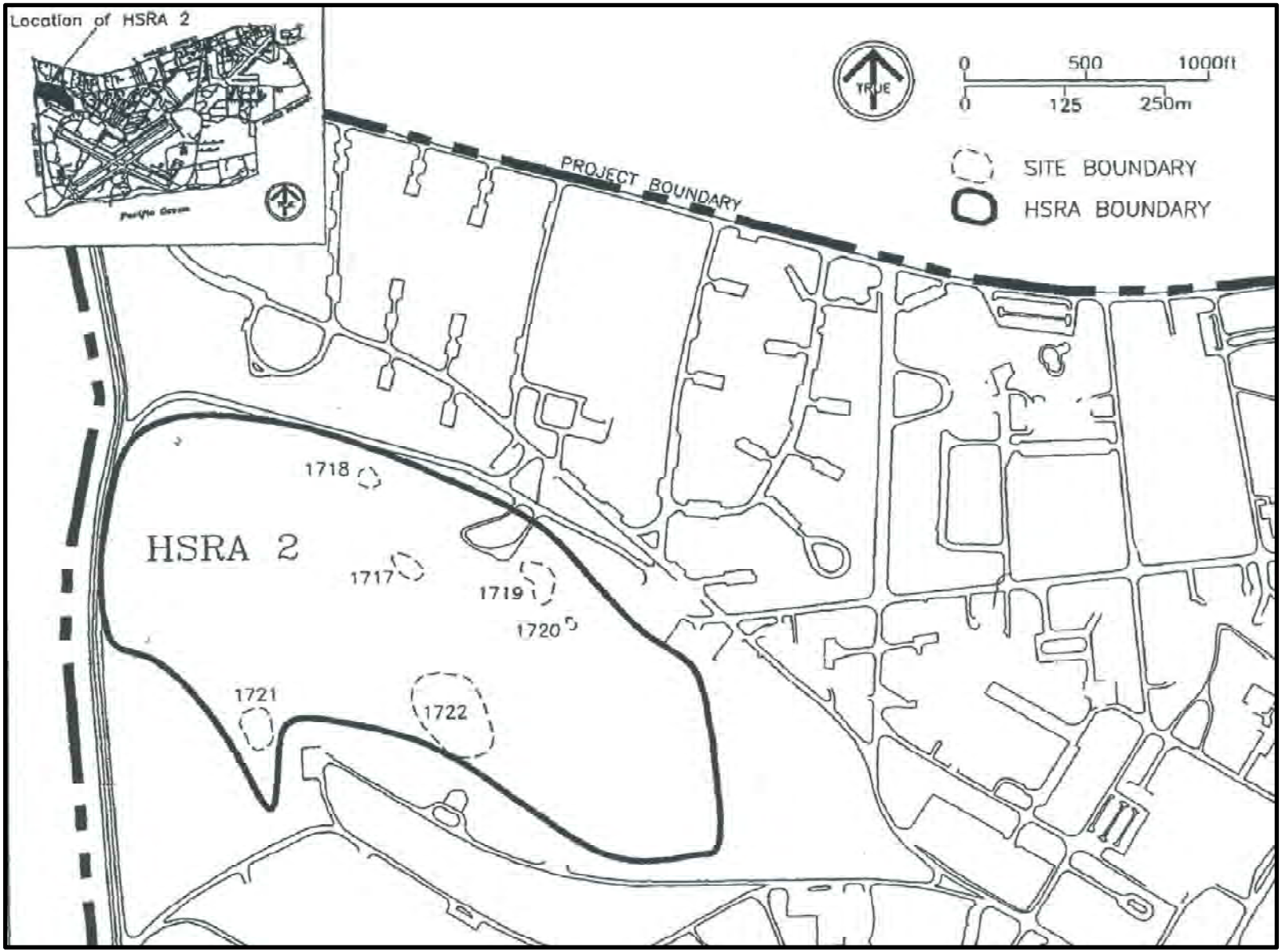


Figure 2-3. Northwest Corner of NASBARPT Showing Beardsley's (2001:IV-1) HSRA 2 and Previously Recorded Sites.

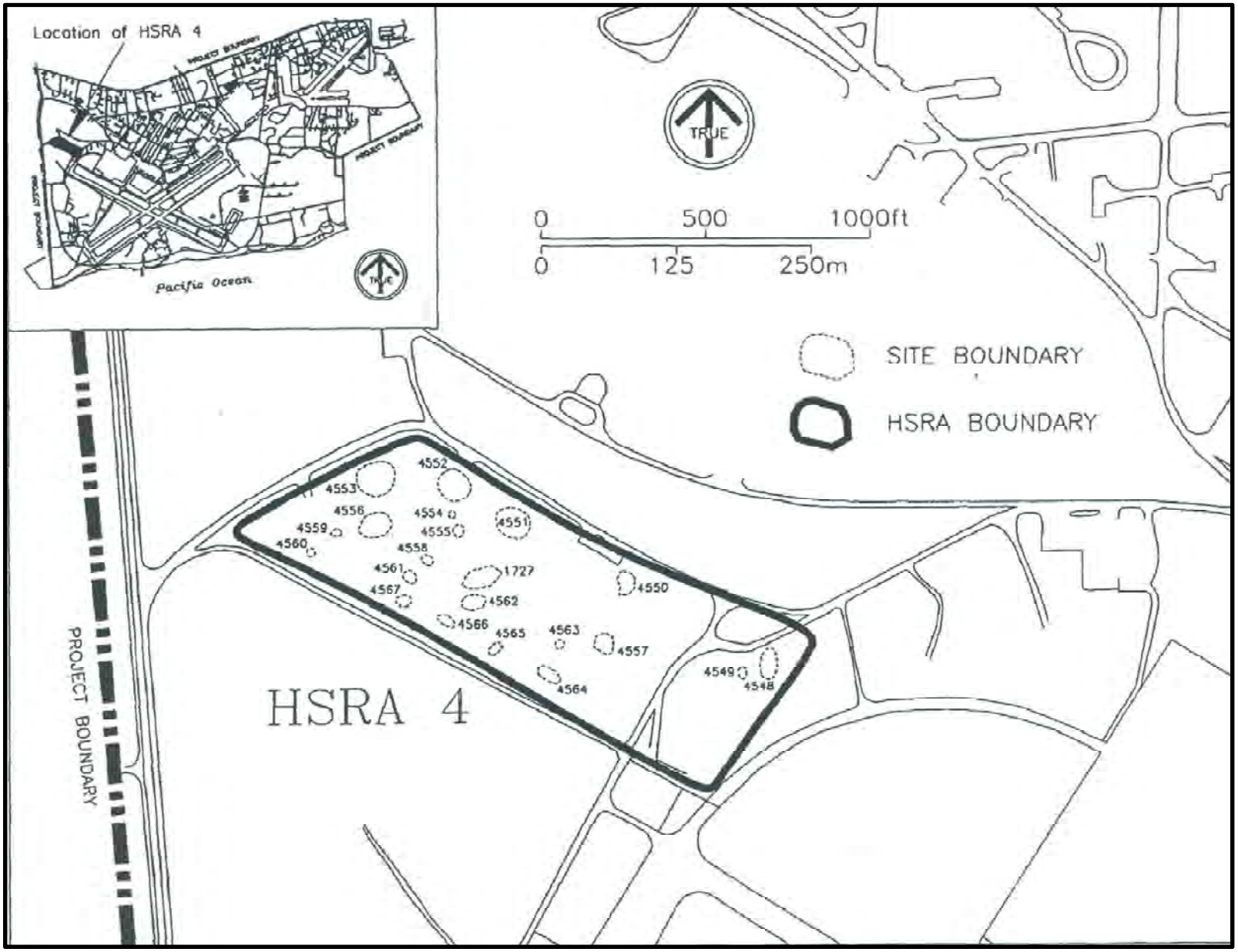


Figure 2-4. Northwest Corner of NASBARPT Showing Beardsley's (2001:IV-17 HSRA 4 and Previously Recorded Sites.

Beardsley (2001:IV.24) noted that the combination of vague original feature descriptions and later bulldozing made re-identification of over half the features impossible; however, 12 features were recorded. Single excavation units were placed in Features B, C/D, E, L, M, and O. Sparse to moderate faunal material was recovered from all of the excavations. In addition, 10 pieces of historic glass were recovered from Feature O. Two charcoal samples from subfeatures within Feature B were submitted for radiocarbon dating. Beta No. 85057 from an ash concentration returned a modern date, while Beta No. 85055 from a cobble-lined pit returned a date of calAD 1468-1955.

Site 50-80-12-4554

Site 4554 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.40) originally recorded Site 4554 as an unaltered sinkhole with a cobble alignment. No artifacts were recorded.

Site 50-80-12-4555

Site 4555 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.41) originally recorded Site 4555 as a crescent-shaped mound on a partially exposed outcrop. A single shovel probe recovered no artifacts.

Site 50-80-12-4556

Site 4556 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.41) originally recorded Site 4556 as a complex of six agricultural and habitation features (two terraces, two mounds, a modified sinkhole, and a cairn). Single test units were excavated in each terrace feature (Features A and D). No artifactual material was recovered, although “architectural” material was noted in the upper levels.

Site 50-80-12-4558

Site 4558 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.41) originally recorded Site 4558 as two agricultural features (one L-shaped wall and one mound). A single test unit was excavated in the interior of the L-shape (Feature A). No artifactual material was recovered, although “architectural” material was noted in the upper levels.

Site 50-80-12-4559

Site 4559 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.41) originally recorded Site 4559 as a complex of four agricultural and habitation features (two walls, mounds, and a terrace). A single shovel probe was excavated between the wall and the mound and a test unit was excavated in the terrace (Feature D). No artifactual material was recovered, although “architectural” material was noted in the upper levels.

Site 50-80-12-4560

Site 4560 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.46) originally recorded Site 4560 as a complex of three agricultural features (one mound, one terrace, and one modified sinkhole). Test units were excavated in the terrace (Feature B) and sinkhole (Feature C). No artifactual material was recovered, although “architectural” material was noted in the upper levels.

Site 50-80-12-4561

Site 4561 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.47) originally recorded Site 4561 as a complex of three agricultural features (two walls and one cairn). A shovel probe was excavated adjacent to one wall (Feature C), while single test units were excavated in the cairn (Feature A) and adjacent to the other wall (Feature B). No artifactual material was recovered, although "architectural" material was noted in the upper levels.

Site 50-80-12-4562

Site 4562 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.49) originally recorded Site 4562 as a complex of five agricultural features (one mound, one terrace, one wall, one L-shaped wall, one mound, and one modified sinkhole). One shovel test probe was excavated in the sinkhole (Feature E) during a previous survey (Burgett and Rosendahl (1992). No artifactual material was recovered.

Site 50-80-12-4566

Site 4566 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.46) originally recorded Site 4566 as a complex of two agricultural features (one L-shaped wall and one terrace). Test units were excavated in each feature. Three subfeatures were recorded in Feature A (L-shape) and one radiocarbon sample was submitted from HF-3, a "pocket of Layer I material" (Beardsley 2001:IV.54). The associated radiocarbon date was modern. No additional cultural material was recovered.

Site 50-80-12-4567

Site 4567 was destroyed prior to the current project (see Figure 2-4). Beardsley (2001:IV.46) originally recorded Site 4567 as a complex of two agricultural features (one modified sinkhole and one wall). A shovel probe was excavated in the sinkhole (Feature A) and two shovel probes and a test unit were excavated near the wall (Feature B). No artifactual material was recovered.

Archaeological Studies Since 2001

Previous archaeological studies in the Barbers Point region conducted before 2001 are presented in Beardsley (2001). Since 2001, 86 archaeological projects requiring fieldwork (assessments, surveys, monitoring, and data recovery) have been conducted in 'Ewa District, 26 of which were undertaken in Honouliuli Ahupua'a. Eight projects have been undertaken in areas near the current project (Groza and Hammatt 2010; Groza et al. 2008; Hoffman et al. 2005; Sinoto and Titchenal 2002; Terry et al. 2004; The Louis Berger Group 2009; Tome and Spear 2010; Tulchin et al. 2007). Two projects to the west of the current study area (Groza et al. 2008; Tulchin et al. 2007), two projects to the east of the current study area (The Louis Berger Group 2009; Tome and Spear 2010), and one project to the southwest of the current study area (Groza and Hammatt 2010) reported no significant cultural resources. Table 2-2 identifies the archaeological sites reported during these studies.

Terry et al. (2004) conducted test excavations at two sinkhole locations discovered as part of a larger assessment project west of the current study area (Cordy and Hammatt 2003) to explore the possibility of human interment or other archaeological resources. Recovered artifacts included post-1910 historic artifacts and because "no further work" was recommended,

it is inferred that the sinkholes no longer meet National or Hawaii Register of Historic Places (NRHP and HRHP) significance criteria.

Hoffman et al. (2005) conducted an archaeological survey to the south of the Terry et al. (2004) project and recorded 19 sites, 13 of which had been previously recorded (Hammatt et al. 1994). The sites included both pre-and post-Contact types. The pre-Contact site types are similar to those found in the Barbers Point area, consisting primarily of agricultural features, limestone sinks, temporary habitation, and possible human interments. Likewise, the post-Contact site types reflect agricultural and ranching activities in the area. Several sites may relate to the O.R. & L. railway. All 19 sites were recommended eligible for the HRHP.

Table 2-2. Sites Recorded Near the Current Study Area since 2001.

Site	Description	NRHP/HRHP Significance	Recommendation	Reference
50-80-12-6674	Two sinkholes	N/A	No further work	Terry et al. 2004
50-80-12-4893	Filled sinkhole	D	No further work	Hoffman et al. 2005
50-80-12-4895	Agricultural mounds	D	No further work	Hoffman et al. 2005
50-80-12-4896	Temp. habitation/ agriculture	C, D	Data Recovery/ Preservation	Hoffman et al. 2005
50-80-12-4897	Agriculture	D	No further work	Hoffman et al. 2005
50-80-12-4898	Agriculture	D	No further work	Hoffman et al. 2005
50-80-12-4900	Agriculture	D	No further work	Hoffman et al. 2005
50-80-12-6679	Historic canal	D	No further work	Hoffman et al. 2005
50-80-12-6684	Tem. Habitation	D	No further work	Hoffman et al. 2005
50-80-12-6685	Temp. habitation	D	No further work	Hoffman et al. 2005
50-80-12-6686	Mound Complex	D	No further work	Hoffman et al. 2005
50-80-12-6687	Enclosure	D	SHPD consultation	Hoffman et al. 2005
50-80-12-6688	Geographic Marker	D	Preservation	Hoffman et al. 2005
50-80-12-6689	Agricultural Flume	D	No further work	Hoffman et al. 2005
50-80-12-9545	Sinkhole habitation	C, D	Preservation	Hoffman et al. 2005
50-80-12-9546	Historic Ranch Wall	D	No further work	Hoffman et al. 2005
50-80-12-9555	Cist mound	D	No further work	Hoffman et al. 2005
50-80-12-9617	Temp. Habitation	D	Preservation	Hoffman et al. 2005
50-80-12-9633	Burial Cave	C, D, E (HI only)	Preservation	Hoffman et al. 2005
50-80-12-9714	Transportation (RR)	A, B, C, D	Preservation	Hoffman et al. 2005
50-80-12-6373	Feature Complex	Not Eligible	No further work	Sinoto and Tichenal 2002
50-80-12-6374	Sinkhole kiln	C, D	Data Recovery	Sinoto and Tichenal 2002
50-80-12-6375	Sinkhole Paleontological	Not Eligible	No further work	Sinoto and Tichenal 2002

Sinoto and Titchenal (2002) conducted an archaeological survey to the southwest of the current study area and recorded two archaeological sites and one paleontological site. One archaeological site included a circular enclosure, a capped sinkhole, and a cist-like structure that produced sparse evidence of pre-Contact occupation. Another sinkhole complex appears to have been used historically as a lime kiln. Excavations at another sinkhole recovered evidence of prehistorically extinct avifauna.

SECTION 3 METHODOLOGY

Archaeological surveys and test excavations were undertaken in Parcels KS1 and KS2 intermittently during a four-month period between March 15, 2011 and July 15, 2011. The investigation was conducted in four phases beginning with the AIS of Parcel KS1 between March 15 and April 14 followed by the AIS of Parcel KS2 from April 18 through April 27. Test excavations were undertaken in Parcel KS1 between April 29 and May 27. Test excavations were conducted in Parcel KS2 between July 11 and July 15.

SURVEY METHODS

In both the KS1 and KS2 project areas, an intensive pedestrian survey was undertaken utilizing transects that ranged from 3.0 to 10.0 meters (m) in width. The majority of both parcels was surveyed in 5.0 m interval transects. Wider transects were employed only in areas of impenetrable piles of bulldozed trees. Ground visibility in both parcels was limited by uncommonly dense vegetation. Extensive bulldozer clearing of both parcels appears to have been undertaken within the past 24 months. These recently grubbed areas are dominated by a nearly contiguous cover of tall grasses, four to six feet in height (Figure 3-1). The KS1 project area exhibits alternating north to south bulldozed transects about 10.0 m in width with intervening windrows of standing trees and bulldozed debris about 5.0 m in width (Figure 3-2). With the exception of several previously recorded archaeological sites which had been identified by flagging tape, this pattern of cleared transects and intermittent windrows is fairly uniform across the entire parcel. In Parcel KS2 a similar pattern of bulldozer and windrow transects are oriented from east to west (Figure 3-3 and 3-4).

Survey of KS1 began in the northwest corner of the parcel. Pedestrian transects at 5.0 to 10.0 m intervals were oriented from true north to south. Transects were begun along the northern project boundary and proceeded to the southern boundary where the transect line was extended to the east and the property was transected from south to north. Archeological sites, including previously recorded sites, were identified and the boundaries of these sites were marked with flagging tape and GPS locations were recorded.

Site Clearing

All of the sites areas identified and flagged during the pedestrian survey exhibited dense vegetation including high grasses, trees and vines. It was determined that extensive clearing of vegetation would be required prior to detailed mapping and recording of site features and boundaries. An independent contractor was retained to perform the site clearing tasks. Site clearing was initiated shortly after the survey effort was begun. As sites were identified and flagged the clearing crew proceeded from location to location beginning in the northwest portion of the parcel at Site 1718 and proceeding to the southwest parcel corner.

Clearing crews consisted of approximately six individuals including a crew foreman. Clearing in the KS1 project area began on April 25 at Site 1718. At this time, prior to the commencement of clearing activities, a meeting was conducted between the PCSI Project Director and the clearing crew explaining the purpose of the task and the methods to be employed during the clearing process. The clearing of features and site areas for the purpose of mapping and recordation was accomplished with minimal disturbance of the ground surface and subsurface proveniences. Tall grasses and vines were cut at ground level with sickles or line trimmers. Some small trees, primarily *koa haole*, were removed at ground level. Trees exceeding several inches in diameter were left standing. Downed *kiawe* trees that restricted

Bulldozed cut; view to east

Bulldozed cut; view to east

Figure 3-1. Photographs of Vegetation in KS1, Bulldozed Area.

Bulldozed cut; view to south

Bulldozed cut; view to east

Figure 3-2. Photographs of Vegetation in KS1, Non-Bulldozed Area.

Bulldozed cut; view to east

Bulldozed cut; view to east

Figure 3-3. Photographs of Vegetation in KS2, Northern Parcel, Bulldozed Area.

Bulldozed cut; view to South

Bulldozed cut; view to east

Figure 3-4. Photographs of Vegetation in KS2, Southern Parcel, Bulldozed Area.

surface visibility were removed. Cut grasses and trees were gathered and piled outside the site perimeter boundaries. The clearing process was monitored by the Project Director. The clearing effort resulting in greatly enhanced surface visibility within the site areas.

Clearing of identified sites in the KS2 project area proceed in the same manner with a different independent contractor. Clearing of sites in the KS2 project area began on April 25 and included a meeting of the clearing crew and Project Director explaining the purpose and clearing methods to be employed.

Site Recordation

Following the clearing effort a detailed recordation of site elements was undertaken. This included the identification and designation of all sites and features. Each feature was individually recorded. The recording process included the production of a plan view map of each feature utilizing tape and compass. Feature forms were completed describing the type and function of each feature along with descriptions of soils, vegetation, and surface artifacts. A tape and compass map, locating individual features and site boundaries, was executed for each site. A comprehensive photographic record was obtained for each feature. GPS data was collected for feature and site boundaries. The recordation of sites in the KS1 project area was undertaken between March 22 and April 14. The recordation of sites in the KS2 project area was completed between April 25 and April 27.

Site and Feature Type Definitions

Definitions of site and feature types used for site and feature recording in the KS1 and KS2 project areas are provided below. Terms used for site condition are defined in this section as well

Artifact Scatter: This feature type consists of surface presence of artifacts within a restricted space. Traditional artifact scatters can include basalt or volcanic glass debitage. Historic artifact scatters often include glass bottles, ceramic objects, and/or metal objects that usually includes items such as marine shell, sea urchin, and bone (vertebrate) remains within a restricted space.

Cairn: This term is used to distinguish generally large, well-built mounded structures of unmortared rock from the smaller and more numerous stone mounds (see below). Cairns were often built for shrines (Davis 1995:93), trail markers, and *ahupua`a* boundary markers (Davis 1995).

C-shape: A stacked walled structure of unmortared rock construction that defines, but does not completely enclose, the interior floor. These are called C-shapes because their ground plan is commonly semicircular, in the shape of the letter “C”. Variants include U-shapes with the ends of the curving walls extending straight along either side of the floor; L-shapes with two straight wall segments meeting at an angle; Box C-shapes with a linear wall (with no visible curves) connected at both ends by shorter wall segments that extend out at right angles. C-Shapes were first recognized in Makaha Valley on Oahu (Green 1980) and at Lapakahi (Rosendahl 1972) on Hawaii. Subsequently this feature type has been identified in many contexts, but appears to be most prevalent in leeward sites. The original definition was intended to describe pre-Contact features; however, modern fishermen, hunters and military troops in training also construct C-shapes.

Enclosure: A space enclosed by a freestanding wall, natural outcrop, or a combination of both. This feature type is generally described in terms of the plan view of the enclosed space (e.g., rectangular, square, circular, oval) and can include additional architectural embellishments such as constructed entrances, attached terraces, and the incorporation of special rocks (e.g.,

uprights, water worn boulders, etc.) into the construction. Enclosures were believed to have been habitation sites whose walls were used as the foundations for a pole-and thatch superstructure (Davis 1995:92).

Modified Outcrop: Natural bedrock outcrops against or on top of which are placed or stacked piles of cobbles and boulders.

Modified Sinkhole: Features of this type are natural features of the landscape that have been structurally modified. These modifications include building cobble/boulder alignments or unmortared rock walls around the entrance of the sinkhole, or down on the interior floor, or filling in the sinkhole with rubble to the level of the adjacent ground surface.

Mounds: This category ranges from rough piles of rock to large well-constructed structures. They are variable in plan view but are generally oval, circular, or elongated.

Terrace: A terrace includes both a level surface and a rock retaining wall that defines the downslope edge of the level surface. The retaining wall generally appears nearly vertical in cross section but actually leans slightly against the slope. Terraces have one to three faced sides. Earthen terraces were utilized for agriculture. Larger terraces with rock surfaces were believed to have been habitation sites whose surface was the foundations for a pole-and thatch superstructure. Smaller terraces were sometime used as surface markers for burials.

Wall: These features are divided into free-standing walls and retaining walls. Freestanding walls are linear, or curvilinear, structures which are at least two courses high and longer than they are wide. They range from low labor-intensive, rubble walls to high labor-intensive walls that are stacked or bilaterally faced, nearly vertical or vertical, and core-filled. Stacked or multiple-stacked walls are constructed entirely of similar sized stones, generally cobbles and boulder, and well-faced on both sides. Core-filled walls have stacked cobble and/or boulder facings and a core-fill of smaller materials (pebbles and small to large cobbles).

Retaining walls are usually associated with terraces. These walls are faced on the exterior side, and generally appear nearly vertical in cross section but actually lean slightly against the retained slope. The top of a retaining wall is usually level or almost level with the surface behind the wall.

A subcomponent of this feature type is a wall segment. These are typically shorter than walls, and may include intact segments of walls that have been destroyed or impacted by bulldozing or other similar activities.

Feature Condition

The condition, or physical integrity, of stone structural features in archaeological reporting in Hawaii is often described with terms such as “poor,” “fair,” or “good.” For the sites and features in the KS1 and KS2 project areas, the condition of surface features are provided in these terms.

- Good – Little to no damage had occurred to architectural remains.
- Fair – Some tumble may have occurred to architectural remains, but foundations remain intact and definable, and at least half of the feature appears intact.
- Poor – Half or more of the feature’s architecture has tumbled, and/or sections of the foundation have been damaged.

Significance Evaluations

Evaluating the significance of archaeological sites or historic properties is a requirement for state-regulated projects under HAR Chapter 6E-8 and its implementing regulation (Chapter §13-275-6). The purpose of the AIS was to determine if archaeological resources that are on, or potentially eligible for, the NRHP or HRHP were located in the project APE. Resources were assessed against the NRHP criteria (36 CFR 60.4) to determine their potential for eligibility. These criteria require that the quality of significance in American history, architecture, culture, and archaeology should be present in buildings, structures, objects, sites, or districts that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that the buildings, structures, objects, sites, or districts:

- A. are associated with events that have made a significant contribution to the broad patterns of our history;
- B. are associated with the lives of persons significant in our past;
- C. embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. have yielded, or may be likely to yield, information important in prehistory or history.

In addition, one other criterion (e) has been added to the HRHP evaluation:

> Have an important value to the native Hawaiian people or other another ethnic group with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity (Chapter §13-275-6).

Typically, criterion (e) is invoked in Hawai‘i when human burials are present in archaeological contexts. However, the criterion has also been used when other resources such as Traditional Cultural Properties (TCP) are being evaluated.

Excavation Methods

Following an assessment of data gathered during the survey process, test excavations were conducted in selected sites and features beginning in the KS1 project area on April 29 and continued until March 27. In the KS2 project area, test excavations were conducted between July 11 and July 15, 2011.

Controlled test units varied in size, including 0.5 by 0.5 m, 1.0 m by 1.0 m, and 1.5 m by 1.0 m, and were excavated in selected sites and features in the KS1 and KS2 project areas (see Section 4). Controlled shovel test probes were also employed in some areas in both parcels to determine the lateral extent of subsurface cultural deposits outside of some of the habitation features being tested. Test unit and shovel test probe locations were added to the appropriate plan view maps for features being tested. A unit datum for test units was established; usually at surface level of the highest corner of the unit. Pre- and post-excavation photographs were taken using a digital color camera, and a drawing of the test unit surface was undertaken.

Excavation methodologies followed standard conventions: natural or cultural layers were identified and excavated as a stratigraphic unit. Subsurface cultural features were excavated independently. When natural or cultural stratigraphic layers exceeded 10.0 centimeters (cm) in thickness, arbitrary 10.0 cm levels were imposed. All materials were excavated manually (i.e.,

hand trowel to dustpan to bucket). Excavated materials were screened through 1/4- and 1/8-inch (3.2 millimeters [mm]) mesh, and all cultural materials were collected. Unit recordation methods also followed standard conventions. Photographic records were obtained for each excavated layer or feature. Each excavated level was recorded on a form which included a plan view floor drawing, an inventory of recovered artifacts, and a detailed description of the soils encountered in that level of excavation. A soil sample was collected from each excavated layer. Detailed descriptions of soil/sediment layers were prepared using the United States Department of Agriculture, Soil Conservation Service standards, and a standard field manual for soil descriptions (Schoeneberger et al. 1998). Soil characteristics recorded during excavations include color (Munsell Color 2000), texture, and consistency, approximate percentage of rock inclusions, roots, and lower boundary topography. Roman numerals (I-III) were used to designate stratigraphic layers. These indicate the relative position of the layers within the stratigraphic sequence (Layer I being the uppermost layer). Stratigraphic profiles were drawn and photographed for each test unit. Shovel test probes were also excavated manually (but without layer/level control during excavation), and brief descriptions and stratigraphic profiles prepared.

LABORATORY METHODS

Analyses of faunal remains, floral remains, and artifacts were conducted at PCSI's Archaeology Laboratory in Honolulu. Artifacts were cleaned prior to analysis and cataloging. Recovered items were identified, recorded, and entered into a database.

Invertebrate faunal remains were cleaned, weighed, and identified. Identifications were determined using PCSI's invertebrate reference collection and Kay (1979). Vertebrate faunal remains were sorted and identified by Dr. Sara Collins of PCSI. Bishop Museum reference collections were used for vertebrate faunal identification where warranted; these remains were identified to the lowest taxon (genus and species) possible. Identification and analysis of historic artifacts recovered during the investigation was provided by Paul Titchenal.

Wood charcoal samples were sent to International Archaeological Research Institute, Inc. (IARII) in Honolulu for identification analysis, conducted by Gail Murakami. The identified wood charcoal samples were sent to Beta Analytic, Inc. for radiocarbon dating.

DISPOSITION OF COLLECTED MATERIALS AND RECORDS

All field records, maps, photographs, related documents, faunal remains, and artifacts are temporarily curated at PCSI's Archaeology Laboratory and Office in Honolulu. These records and related materials will be curated in accordance with applicable State and Federal law upon completion of the project.

COMMUNITY CONSULTATION FOR THE ARCHAEOLOGICAL INVENTORY SURVEY

Community consultation for the AIS was conducted with a member of the local community, Mr. Shad Kane. Mr. Kane visited the KS1 project area on April 26, 2011 and walked several site areas with Steve Clark, Project Manager for the KS1 and KS1 projects. Sites 1718, 1719, 7178, and 7182 were visited and some of the features were discussed in detail. Mr. Kane stated that he had not seen these sites before but had seen sites to the east of this area, including Sites 1723, 1724, and 1725 when Dave Tuggle was working there. Mr. Kane had also been on other parts of the former Barbers Point Naval Air Station lands to visit archaeological sites.

Mr. Kane expressed that it would be worthwhile to save as many of the sites as possible, and not only the sites, but as much of the landscape as possible, including sinkholes.

Mr. Kane also expressed an interest in working with DHHL and representatives of the two solar companies to care for any sites that are scheduled for preservation. Mr. Kane has been working with a private non-profit organization, the Kalaeloa Heritage and Legacy Foundation, and with the Kalaeloa Development Authority as part of the Hawaii Community Development Authority, a State of Hawaii agency. These organizations are working in partnership with the State toward building the Kalaeloa Heritage Park and establishing partnerships with other landowners and developers who have cultural resources on their properties. The objective would be to integrate preserved sites in the KS1 and KS2 project area into the Kalaeloa Heritage Park.

SECTION 4 SURVEY AND EXCAVATION RESULTS

This section presents the results of the 2011 archaeological inventory survey and test excavations. As agreed upon in the June 2011 meeting with SHPD (see Section 1), this section includes survey and excavation data presented by Beardsley (2001) for six archaeological sites included in her study that are also located within the current APE (Site 1717, 1718, 1719, 1720, and 1722 in KS1, and Site 1721 in KS2). Including these data serves to present a more comprehensive description of those six sites and facilitates decision-making concerning NRHP significance and future work recommendations. Where Beardsley focused primarily on habitation and possible burial features identified by Haun (1991) and recommended for testing by Tuggle (1997a, 1997b), the current project explored sinkholes, underrepresented habitation feature types, and newly recorded features not identified during earlier surveys. Beardsley's site descriptions and excavation results have been presented verbatim for the six sites to avoid errors and misrepresentations of the data. Some background information from Section 2 is repeated in the site descriptions for selected sites investigated by Beardsley.

Excavation results for features tested in 1995 and 2011 are presented after the description of the tested features. Description and excavation results for two sites presumed to have been destroyed (Sites 1720 and 1722; see Section 2), are included in the results; their locations as mapped by Beardsley (2001:Figure IV.1) are presented in Figure 2-3.

Table 4-1 presents the 16 sites and 86 features identified in the KS1 and KS2 project areas during the 2011 fieldwork. To facilitate data presentation, and because the KS1 and KS2 project areas were investigated separately, the survey and excavation results for sites in KS1 and KS2 are presented separately, starting with KS1.

Table 4-1. Summary of 2011 Archaeological Sites and Features in KS1 and KS2.

SIHP Site 50-80-12-	Fe.	Feature Type	Feature Function	1995 Area Tested (m^2)	2011 Area Tested (m^2)
KS1 Sites					
1717 Feature Complex					
	A	L-shaped wall	Agriculture		
	B	Linear wall	Agriculture		
	C	Cairn	Agriculture	1.0	
	D	Enclosure	Temporary habitation	1.0	
	E	L-shaped wall	Temporary habitation		3.0
	F	Enclosure	Temporary habitation	1.0	
	G	Box C-Shape	Temporary habitation		1.0
	H	Mound complex	Agriculture		3.0
	I	Wall segment	Agriculture		
	J	Mound	Agriculture		
	K	Modified outcrop	Agriculture		
	L	Mound complex	Agriculture		
	M	Mound	Agriculture		1.0
	N	Mound complex	Agriculture		
	O	Mound complex	Agriculture		
	P	Mound	Agriculture		1.5
	Q	Modified outcrop	Agriculture		
	R	Mound complex	Temporary habitation		

SIHP Site 50-80-12-	Fe.	Feature Type	Feature Function	1995 Area Tested (m^2)	2011 Area Tested (m^2)
7179 Military Site					
	A	Platform	Standard support		
1718 Feature Complex					
	A	Enclosure	Temporary habitation	1.0	
	B	Mound	Agriculture	0.5	
	C	L-Shape	Temporary habitation	1.0	
	D	C-Shape	Temporary habitation	1.0	
	E	Mound	Agriculture	1.0	
	F	C-shaped wall	Agriculture		
	G	Modified outcrop	Agriculture		
	H	Mound	Agriculture		1.0
	I	Mound	Agriculture		
	J	Circular enclosure	Temporary habitation		1.0
	K	Terrace	Agriculture		1.0
	L	Mound	Agriculture		
1719 Feature Complex					
	A	C-Shape	Agriculture	1.0	
	B	Rectangular enclosure	Temporary habitation	2.0	
	C	Irregular-shaped enclosure	Temporary habitation	1.0	
	D	C-Shaped wall	Agriculture	0.5	
	E	Cairn	Temporary habitation	0.25	
	F	Area of mounds, modified outcrops, wall segments	Agriculture		SC
7178 Military Feature Complex Adjacent to Site 1719					
	A	Metal pipeline	Water access		
	B	Wall/ bulldozed push	Clearing		
	C	Pathway complex	Transport/access		
	D	Concrete Sentry post	Military security		
	E	Enclosure	Military activity area		
	F	Shower Structure	Bath House		
7182 Sinkhole Complex					
	A	Sinkhole	unknown		
	B	Sinkhole	unknown		
	C	Sinkhole	Military Rubbish dump		0.25
	D	Sinkhole	Military Rubbish dump		
	E	Sinkhole	unknown		
	F	Sinkhole	unknown		0.25
	G	Sinkhole	unknown		
	H	Sinkhole	unknown		
	I	Sinkhole	Temporary habitation		0.25
	J	Sinkhole	Military Rubbish dump		
	K	Sinkhole	unknown		

SIHP Site 50-80-12-	Fe.	Feature Type	Feature Function	1995 Area Tested (m^2)	2011 Area Tested (m^2)
7184 Sinkhole					
	A	Sinkhole	Unknown		
7185 Sinkhole					
	A	Sinkhole	Agriculture		
	B	Sinkhole	Agriculture		
	C	Sinkhole	Agriculture		0.5
	D	Sinkhole	Agriculture		1.0
	E	Sinkhole	Agriculture		
7186 Sinkhole					
	A	Modified Sinkhole	Agriculture		1.0
	B	Sinkhole	Agriculture		0.25
7187 Feature Complex					
	A	Possible road	Clearing or transport		
	B	Mound	Agriculture		
	C	Linear mound	Agriculture		
7188 Military / Industrial Site					
	A	Concrete vault	Drywell		
KS2 Sites					
1721 Feature Complex					
	A	Modified Sinkhole	Temporary habitation	1.0, SC*	
	B	Linear wall	Temporary habitation		
	C	L-shaped wall	Temporary habitation	1.0	
	D	L-shaped wall	Temporary habitation	1.0	
	E	Mound	Agriculture	0.5	
	F	Linear wall	Agriculture		
	G	Linear wall	Agriculture		
	H	Modified Sinkhole	Agriculture		
7176 Feature Complex					
	A	Wall and enclosure	Military		2.25
	B	Terrace	Military		1.0
7177 Military Feature Complex					
	A	Concrete foundation	Building foundation		
	B	Concrete foundation	Building foundation		
	C	Concrete vault	Oil/Water separator		
	D	Concrete vault	Oil/Water separator		SC*
	E	Concrete foundation	Building foundation		
	F	Concrete foundation	Building foundation		
	G	Concrete foundation	Building foundation		

SIHP Site 50-80-12-	Fe.	Feature Type	Feature Function	1995 Area Tested (m^2)	2011 Area Tested (m^2)
7181 Historic Scatter					
	A	Historic artifact scatter	Military refuse dump		SC*
	B	Historic artifact scatter	Military refuse dump		SC*
7180 Military site					
	A	Concrete pillbox	Portable machine gun pillbox		

*SC= Surface Collection

Figures 4-1 and 4-2 are separate site location maps for KS1 and KS2 project areas, respectively. These figures also show feature locations within the identified site boundaries.

In addition to relocating Sites 1717, 1718, 1719, 1721, the 2011 survey expanded the boundaries of Site 1717 and 1718, and identified additional features in both of these sites, including a previously unrecorded habitation feature in Site 1718 (Feature J). The 2011 survey also identified new sinkhole sites, including Sites 7182, 7184, 7185, and 7186.

A component of the archaeological record in the KS1 and KS2 project areas that was not recorded in detail by previous surveys includes military sites and features that were part of NASBARPT. Figures 4-1 and 4-2 show these military sites and features in green. In the KS1 project area, military sites include:

- Sites 7179, a triangular platform within the expanded boundary of Site 1717, a pre-Contact habitation/agricultural feature complex. Some military artifacts (e.g., communications wire) are present on the surface of Site 1717.
- Site 7178, a possible military encampment situated adjacent to, and within the boundary of Site 1719, a pre-Contact Hawaiian habitation/agricultural site. Among the features of Site 7178 are a concrete sentry post, a poorly preserved wooden-walled bath house, cobble-lined walkways, and metal pipes (i.e., water lines) that lead to the bathhouse.
- Several of the sinkholes at Site 7182, about 40 m south of Site 7178, have been filled with bottles, cans, and barrels. This appears to be a rubbish dump that is likely associated with the encampment at Site 7178.
- Site 7188, a concrete drywell situated about 50.0 m southeast of Site 1719 may be of military origin.

In the KS2 project area, military sites include:

- Sites 7177, a complex of five (5) concrete foundations of various sizes, and two (2) subterranean concrete vaults.
- Site 7181, a rubbish dump associated with Site 7177.
- Site 7180, a portable concrete machine gun pillbox

In addition to the sites mentioned above, most if not all of the historic artifacts recovered from sites and features in the current survey are likely related to the military sites. These artifacts are presented and discussed in Section 5 (Results of Laboratory Analyses).

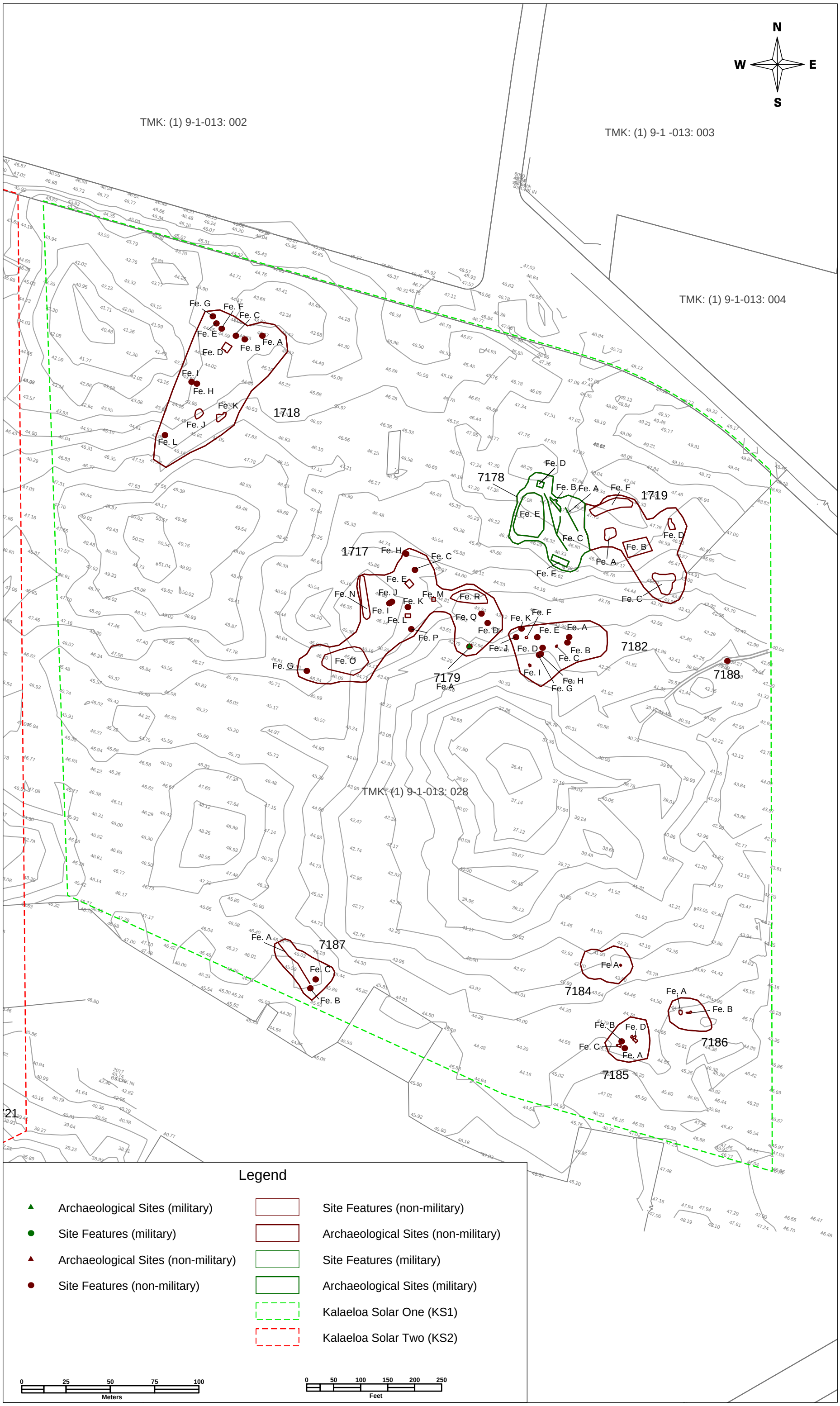


Figure 4-1. Kalaeloa Solar One Project Area Showing Locations of Archaeological Sites and Features.

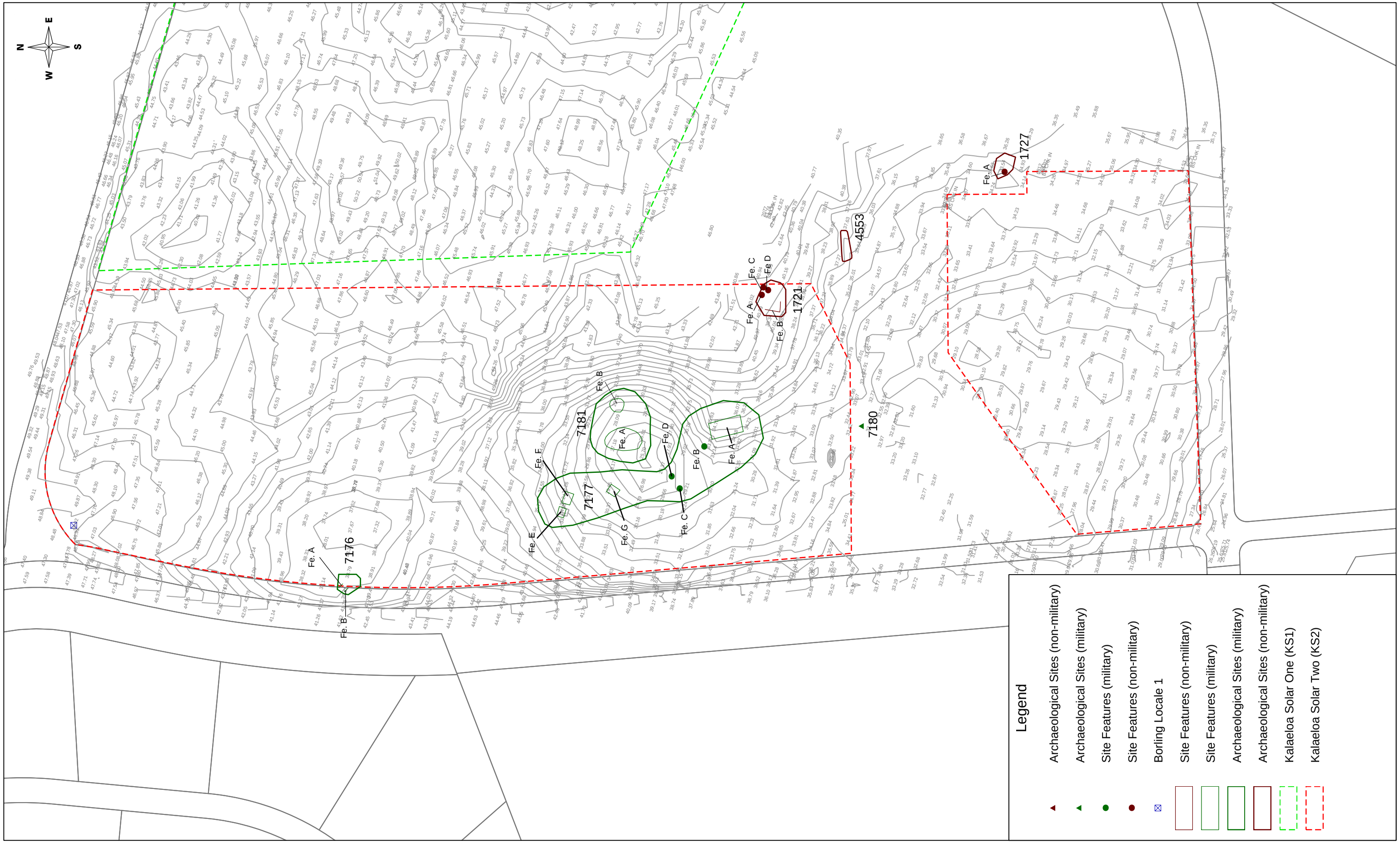


Figure 4-2. Kalaeloa Solar Two Project Area Showing Locations of Archaeological Sites and Features.

ARCHAEOLOGICAL SITES IN THE KS1 PROJECT AREA

A total of 11 archaeological sites consisting of 66 features were documented in the KS1 project area. Site and feature descriptions and results of test excavations are presented below.

State Site 50-80-12-1717

Temporary Site Number: BPBM 234
Site Type: Feature complex
Site Function: Temporary habitation and agriculture
Site Dimensions: 50.0 m by 35.0 m
Number of Features: 18
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 347-351, 363-373, 400
Current Status: Additional features recorded in 2011

Description:

Haun (1991:37) originally recorded Site 1717 as a small habitation complex of four features (Features A-D), with Feature C recorded as a possible human burial (see Figure 4-1). However, the original Bishop Museum field maps (BPBM 1985:BA-1) indicate that "many mounds appear throughout the area" and that "some mounds may be other feature types." No excavations were conducted at this site as part of the Haun (1991) study.

Beardsley (2001:IV.9) recorded six features at Site 1717, two of which (Features E and F) were not recorded by Haun (1991). Excavations were conducted at Feature C (cairn), Feature D (enclosure), and Feature F (enclosure). No cultural material or evidence of human interment was recorded within Feature C, while excavations at Feature D recovered mixed historic and traditional artifact types (limestone flakes and historic glass). Excavations at Feature F recovered sparse cultural material (three limestone flakes). In addition, charcoal from the cultural layer (Layer II) in Feature F produced a date of cal A.D. 1432-1664.

It is possible that Jones (1993) recorded features of Site 1717 at the reconnaissance level (Jones 1993: Figure 6 and Table 1). However, Site 1717 appears to be near or just outside that project's study area where features were recorded but not correlated with existing site locations.

One soil sample from excavations at Feature F was submitted for pollen, phytolith, and macrofloral analysis. The samples contained a mix of native (e.g., *Antidesma sp.)* and introduced species (e.g., *Leucaena* spp*.* and *Prosopis* spp*.* (Scott-Cummings and Puseman 2001 [in Beardsley 2001]).

In 2011, an additional 12 features (Features G-R) were recorded as part of this site; however three features (Features A, B, and F) from the previous surveys were not relocated. Figures 4-3 and 4-4 present plan Views of Site 1717. Figure A-1 in Appendix A provides Beardsley's plan View of Site 1717.

In 2011, the site was partially impacted by five bulldozed cuts that extended roughly north/south adjacent to and through the site. One cut extends along the east side, another one along the west side, and three down the central portion of the site. The three cuts in the center created four artificial breaks in the site. Features G and O are located along the west side of the site, Feature N is separated from Features G and O to the west and C, E, and H-M to the east by two cuts, and Features D, Q, and R by cuts along the west and east sides (see Figures 4-3 and 4-4).

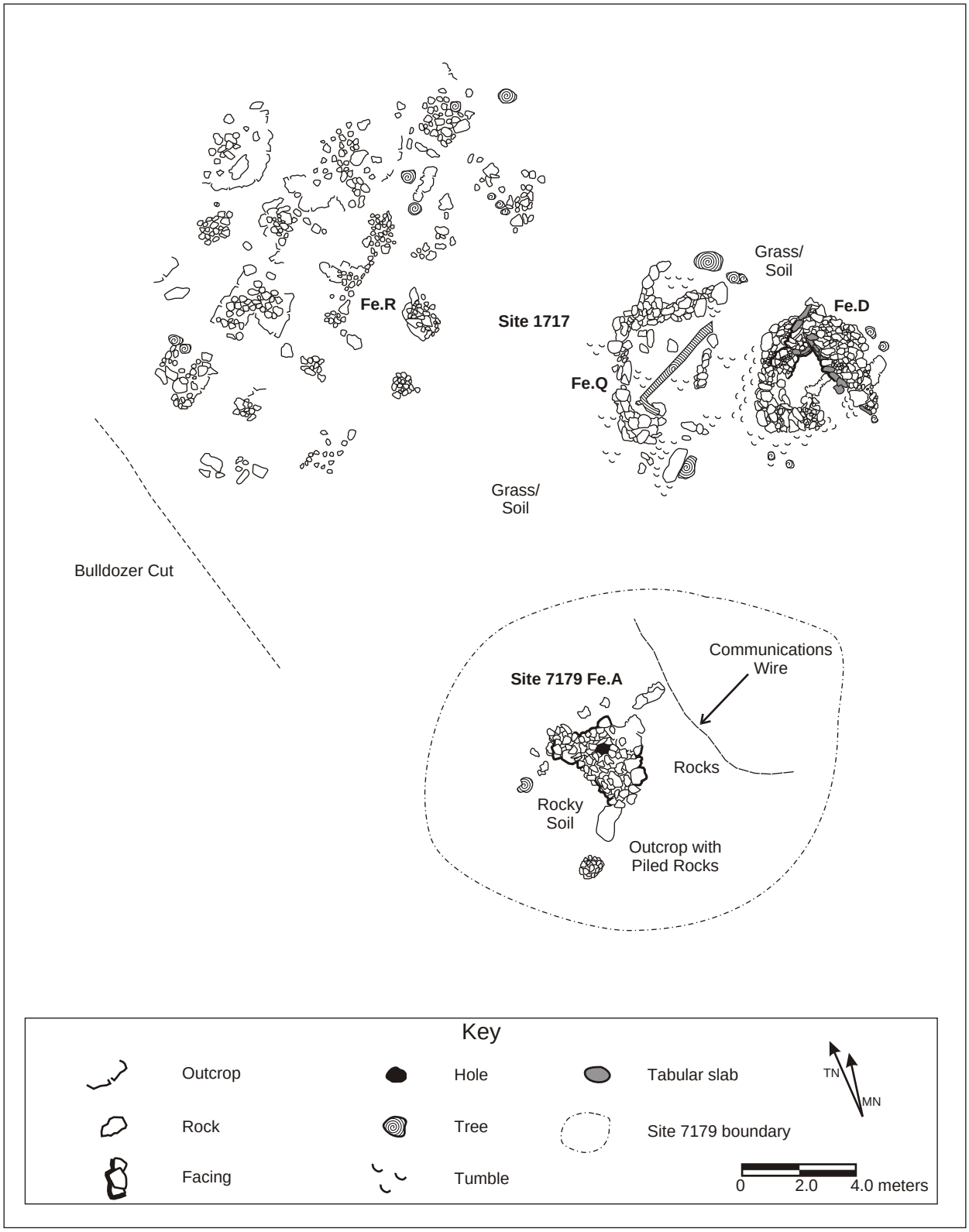


Figure 4-3. Site 1717 Features D, Q, and R, and Site 7179 Feature A, Plan View.

Figure 4-4. Site 1717 Features C, E, and G through P, Plan View.

Regarding the three features not relocated in 2011, it is likely that Feature A was altered to the point where it could no longer be recognized. According to a plan map drawn by Beardsley (2001: Figure IV-2) Feature A should be located approximately 1.0 m southeast of Feature C but nothing was observed in that area in 2011. Feature B, according to the plan map, should be located approximately 6.0 m south of Feature A and less than 1.0 m north of Feature D. In 2011 Feature D, identified by a PHRI site tag, was more than 25.0 m east of Feature C, not as depicted on the original map drawn by Beardsley (2001: Figure IV-2).

A feature recorded in 2011 (Feature Q) may be an extensively altered Feature B, as reported in 2001, but it cannot be said with certainty that they are one in the same. As for Feature F, if located as Beardsley reported (Beardsley 2001: Figure IV-2) it was likely destroyed by one of the recent bulldozer cuts.

Descriptions for Features A through F were taken from Beardsley (2001) and modified, if and when necessary.

Feature A is a wall constructed with limestone cobbles and boulders stacked up to four or more courses high (see Figure A-1 in Appendix A). The wall measures approximately 3.3 m by 3.0 m with a maximum height of 0.3 m. The stones range from 20.0 to 80.0 cm in diameter, and form rubble-filled core retaining walls roughly 50.0 to 80.0 cm thick. The interior of each wall appears nearly faced with vertically oriented slabs, while the exterior of the walls is sloping outward as if the process of collapse. It is built on exposed bedrock as well as a soil horizon. A dome-shaped bedrock outcrop on the eastern side of the feature creates another wall, making this almost a U-shaped enclosure. The walls and bedrock outcrop define an interior area of about 2.0 m by 1.3 m. According to Beardsley the feature was in fair to poor condition and unaltered. This feature was not relocated in 2011.

Feature B is a wall measuring approximately 5.0 m by 1.0 m with a maximum height of 0.5 m. It is constructed of limestone cobbles and boulders (20.0 to 70.0 cm in diameter) loosely piled one to two courses high in a relatively straight alignment, this feature may have been part of a larger enclosure (see Figure A-1 in Appendix A). It appears to have partially dismantled and perhaps bulldozed, as many components of the wall are scattered to either side. An opening (about 25.0 cm wide) also appears near the western end of the alignment, flanked by two large boulders that seem to serve as part of the retaining walls, holding back a rubble-filled core. This type of opening is common in enclosure walls throughout the project area; this might be an indication that this wall is all that is left of a former enclosure. The feature was reported to be in fair condition and unaltered. This feature was not identified in 2011.

Feature C is a roughly circular cairn built six courses high with limestone cobbles and boulders (0.7 m to 1.3 m in diameter), along with some limestone slabs. The slabs are placed on-end along the southern edge of the feature (see Figure A-1 in Appendix A). The feature was in good condition and unaltered prior to excavation.

At the conclusion of the Bishop Museum survey, the feature was interpreted as a possible burial site, although based solely on form. Beardsley (2001) excavated (EU-54) into the middle of this feature to determine the presence or absence of human remains. No human remains or cultural material was observed or collected within the architectural and soil matrices exposed during testing. Two metal oil cans were noted on the surface of the northern side of the feature.

In 2011, the two rusted metal cans noted above are now located west of the feature. One can measures 18.0 cm by 12.0 cm and is 9.0 cm high. The top has a circular opening in a corner and a metal ring adjacent to the opening. No markings were observed. The second can, measuring 24.0 m cm by 17.0 cm and 10.5 cm high, has a screw top and metal handle on top

and the remnants of a painted label on the side, most of the label's text is not legible. The words which are visible include the following: "Poison??? A Food Container ? Solvent Cleaning."

In 1995 a single excavation unit, EU-54, was placed in the middle of the cairn (Beardsley 2001). It is a 1.0 m by 1.0 m unit that was excavated in three layers to 82.0 cmbd. The upper layer contained the architectural matrix of limestone cobbles and boulders; Layer II and III were both non-cultural.

Stratigraphy, north wall profile:

I 38 to 46 cm thick limestone cobbles and boulders; abrupt, clear, wavy boundary; architectural.

II 9 to 11 cm thick; very dark grayish brown (10YR 3/2, moist) to dark brown (10YR 3/3, dry); sandy loam; strong, fine to coarse, crumb to granular structure; soft to slightly hard, very friable to friable, slightly sticky, slightly plastic consistency; common, fine to coarse, vesicular to tubular roots; abrupt wavy boundary; non-cultural deposit.

III 19 to 21 cm thick; brown (7.5YR 5/2) to pinkish gray (7.5YR 6/2); sandy loam; moderate, very fine to fine granular structure; loose to soft, very friable, non-sticky to slightly sticky, non-plastic consistency; few fine to coarse tubular roots; non-cultural.

Feature D is a square-shaped enclosure with a narrow opening (1.0 m wide) to the south (see Figure 4-3; see Figure 1 in Appendix A). The enclosure measures approximately 4.5 m by 4.5 m with a maximum height of 0.55 m. It is a multiple-course construction of stacked cobbles and boulders, with a number of limestone slabs used as facing for the walls, particularly the interior sides (Figure 4-5). The walls are nearly 1.0 m wide and contain a rubble-filled core between two retaining walls. The interior floor is leveled soil, and consists of an area roughly 2.0 m by 2.0 m. The feature was in fair condition and appeared to be disturbed prior to excavation.

In 1995, a single excavation unit, EU-52, was place in interior of the feature, at the northern end and extending into the northern wall (Beardsley 2001). It is a 1.0 m by 1.0 m unit that was excavated in three layers to 44.0 cmbd, where it was terminated when bedrock was exposed over 50% of the unit. The architectural elements of the wall are embedded into Layer I. Within the excavations, Layers I and II contained a sparse amount of faunal remains and a mix of both historic and Hawaiian artifacts. Layer III was sterile.

Stratigraphy, south wall profile:

I 13 to 19 cm thick, very dark gray (10YR 3/1, moist) to very dark brown (10YR 2/2, dry); loamy sand; moderate, fine crumb structure; soft, very friable, non-sticky, non-plastic consistency; many roots; abrupt, irregular boundary; cultural.

II 13 to 18 cm thick; yellowish brown (10YR 5/4, moist) to yellowish brown (10YR 5/6, dry); loam; moderate, medium granular structure; soft, friable, slightly sticky, slightly plastic consistency; few roots; abrupt, wavy boundary; cultural deposit.

III 5 to 12 cm thick; yellowish brown (10YR 5/8) to very pale brown (10YR 7/4); fine sandy loam; weak, very fine crumb structure; soft, very friable, non-sticky, non-plastic consistency; abrupt smooth boundary; non-cultural.

Site 1717 Feature D; view to north.

Site 1717 Feature E; view to north.

Figure 4-5. Photographs of Site 1717, Feature D and E.

Feature E, a possible C-shaped enclosure, is located approximately 11.0 m south of Feature C and 8.0 m west of Feature M (see Figure 4-4; and Figure 1 in Appendix A). The enclosure is open to the northwest and measures approximately 3.6 m by 3.4 m with a maximum wall height of 0.45 m (see Figure 4-5). The feature is constructed of piled cobbles and small boulders. The west side is represented by a few scattered cobbles and small boulders. The south and east sides are more pronounced with the maximum height of the feature along the northeast end where a PHRI aluminum site tag was found. The tag was labeled "Site 1717 Feature E." No surface cultural material was observed. The interior space is roughly 1.5 m by 1.5 m, with walls nearly 1.0 m thick. The feature is in fair to poor condition and appears to be unaltered.

In 2011, a single excavation unit (TU-1) and eight shovel test probes (STP1-8) were excavated in and around Feature E. Test Unit 1 was placed in the southwest interior corner of the C-shape (Figure 4-6). The purpose of the unit was to determine the presence of absence of subsurface cultural materials. The unit measured 1.0 m by 1.0 m and was excavated in three layers to a depth of 45.0 cm. Excavation was terminated on bedrock.

Layers I and II contained more than 70 grams of faunal material which was recovered during excavation. A majority of the faunal material came from Layer II/1 and included gastropods, bivalves, and sparse amount of echinoderms. Wood charcoal was recovered from Layer II/1 and 2 (see Table C-1 in Appendix C).

Stratigraphy, northwest wall profile:

I 5 cm thick; very dark brown (10YR 2/2, dry); silt loam; single grain structure; non-sticky, non-plastic consistency; fine to medium roots, abrupt wavy boundary; cultural.

II 25 cm thick; strong brown (7.5YR 4/6 dry); silt loam, single grain structure; non-sticky, non-plastic consistency; many fine roots; clear wavy boundary; cultural.

III 15 cm thick; light yellowish brown (10YR 6/4); sandy silt, single grain structure; non-sticky, non-plastic consistency; few fine roots; non-cultural.

In addition, six traditional artifacts were recovered during excavations. The artifacts included three basalt fragments, one limestone flake, and two limestone fragments (see Table B-1 in Appendix B).

The eight STPs (STP1-8) were placed around the exterior portion of the enclosure: STP1-4 were placed approximately 0.5 m northwest of the C-shape opening; STP5 was placed adjacent to the southeast exterior portion of the enclosure; STP6 and 7 were placed adjacent to the southwest exterior portion of the enclosure; and STP8 was placed approximately 0.5 m north east of the northeast exterior portion of the enclosure (Figure 4-7).

The STPs measured 50.0 cm by 50.0 cm and were excavated to depths ranging from 40.0 to 50.0 cm. The stratigraphic sequence encountered in the STPs is similar to the test unit stratigraphic sequence observed throughout the site. The excavations yielded marine shell remains in Layer I in all except in STPs 5 and 7. The marine remains consisted of gastropods and sparse amount of bivalves (see Table C-1 in Appendix C).

Feature F is a square-shaped enclosure with walls of subangular limestone cobbles, boulders and slabs built 5 to 11 courses high. It measures approximately 4.3 m by 4.0 m and with a maximum height of 1.2 m. The walls are faced and oriented true north-south/east-west, with squared corners. There is a narrow opening in the south wall (40.0 cm wide), and a section of the western wall appears to be an opening (70.0 cm wide) as well although this area retains more evidence of collapse than other walls. The southwestern corner of the structure displays a

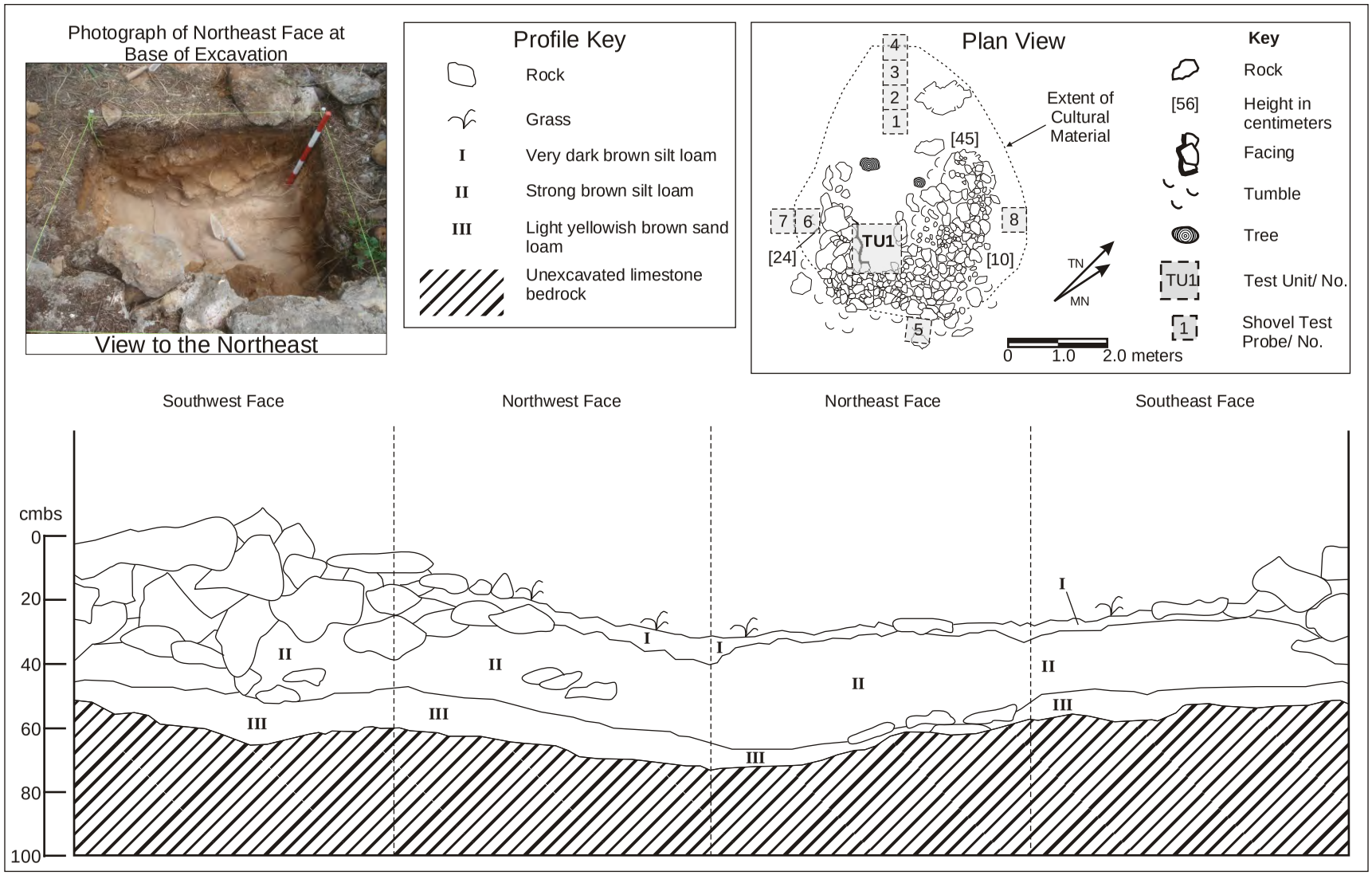


Figure 4-6. Site 1717, Feature E Plan View, Showing Location of TU-1, with Profiles and Photograph.

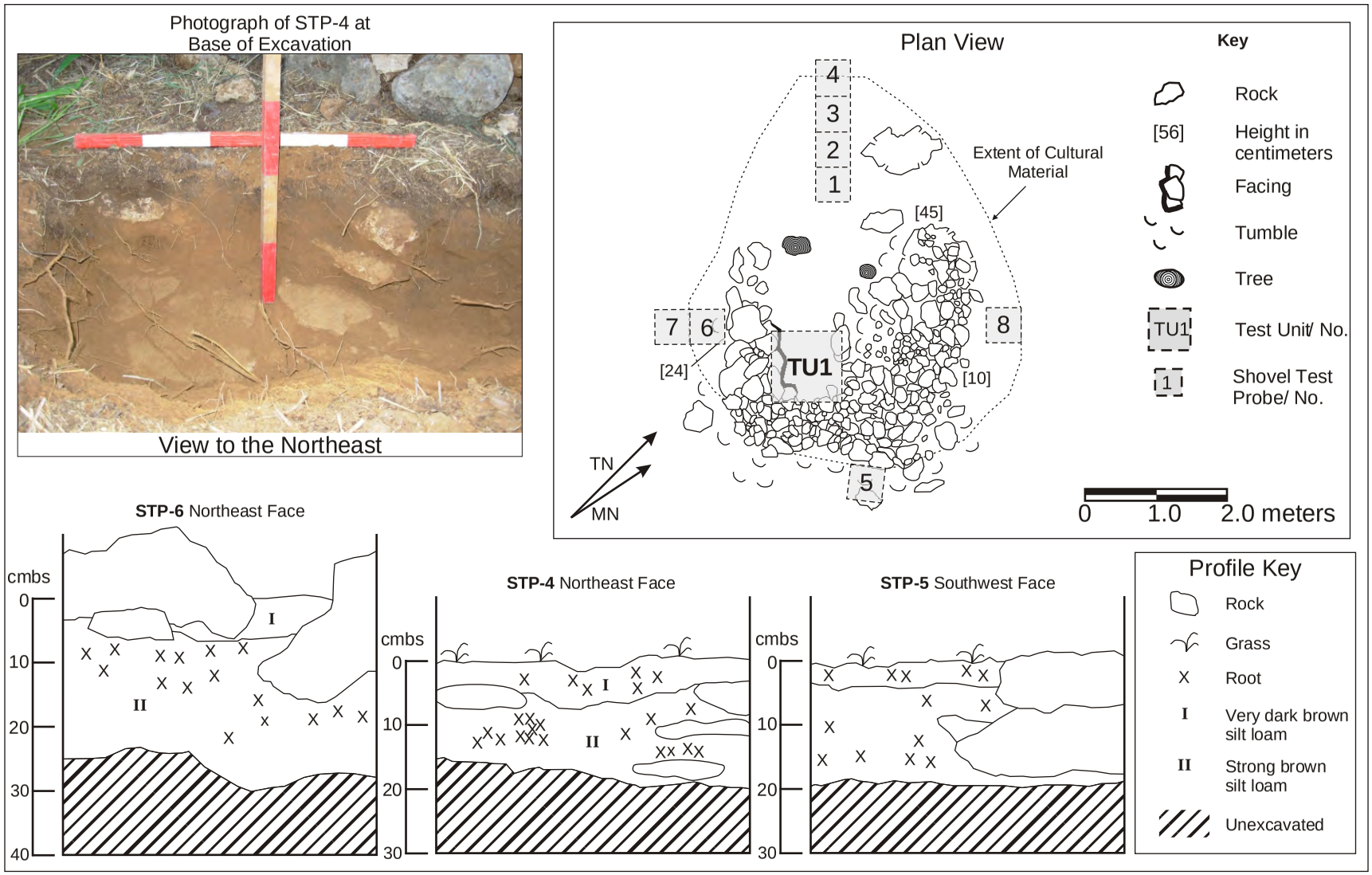


Figure 4-7. Site 1717, Feature E Plan View, showing Locations of TU-1 and STP1-8, with STP4-STP6 Profiles and STP4 Photograph.

somewhat incongruous method of construction, when compared to the remainder of the feature. It is an L-shaped corner that extends from the opening in both the western and southern walls; it is, however, wider than the other walls in the structure and may suggest an additional or modification to the structure as a whole. Bedrock forms the foundation of the northern wall, and is visible around the perimeter of the structure; the other walls, however, appear to have been built atop both bedrock and extending into the soil. The feature was in good condition and unaltered prior to excavation. This feature was not relocated in 2011 and may have been destroyed during recent bulldozing activities.

In 1995, a single excavation unit, EU-53, was placed in the southeastern interior corner of the feature (Beardsley 2001). It is a 1.0 m by 1.0 m unit that was excavated in three layers to a depth of 37.0 cmbd, where it was terminated upon encountering bedrock (see Figure A-2 in Appendix A). The uppermost layer consisted of the architectural materials; Layer II and III contained faunal material with at least indigenous material appearing in Layer III. The foundation of the structure extends through Layer II and into Layer III. A sample of charred material was sent for radiocarbon dating from Layer III; the sample required an extended counting time. The sample yielded a date range of calAD 1430-1670 at two sigma. In addition, a constant volume sample, 254, was submitted for analysis, along with a charcoal sample, 251, 252.

Stratigraphy, south wall profile:

I 10 cm thick; very dark gray (10YR 3/1, moist) to very dark grayish brown (10YR 3/2, dry); sandy loam; weak, very fine to fine granular structure; loose, very friable, slightly sticky, slightly plastic consistency; very few micro to very fine vesicular roots; very abrupt, smooth boundary; non cultural.

II 42 cm thick; dark yellowish brown (10YR 4/6, moist) to brownish yellow (10YR6/8, dry) silt loam, gravel; weak, very fine granular structure; soft, very friable, slightly sticky, slightly plastic consistency; very few micro to very fine vesicular roots; cultural deposit.

Feature G is located at the southwestern end of the site, adjacent to a recent bulldozer cut (see Figure 4-4). The feature is a Box C-shaped-enclosure, open to the south, with walls constructed of stacked slabs. The interior is level soil. The long axis is oriented east/west and measures 4.7 m and is 1.2 m thick. At each end of the wall is a perpendicular wall extending to the south, forming a C-shape measuring approximately 2.5 m long by 1.0 m wide with a maximum height of 0.4 m (Figure 4-8). The walls are constructed of piled limestone cobbles and small to medium-sized boulders and limestone tabular slabs placed on end. No surface cultural material was observed. The feature was in good condition and unaltered prior to excavation.

In 2011, a single excavation unit, TU-1, was placed in the northeast interior corner of the enclosure remnant to determine the presence or absence of subsurface traditional Hawaiian or historic cultural materials and the relationship of the foundation of the structure walls to the surrounding surfaces (Figure 4-9). The unit measured 1.0 m by 0.5 m that was excavated in three layers to a depth of 58.0 cm. Excavation was terminated on bedrock.

Layers I and II contained sparse faunal remains, less than 2.0 grams total weight. Layer I contained gastropods and bivalves and Layer II contained bivalves (see Table C-2 in Appendix C). No faunal remains were encountered in Layer III. Less than 1.0 g of wood charcoal was recovered from Layer III (see Table C-2 in Appendix C).

Site 1717 Feature G; view to west/southwest.

Site 1717 Feature H; view to east.

Figure 4-8. Photographs of Site 1717, Feature G and H.

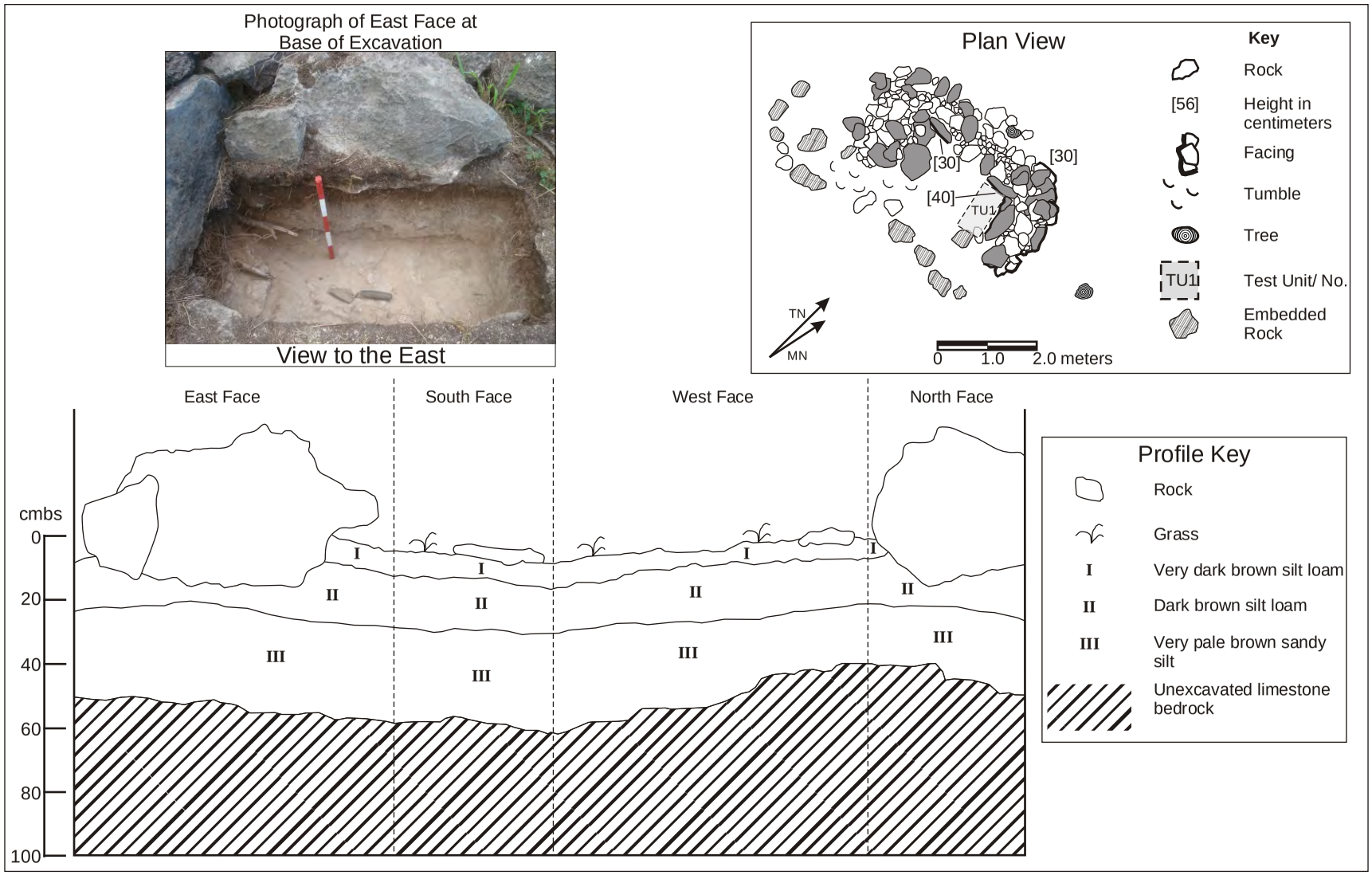


Figure 4-9. Site 1717, Feature G Plan View, Showing Location of TU-1, with Profiles and Photograph.

Stratigraphy, east wall profile:

I 10 cm thick; very dark brown (10YR 2/2, dry); silty loam; single grain structure; non-sticky, non-plastic consistency; fine to medium roots, gradual wavy boundary; non-cultural.

II 10 cm thick; dark brown (10YR 3/3); silty loam; single grain structure; non-sticky, non-plastic consistency; fine to medium roots, abrupt wavy boundary; cultural.

III 38 cm thick; very pale brown (10YR 7/3); sandy silt; non-sticky, non-plastic consistency; fine to medium roots; non-cultural.

Feature H is located at the west/northwest portion of the site and consists of approximately 18 loosely constructed mounds in an area measuring approximately 18.0 m by 15.0 m (see Figure 4-8). The ground surface is relatively level and consists of soil, leaf and branch debris, scattered cobbles and small boulders, and exposed limestone outcrops.

All of the mounds consist of loosely piled cobbles and small boulders placed atop exposed limestone outcrops. They range in size from 1.0 m by 1.0 m to 2.0 m by 2.0 m with an average height of 19.0 cm. One mound, located at the northern end of the feature appears to be more formal in construction than the rest. It is rectangular-shaped and measures approximately 2.2 m by 1.3 m and has a maximum height of 0.38 m. No surface cultural material was observed. The feature is in good condition and unaltered.

In 2011, a total of six subsurface shovel test probes were undertaken in selected areas between the rock piles of Feature H (Figure 4-10). The methods employed in the excavation of the STPs have been described in the methods section. The purpose of shovel test excavations in Feature H was to determine if there was any evidence of agricultural use in this feature locale.

The positions of STPs 1-6 are illustrated on the plan view map of Feature H (see Figure 4-10). A total of six shovel test probes (STP1-6) were excavated within the mound complex. The probes measured between 40.0 and 50.0 cm in diameter and were excavated to a depth between 25.0 cm and over 40.0 cm where excavation was halted either due to bedrock or lack of cultural materials. No faunal remains or cultural materials were observed in the six STP.

All of the shovel test probes exhibited a similar stratigraphic sequence: all of the probes exhibited an O-horizon, primarily organic materials extending to an average depth of 5.0 cmbs. Layer I soils, extending to an average depth of about 17.0 cmbs consisted of loose, very dark brown (10YR 2/2, dry) silty loam with a fine granular structure; soft, friable, non-sticky, non-plastic consistency; few fine to medium roots; abrupt to clear, wavy boundary; non-cultural. Layer II soils extended to bedrock in all of the STPs with an average depth of 30.0 cmbs where limestone bedrock surface was encountered (see Figure 4-10). Layer II soils consist of compact to very compact, very pale brown (10YR 7/3 dry) fine sandy loam; weak, very fine crumb structure; soft, very friable, non-sticky, non plastic consistency; irregular bedrock boundary; non-cultural.

Feature I is a linear wall segment located approximately 1.0 m west of Feature E (see Figure 4-4). The wall segment is oriented roughly east/west and is constructed of piled and stacked cobbles and boulders of various sizes. It measures 4.0 m by 1.0 m and has a maximum height of 0.35 m. No surface cultural material was observed. The feature is in fair to poor condition, but appears to be unaltered by bulldozing.

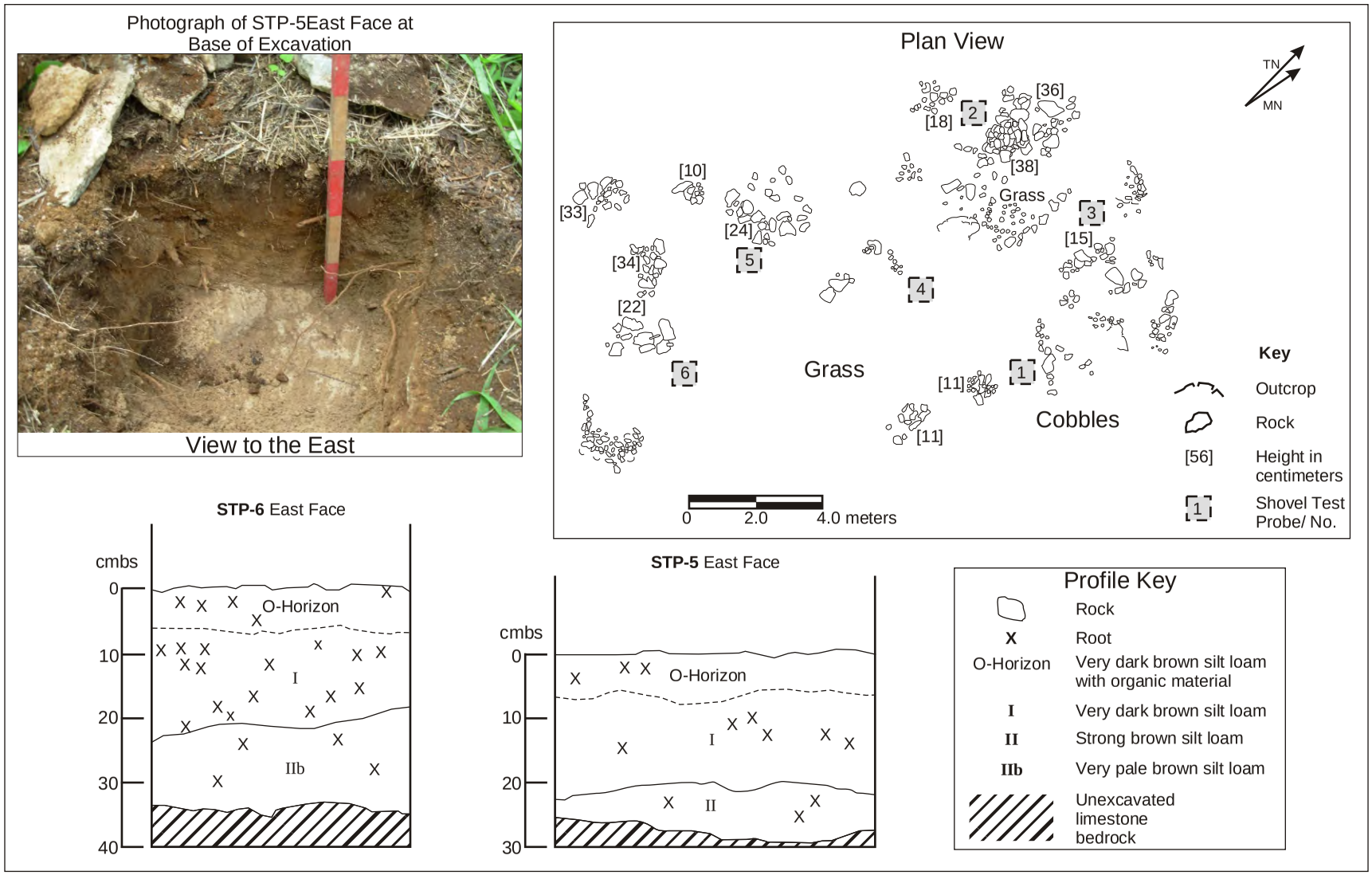


Figure 4-10. Site 1717, Feature H Plan View, Showing Locations of STP1-6, STP5 and STP6 Profiles, and STP5 Photograph.

Feature J is a mound located 1.5 m south of Feature I (see Figure 4-4). The mound is roughly square-shaped and constructed of piled cobbles and small boulders. It measures roughly 1.5 m by 1.0 m and has a height of 0.4 m. No surface cultural material was observed. Feature is in fair to good condition and appears to be unaltered.

Feature K is a modified outcrop located approximately 9.0 m southeast of Feature J. The modification consists of five rock piles located on a large raised limestone outcrop within an area roughly 13.0 m by 7.0 m (see Figure 4-4). The rock piles range in size from 1.2 m by 0.75 m to 3.0 m by 1.5 m. No surface cultural material was observed. The feature is in good condition and appears to be unaltered.

Feature L consists of three to four mounds located 5.0 m south of Feature E and 0.6 m west/northwest of Feature M (see Figure 4-4). These features are situated in an area roughly 8.0 m by 3.0 m and are consist of loosely piled cobbles, with some areas of stacked cobbles and small boulders. The mounds range in size between 1.0 m by 0.6 m and 3.0 m by 1.0 m with a maximum height of 0.28 m. No cultural material was observed. The feature is in good condition and appears to be unaltered.

Feature M is a mound located approximately 0.6 m east of Feature L (see Figure 4-4). The mound is constructed of piled cobbles and small boulders and measures 2.0 m by 1.4 m with a maximum height of 0.44 m (Figure 4-11). No cultural material was observed. The feature was in good condition prior to excavation.

A 1.0 by 1.0 m test unit (TU-1) was excavated in the center of Feature M primarily to determine the presence or absence of human remains (Figure 4-12). No human remains were present. Several examples of marine shell were present. The results of this excavation are provided below (see Table C-2 in Appendix C).

A single excavation unit, TU-1, was placed centrally in the mound to shed light on its function based on the presence or absence of subsurface traditional Hawaiian or historic cultural materials (see Figure 4-12). The unit measured 1.0 m by 1.0 m and was excavated to a depth of 31.0 cm. One stratigraphic layer was encountered, and excavation was terminated on bedrock. The surface of the unit is covered with small limestone cobbles which were removed prior to excavation. A piece of aluminum foil was observed in the cobble covering.

Layer I contained a little over 7.0 grams of faunal remains. The faunal remains consisted of gastropods, bivalves, and echinoderms (see Table C-2 in Appendix C).

Stratigraphy, north wall profile:

I 20 cm thick; dark yellowish brown (10YR 3/6, dry); silty loam; single grain structure; very friable, non-sticky, slightly plastic consistency; very fine to coarse roots; cultural.

Feature N is located approximately 10.0 m west Feature E and consists of a series of roughly 10 rock piles located in a stand of trees between two bulldozer cuts (see Figure 4-4). These features are constructed of loosely piled limestone cobbles and small to medium-sized boulders built on a raised limestone outcrop. The rock piles range in size from 1.0 m by 1.0 m to 2.0 m by 1.5 m with a maximum height of 0.42 m. No surface cultural material was observed. The feature is fair to good condition.

Feature O is a series of rock piles placed on raised limestone outcrop located roughly 6.0 m northeast and east of Feature G and approximately 10.0 m south/southwest of Feature N (see Figure 4-4). These features are constructed of loosely piled limestone cobbles and small to medium-sized boulders built on a raised limestone outcrop. They range in size from 1.1 m

Site 1717 Feature M; view to east.

Site 1717 Feature P; view to south/southeast.

Figure 4-11. Photographs of Site 1717, Feature M and P.

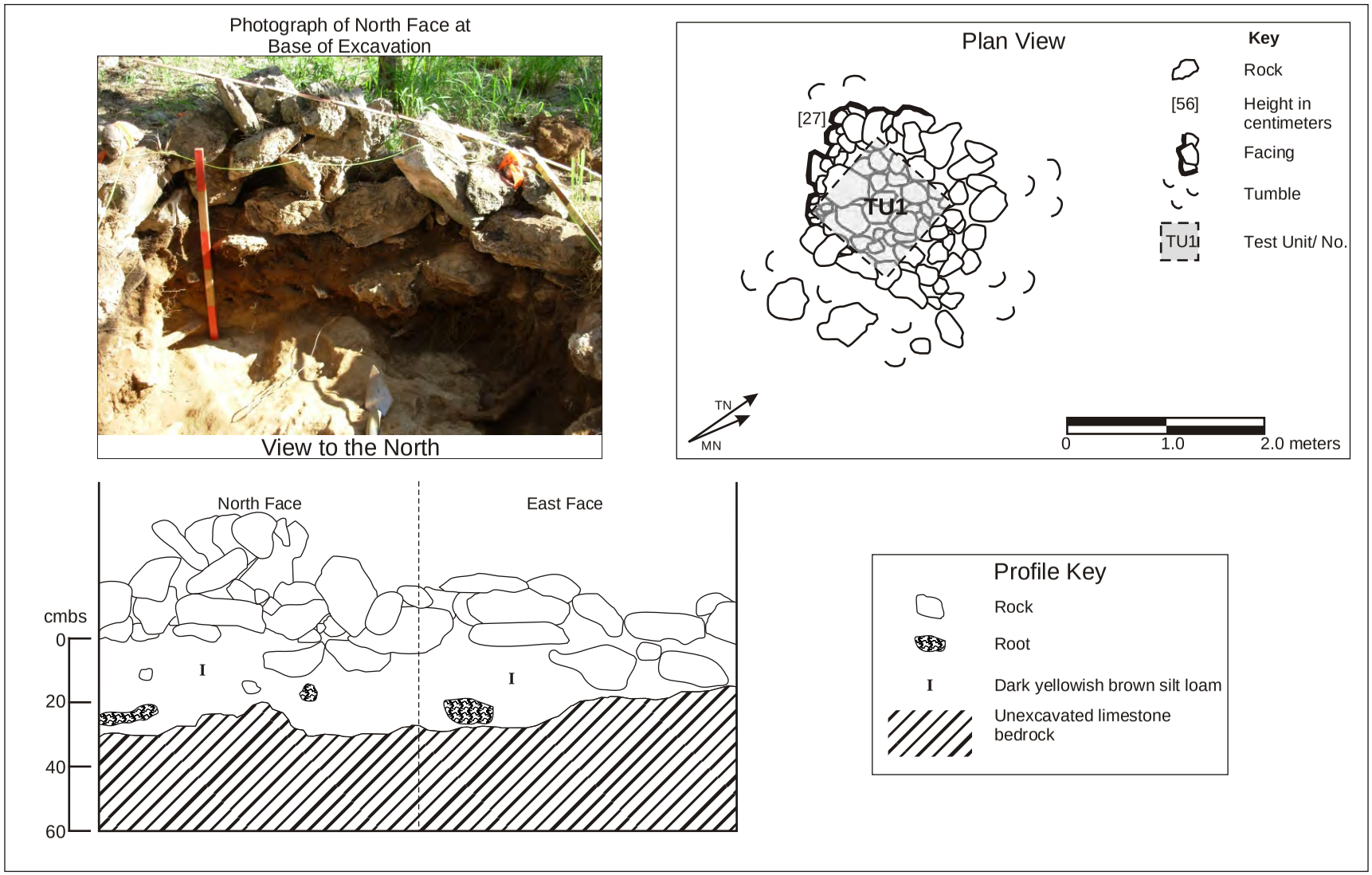


Figure 4-12. Site 1717, Feature M Plan View, Showing Location of TU-1, with profiles and Photograph.

by 1.0 m to 2.1 m by 1.5 m with a maximum height of 0.4 m. No surface cultural material was observed. Feature O is in good condition.

Feature P, an oval-shaped mound, is located approximately 2.0 m south of Feature K (see Figure 4-4). The mound measures 2.8 m by 1.6 m and has a maximum height of 0.5 m. No surface cultural material was observed (see Figure 4-11). Feature was in good condition prior to excavation.

A single excavation unit, TU-1, was placed in the central portion of the mound (Figure 4-13). The purpose of the unit was to determine primarily the presence or absence of a human burial, and to determine the nature and extent of any cultural materials that may be present. Human remains were not present in the mound feature. The unit measured 1.5 m by 1.0 m and was excavated to a depth of 54.0 cm. Two stratigraphic layers were encountered. Excavation was terminated at bedrock.

Stratigraphy, west wall profile:

I 35 cm thick; yellowish brown (10YR 5/4, moist); silty loam; structureless; non-sticky, slightly plastic consistency; fine to coarse roots, abrupt wavy boundary; non-cultural.

II more than 20 cm thick; very dark brown (7.5YR 2.5/3 moist); sandy silty, structureless; slightly sticky, non-plastic consistency; very fine to fine roots; non-cultural.

Feature Q, located approximately 3.0 m west of Feature D, consists of a modified limestone outcrop (see Figure 4-3). The entire feature measures approximately 7.5 m by 4.9 m with the long axis oriented northeast/southwest. Placed along the edge of the outcrop are limestone cobbles and boulders of various sizes. In the center of the feature is a fallen *kiawe* tree. No cultural material was observed. Feature Q is in fair condition and altered by *kiawe* trees.

Feature R is located approximately 6.0 m north/northwest of Feature Q and consists of 14 mounds (Mounds 1-14). The mounds occupy an area measuring approximately 14.0 m by 11.0 m and are constructed of piled cobbles and small boulders with many, if not all of the mounds constructed on raised limestone outcrop (see Figure 4-3). The mounds range in size from 1.0 m by 0.5 m to 2.0 m by 2.0 m with an average height of 0.28 m. No cultural material was observed. The feature is in fair to good condition and appears to be altered.

Interpretation, Significance, and Recommendations

Based on the 18 features described above, as well as the analysis of artifacts and midden (see Section 5), Site 1717 appears to have functioned predominantly as a pre-Contact habitation and agricultural complex. The construction style, workmanship, and use of material are typical of other pre-Contact features on the ‘Ewa Plain with similar functions (Tuggle and Tomonari-Tuggle 1997b). However, the physical setting of the site area has been extensively altered, primarily by bulldozing, so that the site no longer retains sufficient aspects of integrity, such as location and setting, to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Beardsley (2001:IV.9) recommended Site 1717 as eligible for the NRHP under Criterion D. Through mapping, data collection, and material analysis as part of the current study and Beardsley’s (2001) study, the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 1717 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

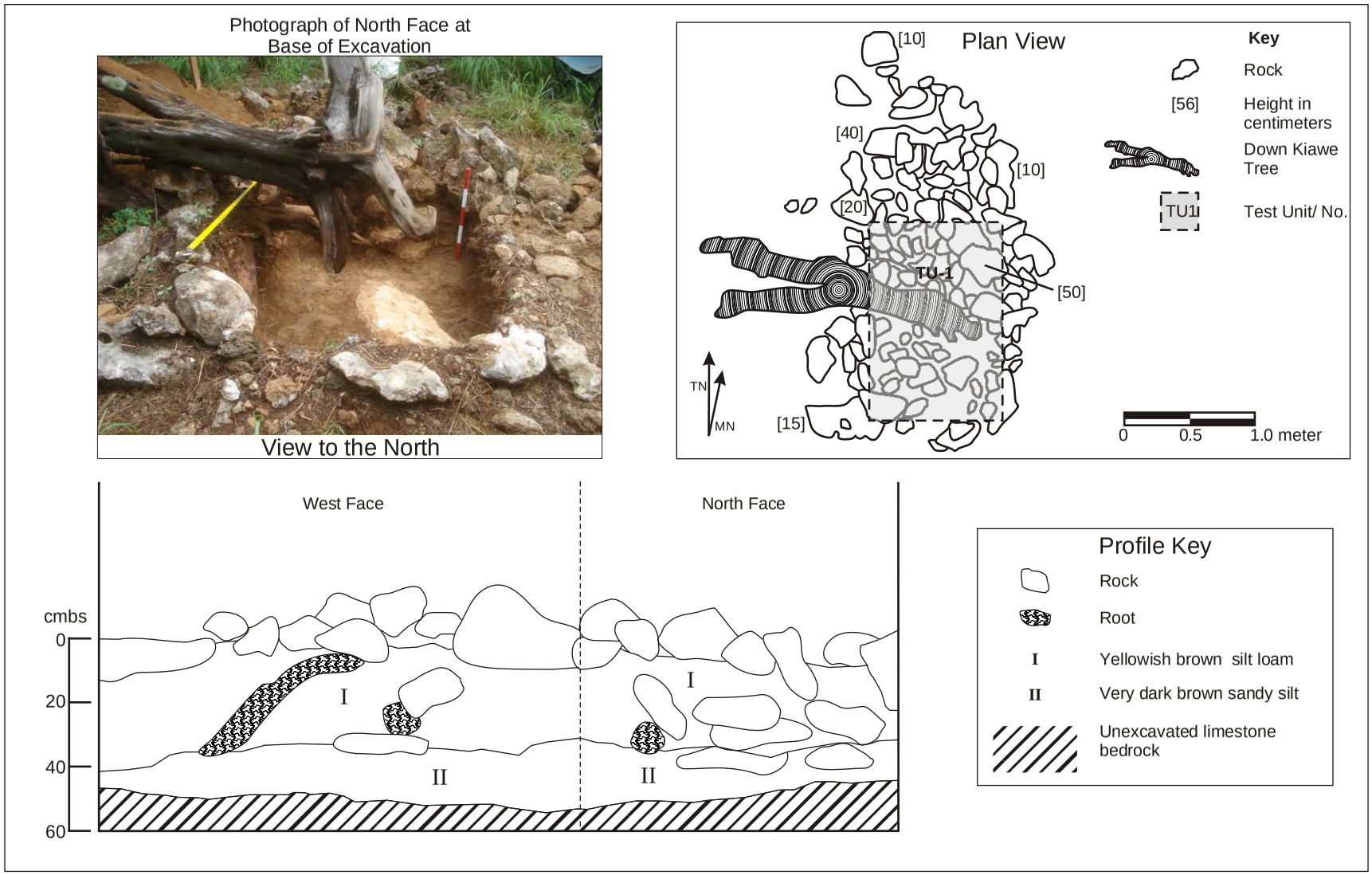


Figure 4-13. Site 1717, Feature P Plan View, Showing Location of TU-1, with profiles and photograph.

State Site 50-80-12-7179

Temporary Site Number: T-2
Site Type: Mound
Site Function: Military/industrial use
Site Dimensions: 5.0 m by 5.0 m
Number of Features: 1
Topography: Relatively level, upraised coral limestone reef with scattered cobbles and small boulders
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 132
Current Status: New Site

Description:

Site 7179 consists of a single mound (Feature A) located within the site boundaries of Site 1717, approximately 15.0 m southwest of Feature D of Site 1717 and 16.0 m south of Feature R of Site 1717 (see Figure 4-1).

Feature A consists of a three sided triangular-shaped low rock platform constructed of stacked limestone boulders and cobbles. The north side incorporates a raised limestone outcrop (see Figure 4-3). The platform measures approximately 3.5 m by 3.5 m by 2.5 m and has a maximum height of 0.45 m. In the center of the feature is a hole measuring 0.5 m by 0.3 m and 0.3 m deep. A black-colored electric wire extends along the east side of the feature towards Feature D of Site 1717. The feature is in good condition and appears to be unaltered.

Interpretation, Significance, and Recommendations

The construction style and design of Site 7179, along with visible industrial components, indicates a probable military or industrial function. The physical setting of the site area has been extensively altered, primarily by bulldozing, so that the site no longer retains sufficient aspects of integrity, such as location and setting, to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Through mapping the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7179 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

State Site 50-80-12-1718

Temporary Site Number: BPBM 235
Site Type: Feature complex
Site Function: Temporary habitation and agriculture
Site Dimensions: 90.0 m by 40.0 m
Number of Features: 12
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 77-119
Current Status: Additional features recorded in 2011

Description:

Site 1718 is a feature complex recorded by Haun (1991:38) as a habitation complex of six features (Features A-F) that included habitation, agricultural, and possible burial structures (Feature E). It is located in the northwest quadrant of KS1 (see Figure 4-1). The original Bishop Museum field maps (BPBM 1985:BA-2) indicate that more mounds as well as disturbed areas were present around the site area. No excavations were conducted at this site as part of the Haun (1991) study.

Site 1718 was originally included as part of an interpretive plan that included trails, signage, and possibly restoration efforts (The Traverse Group 1988). A more recent trail development study (Erkelens 1992) does not include Site 1718.

Beardsley (2001:IV.11) recorded five of the original features (excluding Feature F) at Site 1718 (see A2 in Appendix A). Excavation units of various sizes were excavated in each of the five extant features (Features A-E). Midden (predominantly marine shell) was recovered from all of the excavations and a historic lead pellet was recovered from Feature C (L-shape). The midden concentrations at Features A (enclosure) and D (C-shape) were described as dense, while midden in the remaining excavated features was described as sparse. Excavations at Feature E (possible burial) recovered no evidence of human interment. Two charcoal samples from Feature A were submitted for radiocarbon dating. Beta No. 85052 from Layer III produced a date of calAD 1665-1952, while Beta No. 85053 from a hearth subfeature within the structure produced a date of calAD 1656-1953.

Jones (1993: Table 1) recorded 11 features as part of the Site 1718 complex but did not correlate any of the features with features recorded by Haun (1991). Most of the previously undocumented features recorded by Jones (1993) appear to be mounds, which is consistent with original field maps from the BPBM project (BPBM 1985: B-2; Haun 1991).

In 2011 PCSI relocated the site, found Feature F, recorded six additional features, and excavated test units in three (3) features (Features H, J, and K) and noted that the northwest, central, and western portions of the site appeared to have been bulldozed in the past. The evidence for bulldozing included the presence of parallel linear alignments of soil, cobbles and boulders, the lack of features, and the mounds of soil and cobbles adjacent to the parallel alignments.

Figure 4-14 presents the 2011 site plan for Site 1718. The feature descriptions below include those from Beardsley (2001) and from the recent survey.

<u>Feature A</u> is a rectangular-shaped enclosure located at the northern end of the site (see Figure A-3 in Appendix A). In plan view the enclosure has the appearance of two adjoining boxed C-shapes separated by entrances along the north and south walls (see Figure 4-14).

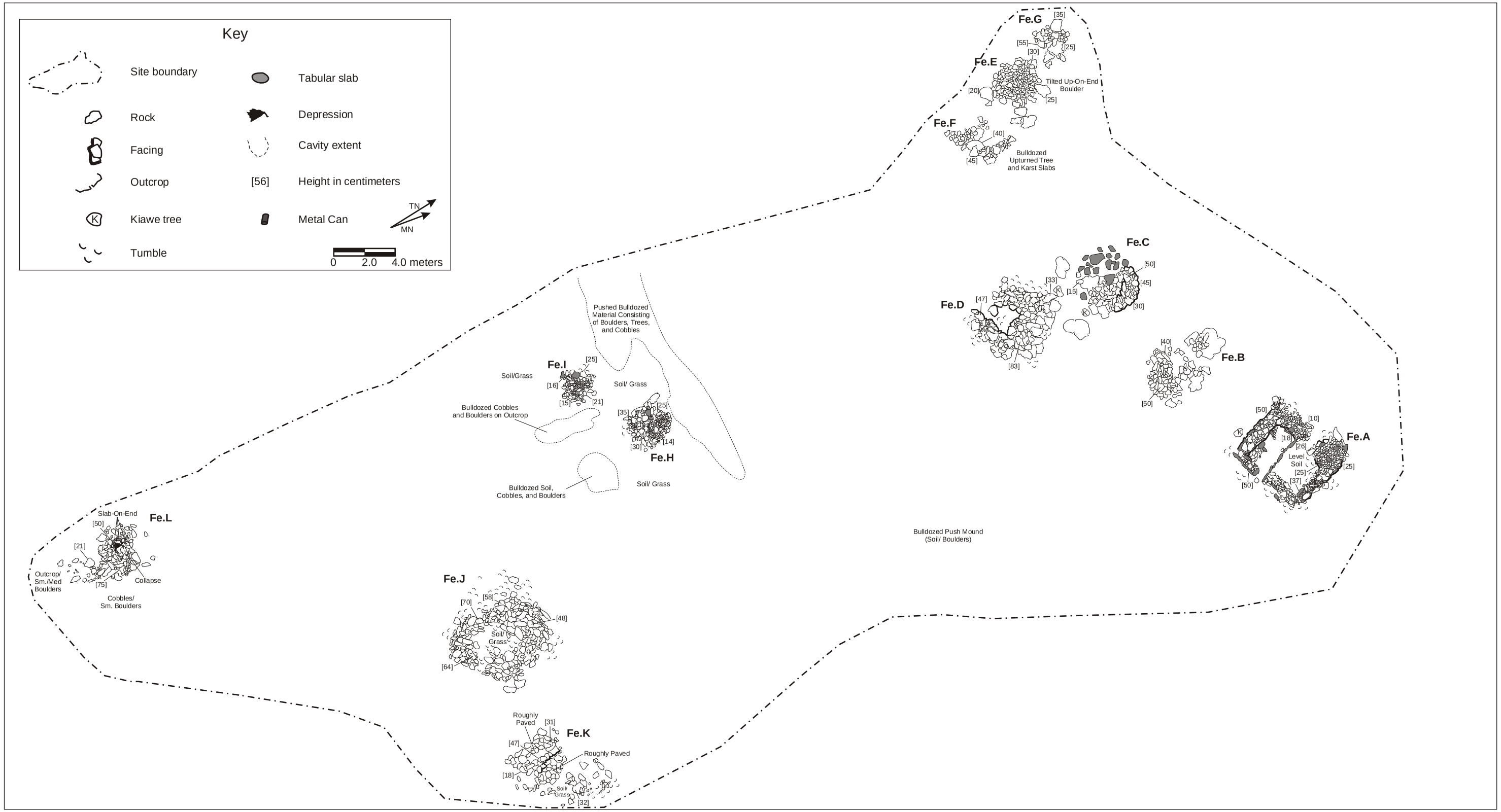


Figure 4-14. Site 1718, Features A through L, Plan View.

The west side is constructed of stacked limestone cobbles and small to medium-sized boulders with limestone slabs placed on end in both the exterior and interior portions of the wall. The long axis of the wall is oriented north/south and measures approximately 9.0 m by 1.5 m with a maximum height of 0.6 m. At the south end of the north/south wall is a short wall extending east for approximately 2.5 m and is 0.6 m wide. It is constructed of limestone slabs placed on end with a cobble core filling (Figure 4-15). At the north end of the north/south wall is a short, partially collapsed wall, extending east/west measuring approximately 5.5 m with a thickness of roughly 1.0 m. The exterior portion of the wall has collapsed but the interior portion is intact and is stacked with at least one slab placed on end.

The east side is less intact with signs of tumble along the southern east/west extending wall and portions of the north/south wall. The northern east/west extending wall is more a circular-shaped mound than a wall. The entire east side is constructed of limestone cobbles and small to medium-sized boulders with an occasional limestone slab placed on end. Some stacking is present along the exterior portion of the north/south wall and portion of the northern east/west extending wall.

The interior of the enclosure is divided into two sections by an alignment of limestone slabs placed on end (see Figure 4-14). At the southern end of the alignment it abuts the western end of the southern east/west extending wall from the east side of the boxed C-shape. The northern end of the alignment abuts the east end of the northern east/west extending wall of the west boxed C-shape.

The interior ground surface of the enclosure is level and consists of soil and scattered cobbles. A possible hearth was observed in the interior central portion along the east wall (see Figure 4-14). No cultural material was observed. The feature is in fair to good condition and has been altered by *kiawe* trees.

A single excavation unit, EU-39, was placed adjacent to the western wall, in the area suspected to contain the slab-lined hearth (see Figure A-4 in Appendix A). It was a 1.0 m by 1.0 m unit excavated in three layers to 35 cmbd, where it was terminated upon encountering bedrock. Layers I and III contained faunal material, along with a moderate density of charcoal; Layer II was sterile. The hearth, HF-6 (11.0 to 24.0 cmbd), was semi-oval, in shape, defined by six limestone cobbles, with limestone pebbles scattered throughout the matrix, commingled with a dense concentration of charcoal and a sparse amount of shell. The hearth was slightly depressed in the center, but it was in generally good shape. It originated in Layer I, continued through Layer II, and appeared to terminate at the Layer II/III contact zone. The on-edge slabs within the architectural component of the walled enclosure were embedded into Layer I. One radiocarbon date (Beta-85052) was run on charred material recovered from Layer III; a second date (Beta-85053) was run on charred material from the hearth. Dates quoted below are at the 2-sigma range, and are statistically identical. This suggests that the charcoal collected from Layer III originated from the hearth. A sample of charcoal was submitted for wood identification.

Beardsley (2001) dated a charcoal sample from Feature A which yielded a C^{14} calibration range of 140 $\pm$ 60 B.P. (AD 1655-1950) and 150 $\pm$ 70 B.P. (AD 1645-1950).

Site 1718 Feature A; view to south/southwest.

Site 1718 Feature B; view to north.

Figure 4-15. Photographs of Site 1718, Feature A and B.

The stratigraphy in EU-39 is as follows:

Stratigraphy, west wall profile:

I 2-30 cm thick; dark brown (7.5YR 3/3, moist) to brown to dark brown (7.5YR 4/4, dry); sandy loam; weak, medium crumb structure; soft, very friable, slightly sticky, slightly plastic consistency; few roots; clear, irregular boundary; cultural.

II 5-12 cm thick; dark brown (7.5YR 3/4, moist) to strong brown (7.5YR 4/6, dry); sandy loam; weak, medium crumb structure; soft, very friable, slightly sticky, slightly plastic consistency; few roots; clear, irregular boundary; non-cultural deposit.

III 2-11 cm thick; strong brown (7.5YR 4/6) to brown (7.5YR 5/4); sandy loam; weak, fine crumb structure; soft, very friable, slightly sticky, slightly plastic consistency; common roots; clear, irregular boundary; cultural.

Feature B is a roughly oval-shaped mound located approximately 5.0 m west of Feature A (see Figure 4-14). The feature is constructed of piled limestone cobbles and small to medium-sized boulders and measures approximately 3.0 m by 2.5 m with a maximum height of 0.5 m (see Figure 4-15). The central portion of the mound has been previously excavated down to bedrock. The removed rock has been placed to the north of the mound. The feature was in good condition but has been altered by testing (Beardsley 2001).

A single excavation unit, EU-36, was placed in the middle of the mound (see Figure A-3 in Appendix A). It is a 1.0 m by 0.5 m unit that was excavated in four layers to 77.0 cmbd, where bedrock was encountered over 75% of the unit along with a small sinkhole opening (50.0 cm in diameter) in the southwestern corner. The base of the sinkhole could not be seen and the opening was too narrow to enter. All layers contained limestone cobbles and boulders. The first two layers also contained small fragments of plastic; the lower two layers were culturally sterile. The base of the mound architecture appears to be embedded in Layer II.

Stratigraphy, east wall profile:

I 18-42 cm thick; limestone; very abrupt, wavy boundary; architectural.

II 5-48 cm thick; very dark brown (10YR 2/2, moist and dry); silt loam, cobbles and boulders; weak, fine to medium crumb structure; soft, loose, non-sticky, non-plastic consistency; many micro to very fine roots; abrupt, smooth boundary; non-cultural deposit.

III 16-22 cm thick; dark brown (7.5YR 3/3, moist and dry); clay loam, cobbles and boulders; weak, fine to medium crumb structure; soft, loose, non-sticky, non-plastic consistency; few micro to very fine roots; abrupt, smooth boundary; non-cultural.

IV 5-48 cm thick; dark brown (7.5YR 3/4, moist) to brown to dark brown (7.5YR 4/4; clay loam, cobbles and gravel; weak, medium to coarse crumb structure; slightly hard, very friable, slightly sticky, slightly plastic consistency; few micro to very fine roots; non-cultural.

Feature C is a possible L-shaped structure located approximately 3.5 m west of Feature B (see Figure 4-14; see Figure A-3 in Appendix A). The structure's northern side exhibits stacked construction using cobbles and limestone slabs placed on end in the construction whereas the southern portion is poorly defined and represented by scattered cobbles and small boulders (Figure 4-16). The feature was in fair to poor condition prior to testing.

Site 1718 Feature C; view to south/southwest.

Site 1718 Feature D; view to north/northeast.

Figure 4-16. Photographs of Site 1718, Feature C and D.

A single excavation unit, EU-37, was placed to overlap the corner of the L-shape, on its interior side (Beardsley 2001; see Figure A-3 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in four layers to 43 cmbd, where it was terminated at the base of two sterile levels and the exposure of bedrock over 50% of the unit. Layer I contained the architecture; Layer II and III contained a sparse amount of faunal material; Layer IV was sterile. The architecture rested on Layer II.

Stratigraphy, north wall profile:

I 8 cmbd - 21 cmbd; limestone; clear boundary; architectural.

II 0-16 cmbd; dark brown (7.5YR) 3/3, moist) to dark brown (7.5YR 3/4, dry); sandy loam; moderate, very fine to coarse granular structure; slightly hard, friable, slightly sticky, slightly plastic consistency; few roots; abrupt boundary; cultural deposit.

III 15-38 cmbd; brown to dark brown (7.5YR 4/4, moist) to strong brown (7.5YR 4/6, dry); sandy clay loam; weak, medium crumb structure; soft, very friable, slightly sticky, plastic consistency; few roots; abrupt boundary; cultural.

IV 34-43 cmbd; strong brown (7.5YR 4/6) to strong brown (7.5YR 5/6); sandy clay loam; moderate coarse to very coarse granular structure; hard, very friable, slightly sticky, plastic consistency; very few roots; non-cultural.

Feature D is a C-shaped structure located approximately 3.0 m southwest of Feature C (see Figure 4-14; see Figure A-3 in Appendix A). It is constructed of stacked limestone cobbles, small to medium-sized boulders, and slabs placed on end (see Figure 4-16). It measures approximately 5.2 m by 5.1 m and opens to the west. The walls are between 0.5 m and 1.0 m thick with a maximum height of 0.7 m. The interior ground surface is level with soil and grasses. The feature was in good condition prior to excavation.

A single excavation unit, EU-38, was placed in the interior section, against the interior east wall (see Figure A-3 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in two layers to 27.0 cmbd, where it was terminated upon encountering bedrock. Both layers contained a modicum of faunal material. The building materials were embedded 1.0-5.0 cm into the upper soil layer (Layer I).

Stratigraphy, north wall profile:

I 14 cm thick; dark brown (7.5YR 3/2, moist) to dark brown (7.5YR 3/4, dry); sandy loam; weak, fine granular structure; soft, friable, slightly sticky, non-plastic consistency; common, very fine vesicular roots; abrupt, irregular boundary; cultural.

II 10 to 27 cm thick; dark brown (7.5YR 3/2, moist) to brown to dark brown (7.5YR 4/4, dry); sandy loam; weak, fine crumb structure; soft, very friable, slightly sticky, non-plastic consistency; few micro vesicular roots; cultural deposit.

Feature E is a mound/platform located approximately 12.0 m north of Feature D and 1.0 m north/northwest of Feature F (see Figure 4-14). The mound is constructed of piled cobbles and small boulders placed on raised limestone outcrop (Figure 4-17). It measures 3.5 m by 2.5 m and has a maximum height of 0.4 m. Large tabular limestone slabs are present along the western and southern edges of the mound. A PHRI aluminum site tag was found along the southern end of the mound. The feature was in fair to good condition prior to excavation and may have been altered by bulldozing activities in the past.

A single excavation unit, EU-40, was placed in the middle of feature (see Figure A-3 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in three layers to 25 cmbd, where it

Site 1718 Feature E; view to east/southeast.

Site 1718 Feature H; view to southeast.

Figure 4-17. Photographs of Site 1718, Feature E and H.

was terminated when bedrock was exposed over 75% of the unit and at the conclusion of a single sterile level. The upper layer contained the architectural materials; Layer II contained a sparse amount of faunal material, and Layer III was sterile. The architectural elements were slightly embedded into the upper soil layer (Layer II).

Stratigraphy, west wall profile:

I 2 to 3 cm thick; limestone; clear, wavy boundary; architectural.

II 5 to 11 cm thick; black (10YR 2/1, moist) to very dark brown (10YR 2/2, dry); sandy loam; moderate, fine to coarse, crumb structure; loose, non-sticky, non-plastic consistency; very few, very fine to fine vesicular roots; abrupt and smooth boundary; cultural deposit.

III 11 to 17 cm thick; dark reddish brown (5YR 2.5/2, moist) to dark reddish brown (5YR 3/4); silt loam; weak, very fine to medium granular structure; loose, very friable, non-sticky, slightly plastic consistency; very few, very fine to medium vesicular roots; non-cultural.

Feature F, not relocated by Beardsley (2001), was relocated during the recent survey (see Figure 4-14). It is located approximately 1.0 m south/southeast of Feature E, near the northwest edge of the site. It consists of a poorly defined C-shape structure constructed of piled, 1-2 courses, limestone cobbles and small boulders measuring approximately 4.0 m by 2.0 m with a maximum height of 0.45 m. No cultural material was observed. The feature appears to have been altered by previous bulldozing activities.

Feature G is located approximately 1.0 m north of Feature E, at the northwestern boundary of the site and adjacent to a recent bulldozer cut (see Figure 4-14). Feature G is a modified outcrop. It consists of limestone cobbles and small boulders piled against a raised limestone outcrop. It measures approximately 2.0 m by 1.0 m with a maximum height of 0.6 m. No surface cultural material was observed. The feature may have been altered by previous bulldozing activities.

Feature H is a rock mound located approximately 22.0 m south/southwest of Feature D (see Figure 4-14). The area between Features D and H appears to have been disturbed in the past. Feature H is constructed of piled limestone cobbles and small to medium -sized boulders (see Figure 4-17). It measures 2.7 m by 2.6 m with a maximum height of 0.35 m. In the center of the mound is an aluminum can. No other cultural material was observed. The feature may have been altered by previous bulldozing activities.

A single excavation unit, TU-1, was placed in the approximate center of the mound (Figure 4-18). The unit measured 1.0 m by 1.0 m and was excavated in two layers to a depth of 61.0 cm. Excavation was terminated on bedrock.

Layer I contained sparse faunal remains, less than 2.0 grams total weight. The faunal remains included gastropods, bivalves, unidentified fish, and small mammal (see Table C-4 in Appendix C). One rusted can was recovered from the rock concentration covering the unit. This rock concentration was removed prior to excavation as was the O-horizon underlying the rock concentration.

Stratigraphy, southeast wall profile:

I 30 cm thick; dark brown (7.5YR 3/4, moist); silt loam; single grain structure; slightly sticky, non-plastic consistency; fine to medium roots, clear wavy boundary; non-cultural.

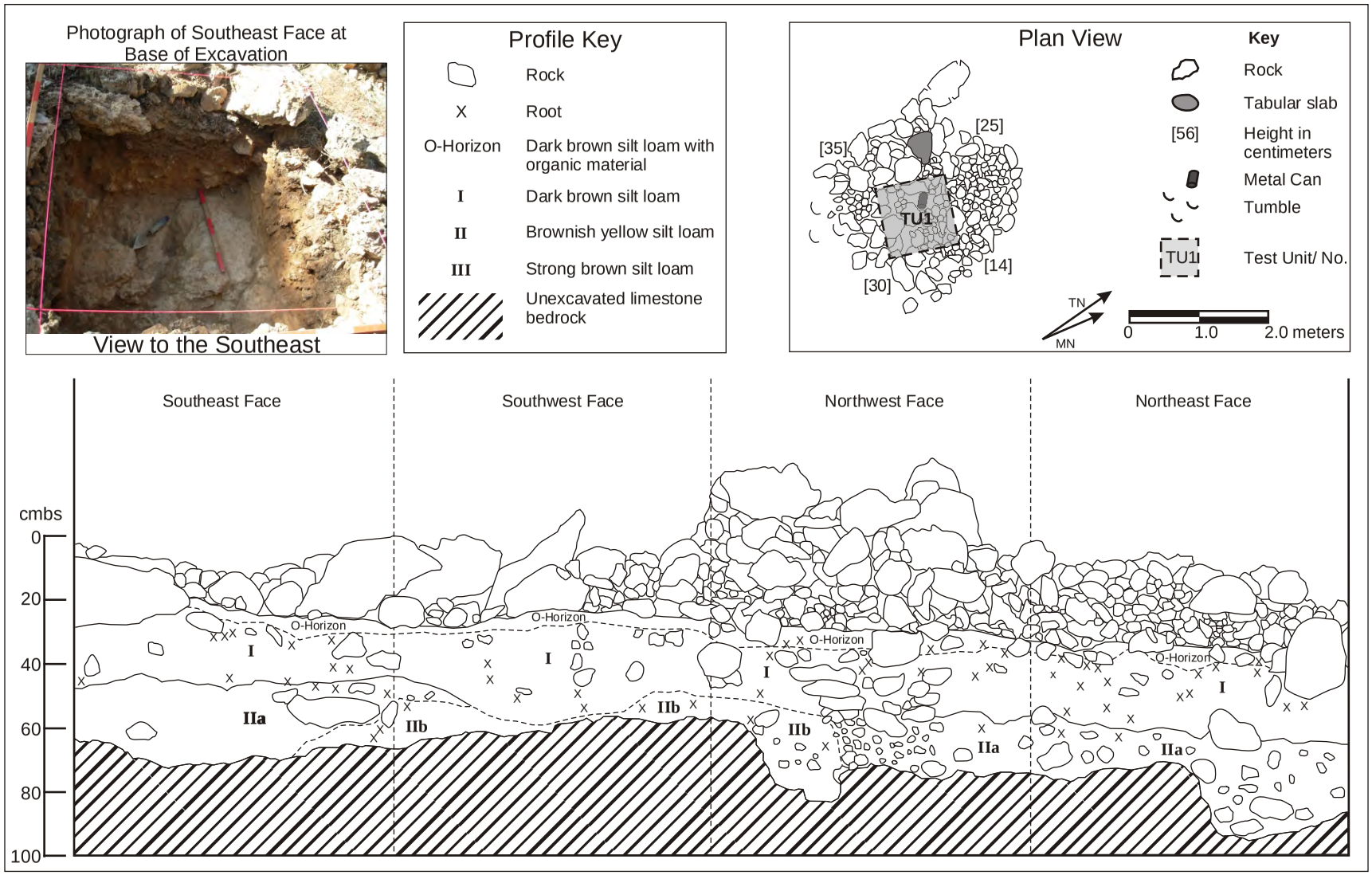


Figure 4-18. Site 1718, Feature H Plan View, Showing Location of TU-1, with Profiles and Photograph .

IIa 25 cm thick; brownish yellow (10YR 6/8); silt loam; single grain structure; slightly sticky, non-plastic consistency; few fine to coarse roots, clear wavy boundary; non-cultural.

IIb 15 cm thick; strong brown (7.5YR 5/8); silt loam; slightly sticky, non-plastic consistency; no roots, clear, wavy boundary; non-cultural.

Feature I is low rock mound located approximately 3.0 m west of Feature H (see Figure 4-14). The area to the southeast and north exhibit signs of past disturbances to the area. The mound is constructed of piled limestone cobbles and boulders of various sizes with three tabular limestone slabs placed along the western portion. The mound measures approximately 2.6 m by 2.3 m with a maximum height of 0.25 m. No cultural material was observed. The feature may have been altered by the past disturbances in the area.

Feature J is a circular-shaped enclosure located approximately 12.0 m south of Feature H (see Figure 4-14). The structure is situated on a slope with the northwest end higher than the southeast (Figure 4-19). It is constructed of piled and stacked cobbles and small to medium-sized boulders and measures 6.3 m by 6.0 m with a maximum height of 0.74 m. A possible entrance is located in the southeast portion of the enclosure. Tumbled cobbles partially block the entrance. The interior wall has several tabular limestone slabs placed on end in the construction. The interior ground surface measures approximately 2.5 m by 2.0 m and consists of tumbled rock, soil, and grasses. No surface cultural material was observed. The feature is in good condition and appears to be unaltered.

A single excavation unit, TU-1, was placed in the southwestern portion of the enclosure abutting the interior wall (Figure 4-20). The unit measured 1.0 m by 1.0 m and was excavated in three layers to a depth of 74.0 cm. Excavation was terminated on bedrock along the western portion and due to lack of cultural material in the eastern portion.

Layers I and II contained an abundance of cultural material; more than 500.0 grams. Faunal remains recovered include over 350.0 grams of gastropods (with *Nerita picea* being the dominant species), 150.0 grams of bivalves (with *Brachidontes crebristriatus* being the dominant species), sparse amount of unidentified echinoderm and crustacean, fish, and sparse amount of small mammal and bird (see Table C-3 in Appendix C). Approximately 20.0 grams of wood charcoal were recovered during screening from Layer II/1.

In addition, 24 traditional artifacts were recovered from Layer II/1. Artifacts included one adze preform fragment, eight limestone flakes and flake fragments, 15 volcanic glass pieces including 10 flakes, four cores, and one nodule (see Table B-2 in Appendix B).

Stratigraphy, southeast wall profile:

I 6 cm thick; dark brown (7.5YR 3/2, dry); silty loam; single grain structure; non-sticky, non-plastic consistency; many fine roots, abrupt wavy boundary; cultural deposit.

II 35 cm thick; dark brown (7.5YR 3/4); silty loam; single grain structure; non-sticky, non-plastic consistency; few fine to medium roots, gradual boundary; cultural deposit.

III more than 25 cm thick; strong brown (7.5YR 4/6); silt; non-sticky, non-plastic consistency; few fine to medium roots, non-cultural deposit.

In order to determine the horizontal extent of the cultural layer within Feature J, a total of nine shovel test probes (STP1, 3, 4 and 5-10) and one trench (STP4) were excavated in four areas extending off the exterior wall of the enclosure (see Figure 4-20). All of the STP's were

Site 1718 Feature J; view to north/northwest.

Site 1718 Feature K; view to northwest.

Figure 4-19. Photographs of Site 1718, Feature J and K.

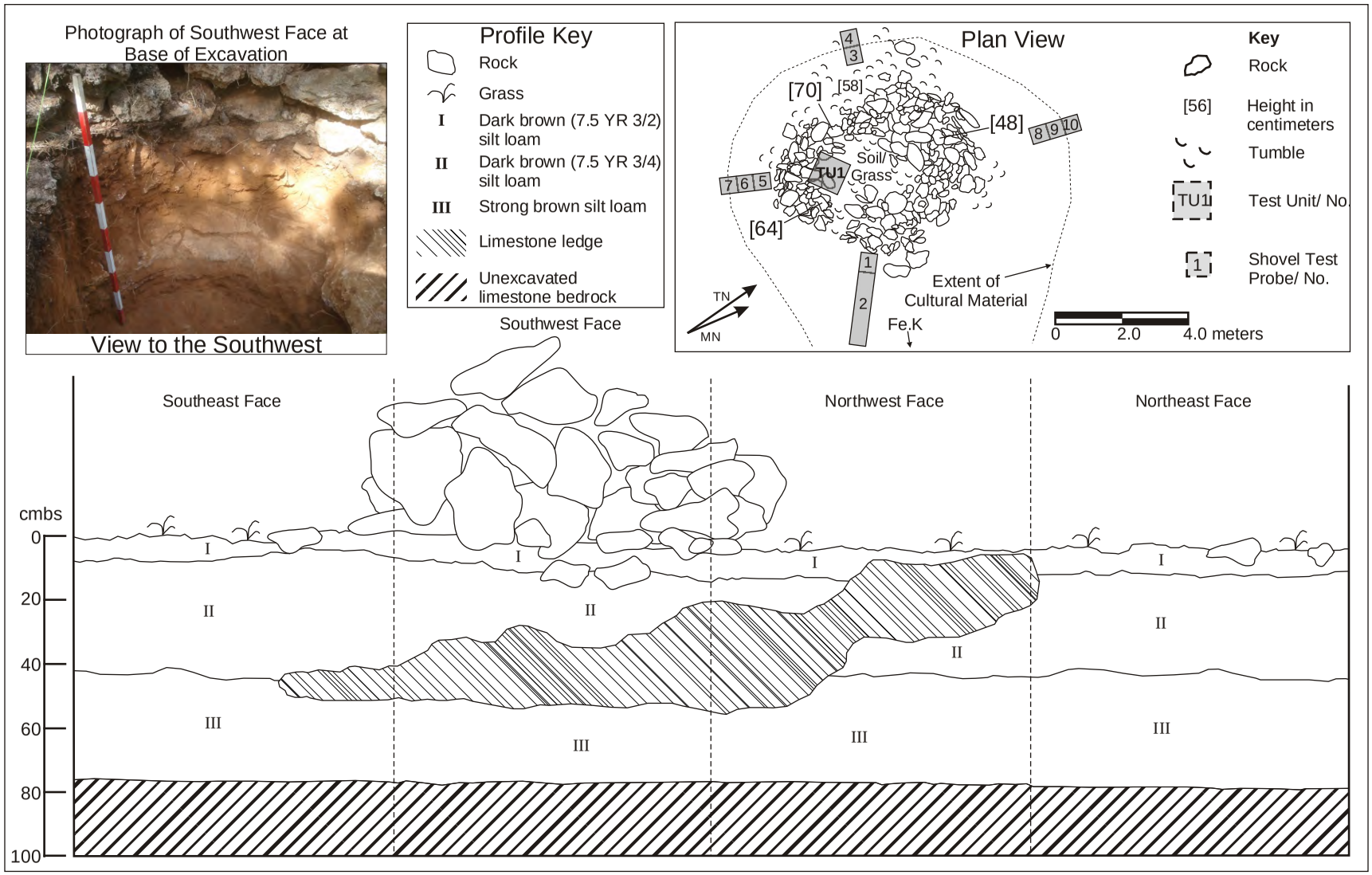


Figure 4-20. Site 1718, Feature J Plan View, Showing Locations of TU-1 and STP1-10, with Profiles and Photograph.

approximately 40.0 cm in diameter with the exception of STP1 and the STP2. STP1 was 50.0 cm^2 and STP2 was 2.36 m long by 0.5 m wide. The stratigraphic sequence of the STPs is similar to the test unit stratigraphic sequence observed throughout the site.

All STPs, with the exception of STP3 and 10, contained marine shell and only three (STP1, 2, and 5) contained traditional artifacts. STP1, located along the southeast exterior portion of the enclosure, contained stone flakes; STP2, located adjacent to STP1 and extending southeast, contained one volcanic glass flake; and STP5, located adjacent to the south exterior wall of the enclosure, contained volcanic glass flakes (see Table B-2 in Appendix B).

Feature K is located approximately 2.0 m east of Feature J (see Figure 4-14). It is an area that appears to have been paved with limestone cobbles and small boulders with a north/south extending alignment through the center of the paving creating a possible two-tiered terrace (see Figure 4-19), measuring 5.5 m by 5.0 m. The alignment measures approximately 2.0 m by 0.5 m wide and 0.47 m high. No cultural material was observed. The feature is in fair to good condition and appears to be unaltered.

A single excavation unit, TU-1, was placed in the approximate center of the possible pavement to determine the presence/absence of a human burial (Figure 4-21). The unit measured 1.0 m by 1.0 m and was excavated in two layers to a depth of 40.0 cm. Excavation was terminated on bedrock.

Layers I and II contained sparse amounts of faunal material. Layer I faunal remains consists of 21.4 grams of gastropods, 7.6 grams of bivalves, less than 1.0 gram of echinoderm and small mammal. Less than 1.0 gram of wood charcoal was also collected from Layer I. Layer II faunal remains included less than 1.0 gram of gastropods. A mix of Layer I and II contained 3.2 grams of gastropods, specifically *Nerita picea* (see Table C-4 in Appendix C).

In addition, 15 traditional artifacts were recovered from Layers I and II. Artifacts from Layer I included seven volcanic glass flakes, four volcanic glass fragments, and two cores. Artifacts from Layer II/1 included two volcanic glass flakes (see Table B-2 in Appendix B).

Stratigraphy, east wall profile:

- I — 15 cm thick; dark reddish brown (5YR 2.5/2, moist); silty loam; single grain structure; non-sticky, non-plastic consistency; fine roots, clear boundary; cultural.
- IIa — 10 cm thick; yellowish red (5YR 4/6); silty clay loam; single grain structure; slightly sticky, slightly plastic consistency; fine to coarse roots, clear boundary; cultural.
- IIb — 6 cm thick; brown (10YR 5/3); silty clay loam; slightly sticky, slightly plastic consistency; fine to coarse roots, non-cultural.

Feature L is a rock mound with a possible cupboard located at the southern end of the site, approximately 22.0 m west/southwest of Feature J (see Figure 4-14). The feature is irregularly-shaped and measures approximately 3.0 m by 2.3 m with a maximum height of 0.74 m. It is constructed of piled cobbles and small to medium-sized boulders with evidence of stacking along the east side where some collapse has occurred. Along the west side of the mound is a depression that leads to the possible cupboard. The depression is lined with limestone slabs placed on end and measures 40.0 cm by 25.0 cm and is 50.0 cm deep. The possible cupboard extends east of the depression and measures 60.0 cm deep and has an interior height of approximately 50.0 cm. No cultural material was observed. The feature may have been altered by the past disturbances to the area.

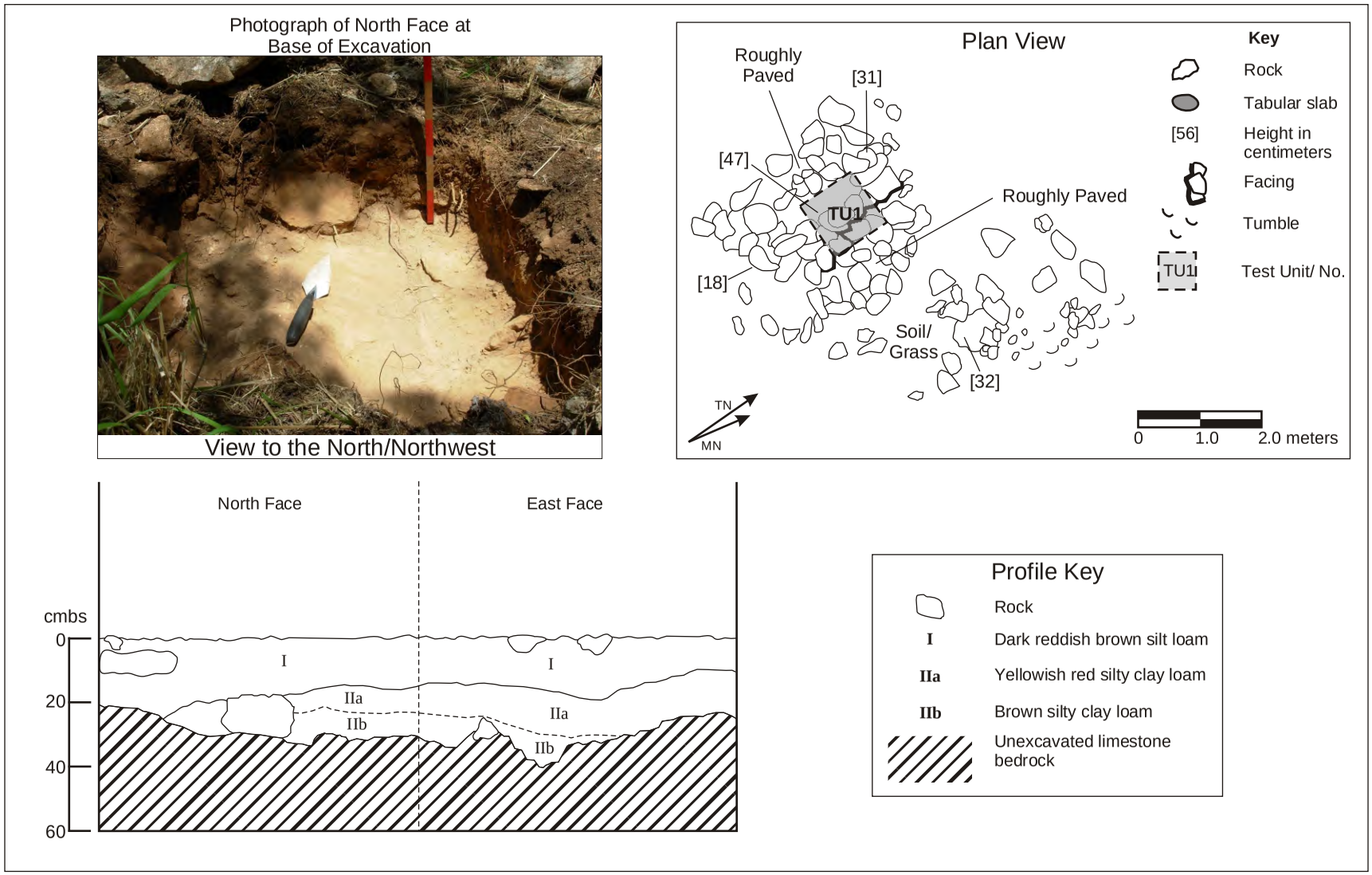


Figure 4-21. Site 1718, Feature K Plan View, Showing Location of TU-1, with Profiles and Photograph.

Interpretation, Significance, and Recommendations

Based on the 12 features described above, as well as the analysis of artifacts and midden (see Section 5), Site 1718 appears to have functioned predominantly as a pre-Contact habitation complex. The construction style, workmanship, and use of material are typical of other pre-Contact features on the ‘Ewa Plain with similar functions (Tuggle and Tomonari-Tuggle 1997b). However, the physical setting of the site area has been extensively altered, primarily by bulldozing, so that portions of the site no longer retain sufficient aspects of integrity, such as location and setting, to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Beardsley (2001:IV.11) recommended Site 1718 as eligible for the NRHP under Criterion D. Through mapping, data collection, and material analysis as part of the current study and Beardsley’s (2001) study, any adverse impacts to Features B, C, D, E, F, G, H, I, K, and L have been mitigated and these features no longer contribute to the significance of the site. However, Features A and J retain the potential to yield information important to understanding late pre-Contact settlement and use of the ‘Ewa Plain and as such continue to contribute to the significance of the site under Criterion D. It is recommended that Features A and J be preserved and that a Historic Preservation Plan (HPP) be developed to address the short-term preservation, long-term preservation, and interpretation of Site 1718.

State Site 50-80-12-1719

Temporary Site Number: BPBM 236
Site Type: Feature complex
Site Function: Habitation and agricultural
Site Dimensions: 50.0 m by 50.0 m
Number of Features: 6
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 004-0043, 352-359
Current Status: One new feature added to the site (Feature F)

Description:

Haun (1991:38) originally recorded Site 1719 as a habitation complex of five features (Features A-E) that included habitation, agricultural, and a possible burial structure (Feature E). The original Bishop Museum field maps (BPBM 1985:BA-3) indicate that bulldozer activity had partially disturbed some of the site area. No excavations were conducted at this site as part of the Haun (1991) study.

Erkelens (1992) surveyed and mapped Site 1719 as part of a trail development study likely generated by the 1988 Natural Resources Management Plan for NASBARPT (The Traverse Group 1988). While no additional features were recorded during the project, Erkelens (1992:8) provided more detailed descriptions of the site and noted that "documentation and interpretation of Site 1719 will remain incomplete until the numerous other features to the north and west of the site are cleared and investigated." Erkelens (1992:4) also noted bulldozing disturbance northeast, west, and southwest of the site.

Beardsley (2001:IV.15) recorded the five original features at Site 1719 (see Figure A-5 in Appendix A). Single excavation units were placed in Features A (C-shape), C (enclosure), and E (cairn), while two excavation units were placed in Feature B (enclosure). Midden (predominantly marine shell) was recovered from all of the excavations and a historic lead pellet was recovered from Feature C. The midden concentration at Feature B was described as dense, while the concentrations from the other features were described as sparse. One charcoal sample from a hearth (HF-5) in Feature B was submitted for radiocarbon dating. Beta No. 85051 produced a date of calAD 1675-1942.

The current study added a large area of modified outcrops and mounds (Feature F) that appears to have been disturbed by military activities. Figure 4-22 presents a plan view of Site 1719. The west end of the site has been disturbed by a probably military encampment, and the military features here were designated as Site 7178, which also appears on Figure 4-22.

<u>Feature A</u> is a C-shaped enclosure constructed of stacked and piled limestone cobbles and small to medium-sized boulders with the occasional limestone slab placed on end (Figure 4-23). It measures approximately 3.4 m by 2.9 m with wall 1.0 m thick and 0.56 m high and is open to the south. The west side of the structure was constructed slightly higher than the rest of the feature. Both ends of the structure are tumbled, gradually sloping to the present ground surface. The interior ground surface is level and consists of soil and scattered cobbles. Several small *koa haole* trees are growing in and around the structure. No cultural material was observed inside or adjacent to the exterior of the structure. The feature is in fair to good condition and appears to be unaltered.

In 1995, a single excavation unit, EU-29, was placed in the interior of the structure (see Figure A-5 in Appendix A). It is 1.0 by 1.0 m unit that was excavated in two layers to 26 cmbd,

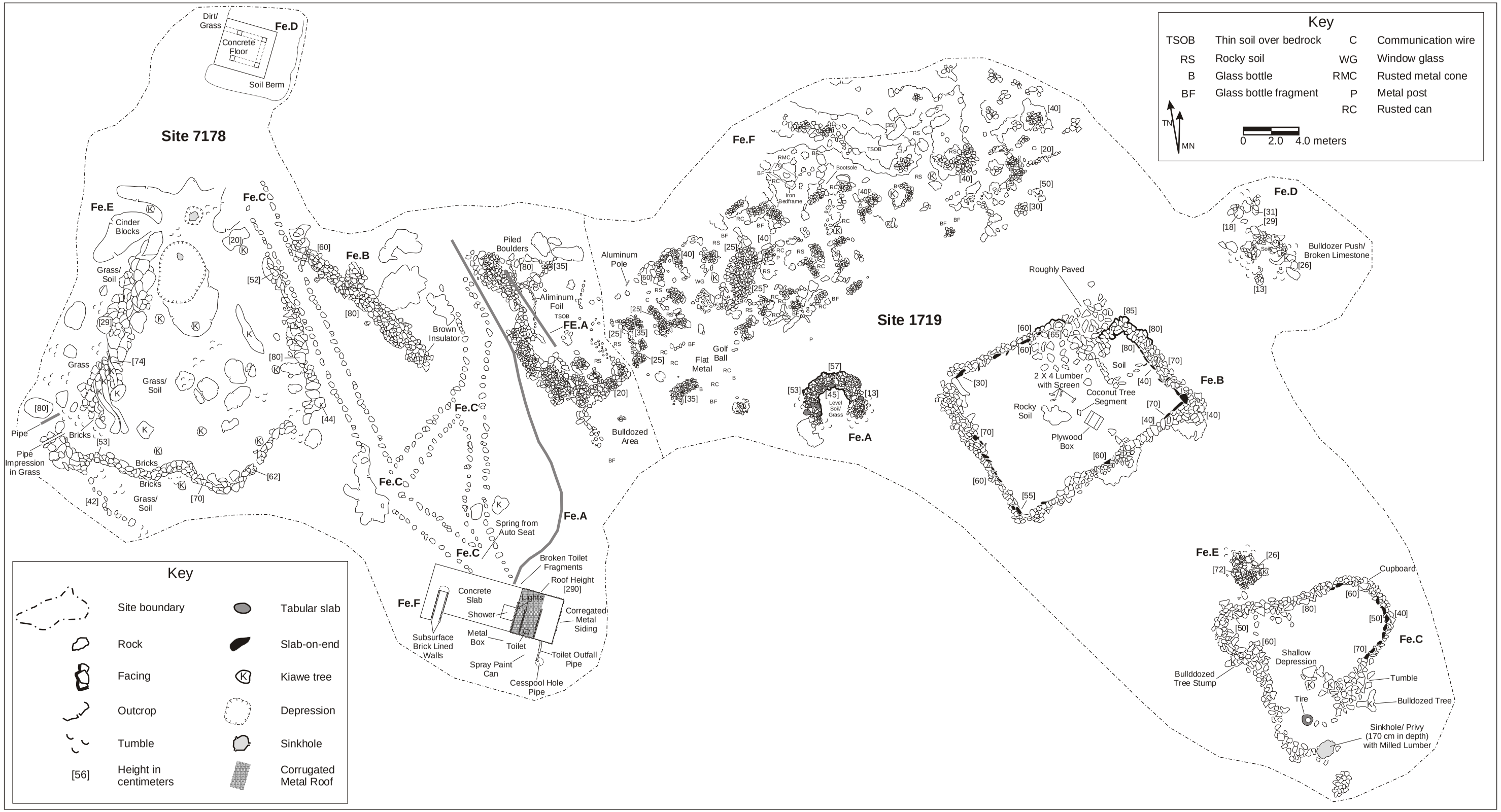


Figure 4-22. Plan Views of Site 1719 Features A through F, and Site 7178 Features A through F.

Site 1719 Feature A; view to north/northwest.

Site 1719 Feature B; view to southwest.

Figure 4-23. Photographs of Site 1719, Feature A and B.

where it was terminated upon encountering bedrock. The upper layer contained a sparse amount of faunal material; the lower layer was sterile. A hearth, HF-4 (7 to 21 cmbd), was encountered in Layer I, intruding into Layer II. It consists of a shallow circular pit of charcoal and fire-altered rock. A sample of charcoal was submitted for identification.

Stratigraphy, south wall profile:

I 8 to 17 thick; dark yellowish brown (10YR 4/4, moist) to brown yellow (10YR 6/6, dry); sandy loam; weak, fine crumb structure; soft, loose, slightly sticky, non-plastic consistency; few roots; abrupt boundary; cultural.

II 1 to 9 thick; very pale brown (10YR 7/4, moist) to pink (7.5YR 8/4, dry); sandy clay; moderate, friable platy structure; slightly hard, friable, sticky, slightly plastic consistency; few roots; non-cultural deposit.

Feature B is a rectangular-shaped enclosure located approximately 5.0 m east of Feature A (see Figure 4-22; see Figure 4-23). The enclosure measures approximately 17.0 m by 12.0 m with wall averaging 1.0 m thick and 0.54 m high. The wall is constructed of stacked limestone cobbles and small to medium-sized boulders with limestone slabs placed on end sporadically placed along the interior and exterior portions of the wall. Portions of the wall are core-filled with small to large-sized cobbles.

The northeast corner of the enclosure is defined by a paved area measuring roughly 3.0 m by 3.0 m with a maximum height of 0.3 m. The paving consists of limestone cobbles, boulders of various sizes, and tabular slabs. No cultural material was observed.

Adjacent and south of the paving and west of the enclosure wall is an area defined by an alignment of cobbles and a tabular slab placed on end. The enclosed area measures approximately 2.8 m by 2.5 m. No cultural material was observed.

The interior ground surface of the main enclosure is level and consists of soil, scattered cobbles and boulders of various sizes, grasses, small trees, and in a few section raised limestone outcrop. Numerous historic artifacts were observed on the surface and included lumber, a plywood box, and meshed screen material. The feature appears to be in good condition and altered by kiawe trees and historic activities in the general area.

In 1995, two excavation units, EU-28 and 33, were placed within the feature (see Figure A-5 in Appendix A). The first excavation unit was placed within the pavement in the northeastern corner. It is 1.0 m by 1.0 m unit excavated in three layers to 48 cmbd and terminated at bedrock. The first layer contained pavement architecture, while Layer II contained a sparse amount of faunal material and a basalt flake and Layer III was sterile. Architectural elements appeared to be embedded into the upper soil layer, Layer II.

Stratigraphy, west wall profile:

I 3 to 12 cm thick; limestone; architectural.

II 22 to 27 cm thick; reddish brown (5YR 4/4) to brown (7.5YR 5/4); slit loam; weak medium structure; soft, very friable, non-sticky, non-plastic; common, very fine to medium vesicular to tubular roots; clear, smooth boundary; cultural.

III 5 to 20 cm thick; reddish yellow (7.5YR 6/6) to pink (7.5YR 7/4); silt clay loam; strong, courses, subangular blocky structure; slightly hard, friable, non-sticky, non-plastic consistency; common micro to fine vesicular roots; non-cultural.

The second excavation unit, EU-33, was placed in the northeastern corner of the enclosure to the south of the pavement. It is a 1.0 m by 1.0 m unit that was excavated in two

layers to 39 cmbd, where it was terminated at the conclusion of three sterile levels. The upper layer contained a sparse amount of faunal material; the lower layer was sterile (see Figure A-6 in Appendix A). One subsurface feature was encountered, HF-5 (13 to 16 cmbd); it is a shallow, oval concentration of charcoal that originated in Layer I and intruded into Layer II. A radiocarbon date (Beta-85051) was generated from charred material recovered from this feature; the sample returned calAD date of 1670-1780, 1795-1945 at 2-sigma range. A sample of charcoal was submitted for identification.

Stratigraphy, west wall profile,

I 9 to 21 cm thick; dark yellowish brown (10YR 4/6, moist) to brown (7.5YR 5/4, dry); silt loam; moderate, medium granular structure; soft, very friable, non-sticky, non-plastic consistency; common, very fine to medium vesicular to tubular roots; clear, smooth boundary; cultural.

II 12 to 24 cm thick; yellowish brown (10YR 5/6) to yellow (10YR 8/6); silt loam; moderate, coarse angular blocky structure; soft, very friable, slightly sticky, slightly plastic consistency; few micro to fine tubular roots; non-cultural.

Feature C is an irregular-shaped enclosure located approximately 14.0 m south of Feature B, near the southeast corner of the site area (see Figure 4-22). The enclosure measures approximately 15.0 m by 13.0 m with walls averaging 0.9 m thick and 0.52 m high (Figure 4-24). The walls are constructed of piled limestone cobbles and small to medium-sized boulders with slabs placed on end along east interior side. The walls may have been constructed using a core-filling but time has collapsed much of the wall. A cavity in the wall is located in the northeast corner enclosure. A gap in the wall, measuring approximately 2.5 m wide, is present along the south side of the enclosure.

At the end of the southeast end of the wall is a pile of cobbles and small boulders measuring 4.0 m by 3.0 m. At the south end of the west wall is a sinkhole measuring approximately 1.5 m by 1.0 m and is 1.7 m deep. Milled lumber is partially covering the sinkhole opening. The feature is in fair condition and appears to be altered by historic military activities.

In 1995, a single excavation unit, EU-31, was placed in the interior of the feature, in the curved northeastern apex, adjacent to the wall (Beardsley 2001; see Figure A-5 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in one layer to a depth of 40 cmbd, where it was terminated on decaying bedrock. The layer contained a sparse amount of faunal material. The architectural materials were embedded into the soil.

Stratigraphy, east wall profile:

I 10 to 40 cm thick; dark yellowish brown (10YR 3/6, moist) to dark yellowish brown (10YR 4/6, dry); sandy loam; weak, fine crumb structure; soft, very friable, non-sticky, non-plastic consistency; few very fine vesicular to tubular roots; clear boundary; cultural.

Feature D is a C-shaped enclosure located 10.0 m east/northeast of Feature B (see Figure 4-22). The C-shape measures 3.0 m by 3.0 m and opens to the south (see Figure 4-24). The walls are 1.0 m wide by 0.24 m high and are constructed of piled cobbles and small to medium-sized boulders with tumble along the west and east exterior walls. The interior ground surface measures approximately 1.5 m by 1.0 m and consists of soil and scattered cobbles on a leveled surface.

A *kiawe* tree is growing in the southeastern portion of the feature and has caused some tumble. The feature is in fair to good condition and has been altered by *kiawe* trees.

Site 1719 Feature C; view to north/northwest.

Site 1719 Feature D; view to south.

Figure 4-24. Photographs of Site 1719, Feature C and D.

In 1995, a single excavation unit, EU-32, was placed inside the feature, against the north wall (Beardsley 2001; see Figure A-5 in Appendix A). It is a 1.0 m by 0.5 m unit that was excavated in two layers to 36 cmbd, where it was terminated upon encountering bedrock. The upper layer contained a sparse amount of faunal material; the lower layer was sterile. Architectural materials were found embedded in Layer I deposits.

Stratigraphy, west wall profile:

I 14 to 21 cm thick; brown to dark brown (10YR 4/3, moist) to yellowish brown (10YR 5/6, dry); loamy sand; moderate, medium granular structure; soft, friable, non-sticky, non-plastic consistency; common, fine vesicular roots; clear, wavy boundary; cultural.

II 0 to 15 cm thick; yellowish brown (10YR 5/6) to light yellowish brown (10YR6/4); loamy sand; moderate, fine crumb structure; soft, friable, non-sticky, non-plastic consistency; common, fine to medium vesicular roots; non-cultural.

Feature E was recorded as a cairn located approximately 2.0 m north of the northwest corner of Feature C (see Figure 4-22). This structure measures roughly 2.5 m by 2.2 m with a maximum height of 0.72 m and is constructed of piled limestone cobbles, small to medium-sized boulders, and slabs placed on end (Figure 4-25). Along the east side of the cairn is an opening to a cavity. The cavity, partially blocked by a slab placed on end, appears to measure 0.7 m by 0.7 m and has a level, soil ground surface. No cultural material was observed. The feature is in good condition.

In 1995, a single excavation unit, EU30, was placed in the cavity (see Figure A-5 in Appendix A). It is a 0.5 m by 0.5 m unit that was excavated in one layer to a depth of 29 cmbd, where it was terminated upon encountering bedrock. The layer contained a moderate amount of faunal material.

Stratigraphy, west wall profile:

I 26 to 29 cm thick; dark yellowish brown (10YR 4/4, moist) to yellowish brown (10YR 5/6, dry); sandy loam; structureless, fine single grain structure; soft, loose, non-sticky, non-plastic consistency; few, fine tubular roots; abrupt, irregular boundary; cultural.

Feature F is a complex of rock mounds, modified outcrops, and wall segments located 10.5 m north of Feature A covering an area 45.0 m by 6.0 m (see Figure 4-22). The area consists of roughly 30 mounds piles placed on top of exposed limestone outcrop. The rock piles are constructed of cobbles and small to medium-sized boulders and range in size from 0.7 m by 0.7 m and 4.0 m by 2.0 m with an average height of 0.4 m. The exposed outcrop has a maximum height of 0.75 m. The mounds related to Feature F are in good condition and appear to be unaltered.

Numerous artifacts were observed within the boundaries of the feature and include rusted cans, broken and whole glass bottles, leather soles, an iron bed frame (see Figure 4-25), and wire (see Table B-5 in Appendix B). Surface artifacts collected from Site 1719 are discussed in the report section titled Artifacts.

Interpretation, Significance, and Recommendations

Based on the six features described above, as well as the analysis of artifacts and midden (see Section 5), Site 1719 appears to have functioned predominantly as a pre-Contact or early post-Contact habitation and agricultural complex. The construction style, workmanship, and use of material are typical of other pre-Contact features on the ‘Ewa Plain with similar

Site 1719 Feature E; view to east/northeast.

Site 1719 Feature F; view to north.

Figure 4-25. Photographs of Site 1719, Feature E and F.

functions (Tuggle and Tomonari-Tuggle 1997b). However, the physical setting of the site area has been extensively altered, primarily by bulldozing, so that portions of the site no longer retain sufficient aspects of integrity, such as location and setting, to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Beardsley (2001:IV.11) recommended Site 1719 as eligible for the NRHP under Criterion D. Through mapping, data collection, and material analysis as part of the current study and Beardsley's (2001) study, any adverse impacts to Features D, E, and have been mitigated and these features no longer contribute to the significance of the site. However, Features A, B, and C retain the potential to yield information important to understanding late pre-Contact settlement and use of the 'Ewa Plain and as such continue to contribute to the significance of the site under Criterion D. It is recommended that Features A, B, and C be preserved and that a Historic Preservation Plan (HPP) be developed to address the short-term preservation, long-term preservation, and interpretation of Site 1719.

State Site 50-80-12-7178

Temporary Site Number: N/A
Site Type: Feature complex
Site Function: Military/industrial use
Site Dimensions: 50.0 m by 50.0 m
Number of Features: 6
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 359, 397-398, 012-019
Current Status: New site

Description:

Site 7178 is located adjacent and west of Site 1719 (see Figure 4-22). The site consists of six features (Features A-F) and measures approximately 50.0 m by 50.0 m. The area of the site appears to be extensively modified due to military activities that once occurred in this area. Surface artifacts collected from Site 7178 are discussed in Section 5.

Feature A is a section of iron pipe located along the west end of Feature F of Site 1719 and extends northwest/southeast (see Figure 4-22). The northern section of the pipe is 9.0 cm diameter and measures 12.0 m long and the southern section narrows to 4.5 cm in diameter and measures 21.0 m. The south end of the pipe appears to connect with the Feature F bath house structure. A section of a second pipe is located 3.0 m east of the northern section and measures approximately 7.0 m long. The feature is in good condition but appears to be out of context, therefore altered.

Feature B is a rock wall located 4.0 m east of Feature D and situated between two sections of Feature C (see Figure 4-22). The wall is constructed of piled cobbles and boulders of various sizes and measures approximately 15.0 m by 1.5 m with a maximum height of 1.0 m. Two artifacts, a brown ceramic insulator and a clear glass bottle (collected), were observed on the wall (see Table B-5 in Appendix B). The feature is likely the result of military activity in the area therefore it is in fair condition and likely an altered feature.

Feature C consists of a series of cobble-lined walkways or paths. The feature consists of two paired rock alignments oriented roughly north/south with a third paired alignment oriented northeast/southwest (Figure 4-26). The two paired north/south alignments are located east of Feature E and west of Feature A with Feature B separating the two (see Figure 4-22). The northeast/southwest alignment is located south of Feature B and connects the two north/south alignments.

The paired alignments are spaced approximately 1.3 m apart and constructed of a single course of cobbles. The west pair of alignments measures approximately 25.0 m long before bending slightly to the southeast for an additional 8.0 m and terminating along the north side of Feature F. The east pair of alignments measures approximately 20.0 m long, joining with the southern end of the western pair at Feature F.

The northeast/southwest alignments measure approximately 8.0 m long and are located approximately 10.0 m south of the north end of the east paired alignments and joins at the slight bend in the eastern side of the west paired alignment. Artifacts associated with the feature include a glass bottle, a car seat, and milled lumber (see Table B-5 in Appendix B).

The feature appears to be unaltered, though some rock may have been moved.

Site 7178 Feature C cobble-lined path; view to north/northwest.

Site 7178 Feature C cobble-lined path; view to south/southeast.

Figure 4-26. Photographs of Site 7178, Feature C.

Feature D is a three-sided concrete structure located approximately 10.0 m north of Feature C (see Figure 4-22). The structure appears to be built on an artificially raised earthen mound. The entrance of the structure is located on the west side (Figure 4-27). The three walls are 2.1 m long and 0.35 m thick and 1.0 m high. There is an addition to the north wall which extends west for approximately 1.0 m. The floor is concrete and measures approximately 2.75 m by 2.0 m. The roof is supported by four concrete support posts, one in each corner, measuring 0.3 m^2 and 0.6 m high. The roof measures approximately 3.9 m by 3.7 m and 0.3 m thick. The feature is in good condition other than the spray paint on the walls.

Artifacts associated with the feature include soda cans, spray paint cans, and various car parts. This military feature has been identified as a concrete sentry post (Tuggle and Tomonari-Tuggle 1994).

Feature E is an irregular-shaped enclosure located west of Feature C and approximately 12.0 m south/southwest of Feature D (see Figure 4-22). The enclosure measures roughly 19.0 m by 17.0 m with walls between 0.4 m and 2.3 m thick and 0.7 m high. The narrowest and widest parts of the wall are located along the west side and southwest corner and appear to be disturbed. The possible intact portions of the wall average 0.8 m thick. The walls are constructed of piled cobbles and boulders with bricks incorporated into the wall near the southwest corner. The interior of the enclosure is relatively level and consists of soils and scatters cobbles and boulders and exposed outcrop. Artifacts associated with the feature include bricks and a metal pipe. The feature is in good condition but appears to have been altered historically.

Extending off the southwest corner is a possible wall measuring approximately 10.0 m by 0.6 m.

Feature F is a corrugated metal and wooden structure located at the south end of Feature C (see Figure 4-22). The structure measures approximately 3.5 m by 3.3 m with a maximum height of 3.2 m (Figure 4-28). The walls are constructed of corrugated metal. The entry way is located in the northwest corner of the structure. The interior and exterior of the structure have been spray painted.

The interior of the structure consists of a concrete floor and two rooms separated by a door. The first room is divided into two compartment separated by a partial wall constructed of wood and corrugated metal. Both compartments are open to the north. The first compartment is located on the west side and measures 2.0 m by 1.0 m. A light switch is located along the west wall, adjacent and south of the entry way. The partial wall, separating the two compartments, measures approximately 1.7 m long. The second compartment, located east of the first, measures approximately 2.3 m by 1.0 m. Remnants of a white porcelain toilet are located against the south wall of the compartment.

The second room is located east of the second compartment of the first room and is accessed through an entry way in the northwest corner. The room measures approximately 3.0 m by 1.3 m. No roof is present over the room.

Off the southeast corner of the structure is a metal pipe extending south into a excavated pit measuring 1.0 m^2. Inside the pit is a 55.0 gallon drum.

A concrete foundation, measuring 6.7 m by 3.5 m, extends west off the western side of the structure. Adjacent to the foundation is a concrete platform located outside the structure, next to the west wall. It measures approximately 1.0 m^2 and 0.3 m high. In the center of the platform is a drain. In the southwest corner of the foundation is a subsurface brick-lined pit measuring 2.5 m by 0.5 m. The interior is soil-filled and has a depth of 20.0 cm. A metal pipe,

Site 7178 Feature D sentry post; view to east/southeast.

Site 7178 Feature D sentry post; view to south.

Figure 4-27. Photographs of Site 7178, Feature D.

Site 7178 Feature F Bath House; view to east/southeast.

Site 7178 Feature F Bath House; view to south/southeast.

Figure 4-28. Photographs of Site 7178, Feature F.

Feature G, abuts the north wall of the foundation, 1.0 m west of the northwest corner of the structure.

The overall condition of the feature is poor with portions collapsing and most, if not all the fixtures missing.

Artifacts associated with the feature include spray paint cans, glass bottles, a metal box, a plastic gun handle, a metal spring, and pieces of a porcelain toilet.

Interpretation, Significance, and Recommendations

Site 7178 consists of six military-related features dating to the military occupation of NASBARPT between 1942 and 1999. The construction style, workmanship, and use of material are typical of other military structures in the Pacific region. However, the physical setting of the site area has been extensively altered, primarily by bulldozing, so that the site no longer retains sufficient aspects of integrity, such as location and setting, to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Through mapping, data collection, and material analysis as part of the current study the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7178 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

State Site 50-80-12-1720

Temporary Site Number: BPBM 237
Site Type: Enclosure and mounds
Site Function: Habitation and agricultural complex
Site Dimensions: 13.0 m by 7.0 m
Number of Features: 2
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses, young banyan
2011 GPS File No.: N/A
Current Status: Not relocated

Description:

Site 1720 was destroyed prior to the current project. Haun (1991:43) recorded the site as a habitation/agricultural complex of two features (see Figure A-7 in Appendix A). Jones (1993: Figure 6, Table 4) delineated Site 1720 as three features (C-shape, small enclosure, and collapsed platform), but provided no additional information. No excavations were conducted at this site as part of the Haun (1991) study.

Beardsley (2001:IV:19) returned to the site and excavated one test unit in Feature A (cairn) and one unit in Feature B (C-shape). Sparse faunal material was recovered from Feature A, while fauna along with mixed traditional and historic artifacts were recovered from Feature B. The following descriptions were taken from Beardsley (2001:IV.19-IV.20) who revisited the site after Haun's original work (1991).

Feature A is an oval shaped platform of multiple (two to eight) courses of limestone cobbles, boulders, and slabs. The north edge and segments of the western side show evidence of having been faced. Several upright, on-edge vertical slabs remain roughly in place, though with some distortion in their positions as the feature has gradually collapsed, spilling its content outward from the core of the structure. Much of the southern portion has been removed, leaving behind a leveled terrace three to four courses high. Scattered, fire-affected limestone pebbles were noted on the surface" (Beardsley 2001:IV.19). The feature was reported to be in fair condition and appeared to be altered.

In 1995, a single excavation unit, EU-35, was placed in the center of the feature (see Figures A-7 and A-8 in Appendix A). It is a 1.0 m by1.0 m unit that was excavated in three layers to 35 cmbd, where it was terminated on bedrock. The upper layer is the architecture; the lower two layers ere nearly sterile, although a very sparse amount of faunal material and charcoal was scattered throughout Layer II. During fieldwork, the excavator commented that the charcoal, in their estimation, was likely recent, blown from the burning cane fields nearby and filtered through the architecture to settle in this first soil horizon. The construction material for the cairn/platform rested within Layer II, the first soil layer encountered in the excavation.

Stratigraphy, west wall profile:

I 31 to 67 cm thick; limestone; clear, wavy boundary; architectural.

II 10 to 15 cm thick; black (10YR 2/1, moist) to very dark brown (10YR 2/2, dry); loam; strong, medium to coarse crumb structure; slightly hard, loose, non-sticky, non-plastic consistency; very few, very fine to medium vesicular roots; abrupt, wavy boundary; non-cultural deposit.

III 5 to 15 cm thick; dark reddish brown (5YR 3/3, moist) to brown to dark brown (7.5YR 4/4); weak, fine to medium granular structure; loose, very friable, non-sticky, slightly plastic; very few, very fine to coarse vesicular roots; non-cultural.

Feature B is a -shaped structure which opens to the south (see Figure A-7 in Appendix A). It is a rubble-filled core construction with retaining walls of multiple courses (four to five), built up with limestone cobbles, boulders, and slabs (ranging from about 10 to 70 cm in diameter). The interior face of the wall is lined with vertical, upright, on-edge slabs. This interior space occupies an area of 2.5 m by 1.8 m; the walls themselves are about 1.2 m wide. To the south of this feature, less than 10 m away is a ditch 1.5 m wide, and about 80-90 cm deep. It has been mechanically cut into the limestone substrate. Surrounding the C-shaped feature, to the southwest and northwest, is an amorphous area of rubble, potentially material excavated from the ditch construction. The western part of the C-shape appears to have been affected by this construction, while the eastern portion remains somewhat intact. Modern glass was observed on the surface" (Beardsley 2001:IV.20). The feature was reported to be in fair condition and appeared to be altered.

In 1995, a single excavation unit, EU-34, was placed in the interior section of the feature, adjacent to the north and east walls (see Figure A-7 in Appendix A). It is a 1.0 m by 0.5 m unit that was excavated in two layers to 32 cmbd, where it was terminated after a sterile level. The upper layer contained a sparse amount of faunal material, along with some glass fragments, basalt adze, and a coral abrader; the lower layer was basically culturally sterile. The architecture is slightly embedded into the upper soil horizon.

Stratigraphy, east wall profile:

I 17 to 21 cm thick; black (10YR 2/1, moist) to very dark brown (10YR 2/2 dry); loam; strong, fine to medium crumb structure; soft, very friable, slightly sticky, slightly plastic consistency; many, fine to coarse vesicular to tubular roots; abrupt, wavy boundary; cultural.

II 7 to 12 cm thick; dark brown (7.5YR 3/4, moist) to dark yellowish brown (10YR 4/4, dry); silty loam; weak, very fine to fine granular structure; soft, very friable, slightly sticky, slightly plastic consistency; few, medium to coarse tubular roots; non-cultural deposit.

Interpretation, Significance, and Recommendations

Because Site 1720 could not be relocated and is presumed destroyed due to extensive ground alteration in the area, there is no interpretation beyond that recorded in Beardsley (2001). Furthermore, there is no longer any significance associated with the site, and there are no further recommendations.

State Site 50-80-12-1722

Temporary Site Number: BPBM 239
Site Type: Feature complex
Site Function: Habitation
Site Dimensions: 180 m by 110 m
Number of Features: 10
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: N/A
Current Status: Not relocated

Description:

Site 1722 was originally recorded as a habitation complex first identified by Haun (1991) and later revisited by Beardsley (2001:IV.24-IV.29). According to a map in Beardsley (2001: Figure IV-1) the site was located along the southern boundary of the project area, approximately 75.0 m north of an unidentified building and 125 m southwest of Site 1719. During the current survey (2011) the site could not be relocated, therefore the following descriptions were taken from Beardsley (2001). Because Features A, F, G, H, I, and J were not relocated by Beardsley, those feature descriptions are from Haun (1991:45-46).

This site is a habitation complex first identified during the Bishop Museum survey (Haun 1991). Ten features (A through J) were identified during that survey; several of these described as remnants; their descriptions were so vague, however, that over half (Features A, F, G, H, I, and J) could not be positively re-identified. Twelve features were located during the current project work. These consist of enclosures (Features E, C/D), walls (Features E, Q), cairns (Features K through P, and S), and a modified sink (Feature R). There has been a great deal of disturbance throughout this site, with evidence of bulldozer activity in a number of the features. Many of the currently identified features appear to be remnants of much larger features that were dismantled, probably by mechanical means. Seven test units were excavated in this site during the current fieldwork; one each in Features E, C/D, F, K, L, M, and O. In addition, three radiocarbon dates were run on recovered materials in two hearth features encountered in Feature B, and on charcoal mixed into the sediments in Feature C/D; a wood charcoal sample, also from Feature B, was submitted for identification" (Beardsley 2001:IV.24; see Section 6 of this report for analysis).

<u>Feature A</u> is an L-shaped wall constructed around a sinkhole opening. It measures 5.0 m by 4.0 m with a maximum wall height of 0.7 m and is constructed of "stacked walls with occasional upright-slab facing. Interior is depressed c. 51 cm below surrounding ground level. Sinkhole is not filled. Artifacts include historic lumber and recent beer bottles" (Haun 1991:45). According to Haun (1991:45) the feature was in poor condition.

<u>Feature B</u>, measuring approximately 5.0 m by 4.2 m with a maximum height of 0.7 m, is a sub-angular, circular enclosure with a rubble-filled core between multi-course retaining walls built with limestone cobbles, boulders, and slabs (see Figure A-12 in Appendix A). Vertical, upright, on-edge slabs define the interior and exterior faces of the walls, as well as line the 60 cm opening in the wall. Width of the walls is almost a uniform 1.25 m; the interior area is leveled soil within a 2.4 m by 2.2 m area, with *kiawe* tree growing in it. Feature L adjoins the enclosure on the east side. The feature was reported to be in excellent condition and unaltered (Beardsley 2001:IV.24).

In 1995, a single excavation unit, EU-46, was placed in the interior of the feature, against the north wall (see Figure A-12 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in

three layers to 38 cmbd, where it was terminated upon encountering decomposing bedrock. The upper two layers contained a sparse amount of faunal material; the lowest layer was sterile. Two horizontal features were encountered in Layer I: HF-8 (13 to 21 cmbd) and HF-9 (14 to 23 cmbd). The former was a concentration of ash. One radiocarbon date (Beta-85057) was run on the sediments recovered from this feature; it returned a modern date. The second feature, HF-9, is a cobble-lined fire pit. A radiocarbon date (Beta-85058) was run on a small sample of charred material from this feature; it returned the date of calAD 1475-1950 at two sigma. The dating sample was so small, it had to be given an extended counting time. A wood charcoal sample (268), also from this feature, was submitted for identification. In profile, both features were encountered adjacent to one another; it is likely they are related. At the conclusion of the excavation, it was evident that the architectural elements within the walls were embedded within the upper soil layer.

Stratigraphy, north wall profile:

I 11 to 14 cm thick; dark brown (7.5YR 3/3, moist) to dark brown (7.5YR 3/4, dry); silt loam; moderate, medium granular structure; soft, very friable, slightly sticky, slightly plastic consistency; common, very fine to coarse vesicular to tubular roots; abrupt, smooth boundary; cultural.

II 10 to 28 cm thick; very dark grayish brown (10YR 3/2, moist) to dark yellowish brown (10YR 4/4, dry); sandy loam; moderate, fine crumb structure; soft, very friable, non-sticky, non-plastic consistency; common, very fine to medium vesicular to tubular roots; clear, smooth boundary; cultural deposit.

III 2 to 11 cm thick; very pale brown (10YR 7/3) to white (10YR 8/2); silty loam; moderate, coarse, angular blocky structure; soft, very friable, non-sticky, non-plastic consistency; common, micro to coarse vesicular to tubular roots; non-cultural.

Features C and D were identified in the Bishop Museum survey (Haun 1991) as a feature remnant and a stacked feature of slabs that were probably once a single feature (see Figure A-11 in Appendix A). The combined features measured approximately 5.4 m by 5.2 m with a maximum height of 0.5 m. There are three wall remnants within this combined feature: the east wall (Feature C), and the west and south walls (Feature D). Each wall is constructed as parallel retaining walls with a rubble-filled core; the retaining walls are multiple-course constructions with limestone cobble, boulders, and slabs as the key elements. Vertical, upright, on-edge slabs define the interior and exterior faces of these walls. The interior space within this combined feature is a 2.0 m by 1.8 m area. The feature was reported to be in poor condition and altered (Beardsley 2001:IV.25).

In 1995, a single excavation unit, EU-47, was placed in the interior section of the feature (see Figure A-12 in Appendix A). It is a 0.5 m by 0.5 m unit that was excavated in three layers to 34 cmbd; where it was terminated at the base of a sterile level. The uppermost layer was a non-cultural humus; the lower two layers were also sterile. The soil layers appeared very mottled and mixed, possibly by bulldozing. A single radiocarbon date (Beta-85113) was run on charred material collected from Layer II; the date, at two sigma, was AD 1655-1950.

Stratigraphy, west wall profile:

I 2 to 8 cm thick; very dark brown (10YR 2/2, moist and dry); loam; weak, fine crumb structure; loose, non-sticky, non-plastic consistency; many, micro to very fine to fine and medium roots; abrupt, smooth boundary; non-cultural.

II 10 cm thick; brown to dark brown (7.5YR 3/3 to 4/3, moist) to brown to dark brown (7.5YR 3/3 to 5/3, dry); sandy loam; weak, fine crumb structure; loose,

slightly sticky, slightly plastic consistency; common, micro to very fine to fine roots; abrupt, smooth boundary; non-cultural deposit.

III 10 to 14 cm thick; brown (7.5YR 5/2, moist) to pinkish gray (7.5YR 6/2); sandy clay; weak, fine crumb structure; loose, non-sticky, non-plastic consistency; few micro to very fine roots; non-cultural.

Feature E is a long, roughly shaped, discontinuous meandering wall that measures approximately 50.0 m by 26.0 m with a maximum height of 0.6 m (see Figure A-12 in Appendix A). The wall is roughly L-shaped and is constructed of multi-course (one to four courses high) of limestone cobbles, boulders, and slabs that can be as large as 1.1 m in size. There are a number of vertical, on-edge slabs along the wall length; however, there are also many collapsed sections along the length as well. It encompasses and connected with Features C, K, and P; Features C and D are located within its south-end curve. Two cavities within the wall have been identified in the southwestern section. One cavity is at the site datum; the second is 8.0 m to the north. The cavities are defined by horizontally placed slabs within the wall interior. There is a 5.0 m gap in the south-end curve of the feature, which looks suspiciously like the result of bulldozing; directly north of this gap is a long berm that extends parallel to the wall. Haun (1991) notes that the gap in the wall and the berm are likely the result of military use of the area. A modern beer bottle was noted on this interior berm. The feature was reported to be in fair condition and altered (Beardsley 2001:IV.26).

In 1995, a single excavation unit, EU-51, was placed in and near the southwestern corner of the wall (see Figure A-12 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in three layers to 28 cmbd, where excavation was terminated at the conclusion of a sterile layer. The upper layer was a non-cultural humus; Layers II and III were also non-cultural. Layer II was a mottled, mixed soil layer with pockets of many different types of soil.

Stratigraphy, north wall profile:

I 3 to 5 cm thick; very dark brown (10YR 2/2, moist and dry); humus; weak, fine crumb structure; loose, non-sticky, non-plastic consistency; many, very fine to fine roots; abrupt, smooth boundary; non-cultural.

II 10 to 17 cm thick; abrupt, wavy boundary; non-cultural deposit.

IIa dark brown (7.5YR 3/2, moist) to dark brown (7.5YR 3/3, dry); sandy clay loam; moderate, medium to coarse to very coarse crumb structure; slightly hard, very friable, non-sticky, non-plastic consistency; many very fine to fine roots.

IIb dark brown (7.5YR 3/3, moist and dry); clay loam; moderate, medium, coarse to very coarse crumb structure; slightly hard, very friable, slightly sticky, slightly plastic consistency; many very fine to fine to medium roots.

IIc dark brown (7.5YR 3/3, moist) to brown to dark brown (7.5YR 4/3, dry); sandy loam; weak, medium to coarse crumb structure; soft, very friable, slightly sticky, slightly plastic consistency; few, very few to fine roots.

IId brown to dark brown (7.5YR 4/4, moist and dry); sandy clay; weak, medium to coarse crumb structure; soft very friable, slightly sticky, slightly plastic; very few fine roots.

IIe dark brown (7.5YR 3/4, moist and dry); sandy loam; structureless; loose, non-sticky, non-plastic consistency; very few fine roots.

III 0 to 7 cm thick; brown (7.5YR 5/3) to pinkish gray (7.5YR 6/2); sandy clay; moderate, medium to coarse and very coarse crumb structure; slightly hard, friable, non-sticky, slightly plastic consistence; few coarse roots; non-cultural.

Feature F is a collapsed cairn measuring 1.6 m by 1.6 m with a maximum height of 0.6 m. The exterior is faced with upright slabs. A number of small cairns are scattered throughout the site that are smaller than those at other sites (Haun 1991:46). The feature was reported to be in poor condition (Haun 1991:46).

Feature G is a collapsed cairn measuring approximately 1.5 m by 1.5 m with a maximum height of 0.3 m. It has facing of large upright slabs. The interior chamber is empty (Haun 1995:46). The feature was reported to be in very poor condition.

Feature H is an elongated feature remnant measuring 2.9 m by 1.6 m with a maximum height of 0.45 m. Upright slabs occur at each end. Several small cairns occur in the vicinity (Haun 1991:46). The feature was reported to be in poor condition.

Feature I is a small cairn with upright slab in facing that measures approximately 1.3 m by 1.3 m with a maximum height of 0.6 m (Haun 1991:46). The feature was reported to be in fair condition.

Feature J is another small cairn with upright slab in facing that measures approximately 1.3 m by 1.3 m with a maximum height of 0.5 m" (Haun 1991:46). The feature was reported to be in fair condition.

Feature K is a cairn measuring approximately 1.0 m by 1.0 m with a maximum height of 0.6 m (see Figure A-12 in Appendix A). It is sub-rectangular in shape with vertical, upright on-edge slabs defining the perimeter. The interior of the structure, multiple courses of limestone cobbles, boulders, and slabs, has collapsed and spilled outward, away from the feature. Many of the perimeter facing slabs have collapsed as a result. The feature was reported in fair condition and unaltered.

In 1995, a single excavation unit, EU-45, was placed in the middle of the feature. It is a 1.0 m by 1.0 m unit that was excavated in two layers to 21 cmbd, where it was terminated at the base of a sterile level. The upper layer was filled with architectural materials; the lower layer contained a very sparse amount of faunal material. The architectural materials are embedded into the soil layer, Layer II.

Stratigraphy, south wall profile:

I 27 to 44 cm thick; limestone; architectural.

II 11 to 18 cm thick; silt loam; non-cultural deposit.

Feature L is a cairn measuring approximately 1.1 m by 1.1 m with a maximum height of 0.5 m. The feature consists of four vertical, upright, on-edge slabs that form a square cavity, 80.0 cm by 60.0 cm in maximum diameter. These walls, or cavity facings, are supported by more massive walls of multiple-course limestone cobbles and boulders. At least one slab leaning against the southern edge of the feature probably served as a capstone. The cavity could have served as storage, or a possible burial. This feature is adjoining Feature B, an enclosure. The feature was reported in good condition and unaltered.

In 1995, a single excavation unit, EU-49, was placed in the cavity interior. It is a 0.8 m by 0.5 m unit that was excavated in four layers to 37 cmbd, where it was terminated upon encountering decomposing bedrock. The upper layer was filled architectural elements; the remaining layers contained a sparse amount of faunal material. The architectural elements appear to extend through the first soil layer, Layer II, and penetrate Layer III. No indications of a burial were encountered.

Stratigraphy, north wall profile:

I 21 to 34 cm thick; limestone; abrupt, wavy boundary; architectural.

II 10 to 15 cm thick; very dark brown (10YR 2/2, moist) to dark brown (7.4YR 3/4, dry); loam, gravel; weak, fine to medium granular structure; loose, very friable, non-sticky, non-plastic consistency; very few, very fine to medium vesicular roots; abrupt, smooth boundary; cultural.

III 6 to 7 cm thick; dark reddish brown (5YR 3/3, moist) to dark reddish brown (5YR 3/4, dry); silt loam; weak, very few to fine single grain structure; loose, very friable, slightly sticky, slightly plastic consistency; very few, very fine to medium vesicular roots; abrupt, smooth boundary; cultural.

IV 8 to 16 cm thick; dark reddish gray (5YR 4/2) to pinkish (7.5YR 6/2); silt loam; weak, very fine to fine single grain structure; loose, non-sticky, non-plastic consistency; very few, fine to coarse vesicular to tubular roots; non-cultural.

Feature M is a cairn measuring approximately 2.5 m by 1.7 m with a maximum height of 0.8 m. It is a multiple-course construction of limestone cobbles, boulders, and slabs stacked three to four courses high in a somewhat elongated, lozenge shaped cairn. Some of the construction material is large, up to 1.2 m in maximum diameter. A number of upright, vertical on-edge slabs appear to have defined the perimeter of the feature; these have collapsed. Within the center of the feature, a hollow cavity is visible from above. It is a small area, 1.0 m by 0.75 m, divided into two compartments by a transverse upright. The more enclosed southern compartment is formed by an overhanging horizontal (capstone) and a large oblique slab. The feature was reported in poor condition and unaltered.

In 1995, a single excavation unit, EU-48, was placed in the cavity. It is a 0.5 m by 0.5 m unit that was excavated in two layers to 28 cmbd, where it was terminated at the end of two sterile levels. The upper layer was filled with architectural material; the lower layer was sterile. The architectural elements rest directly on top of the ground surface.

Stratigraphy, north wall profile:

I 79 cm thick; limestone; architectural.

II 20 to 25 cm thick; dark brown (10YR 2,2, m); loam; moderate structure; non-cultural deposit.

Feature N is cairn measuring approximately 2.0 m by 1.6 m with a maximum height of 0.5 m. It is a sub-angular squared-shaped feature of limestone cobbles, boulders, and slabs. The perimeter was probably once defined by vertical, upright, on-edge slabs; one remains in situ. The feature was reported in good condition and unaltered.

Feature O is a cairn measuring approximately 1.7 m by 1.6 m with a maximum height of 1.1 m. The feature is a sub-angular, nearly squared cairn constructed with multiple courses of limestone cobbles, boulders, and slabs. The perimeter of the feature is defined by vertical, on-edge slabs; the interior surface appears to be paved with horizontally placed slabs. There is a cavity in the southwestern portion, with a narrow opening (20.0 cm by 5.0 cm). Bedrock appears at the base of the feature. A tin can was noted about 20.0 cm from the feature; glass was noted on top of the cairn. The feature was reported in good condition and unaltered.

In 1995, a single excavation unit, EU-50, was placed in the northeast portion of the cairn. It is a 0.5 m by 0.5 m unit that was excavated in two layers to 9.0 cmbd, where it was terminated upon encountering bedrock. The upper layer was filled with architectural material; the lower layer contained a sparse amount of faunal material and a piece of glass. The architectural

elements are set either directly on bedrock, or where there is soil present, embedded slightly into the soil.

Stratigraphy, west wall profile:

I 35 to 63 cm thick; limestone; architectural.

II 3 to 20 cm thick; dark brown (10YR2/2, m.) loam; few, very fine vesicular roots; cultural deposit.

Feature P is a cairn measuring approximately 2.5 m by 2.3 m with a maximum height of 0.4 m (see Figure A-12 in Appendix A). The feature is a circular mound of limestone cobbles, boulders, and slabs. The function is unknown. The feature was reported in good condition and unaltered.

Feature Q is a wall measuring approximately 3.0 m by 0.6 m with a maximum height of 0.4 m. The wall segment is oriented north/south and is constructed with limestone cobbles, boulders, and slabs. Three vertical, upright, on-edge slabs within the construction; two form an outer corner at the south end of the wall, as if the feature was part of a much larger construction. About midway along the wall length there is a cavity within the wall; it is about 30.0 cm in diameter. The feature was reported in fair condition and unaltered.

Feature R is a shallow, modified sinkhole measuring approximately 7.7 m by 3.0 m with a depth of 0.6 m. A natural bedrock lip forms the south and west sides of the feature; the north and east sides are defined by a low semicircular, C-shaped wall. The wall is measures 4.5 m by 1.5 m with a maximum height of 0.6 m. It is constructed with limestone cobbles, boulders, and slabs. Nearly adjacent to the southern terminus of the wall are a number of large boulders around the base of a *koa-haole* tree. A number of trees are growing throughout the area, with some trees fallen across the feature and others displacing some of the architectural elements. The feature was reported in good condition and unaltered.

Feature S is a cairn measuring approximately 2.5 m by 2.4 m with a maximum height of 0.6 m. The feature is elongated, lozenge-shaped mound constructed of limestone cobbles, boulders, and slabs. The slabs appear around the perimeter in what would likely have been their original locations prior to collapse. The feature was reported in poor condition and unaltered.

Interpretation, Significance, and Recommendations

Because Site 1722 could not be relocated and is presumed destroyed due to extensive ground alteration in the area, there is no interpretation beyond that recorded in Beardsley (2001). Furthermore, there is no longer any significance associated with the site, and there are no further recommendations.

State Site 50-80-12-7182

Temporary Site Number: T-1
Site Type: Feature complex
Site Function: Historic Refuse and possible temporary habitation
Site Dimensions: 42.0 m by 25.0 m
Number of Features: 11
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 374-396
Current Status: New Site

Description:

Site 7182 consists of a cluster of 11 sinkholes located approximately 250 m south of Boxer Road and Barber's Point Elementary School and 50.0 m south of Site 1719 (Figure 4-1). The site's boundary has an irregular-shape with six (Features F-K) of the 11 sinkholes located at the western end, three (Features C-E) in the central portion, and two (Features A and B) at the eastern end of the site (Figure 4-29).

Feature A sinkhole is located on the east end of the site (see Figure 4-29). It measures 0.9 by 0.7 m and is 2.2 m deep. The interior ground surface is relatively level with soil and leaf litter. No surface cultural material was observed on the surface. The feature is in good condition and unaltered.

Feature B is located approximately 5.0 m south of Feature A (see Figure 4-29) and measures 1.1 m by 0.6 m and is 0.6 m deep. The interior ground surface is relatively level and consists of soil and leaf litter. No surface cultural material was observed. The feature is in good condition and unaltered.

Feature C is located approximately 6.0 m west of Feature B (see Figure 4-29) and measures 1.5 m by 0.9 m with a depth of 0.95 m. The interior ground surface is littered with at least 50 brown glass bottles, metal cans and miscellaneous metal fragments, fragments of two 55-gallon drums, and a canteen [collected] (Figure 4-30; see Table B-4 in Appendix B). The feature is in good condition and has been altered by historic activities.

A single excavation unit, TU-1, was placed in the southern portion of the sinkhole opening (Figure 4-31). The unit measured 0.5 m by 0.5 m that was excavated in two layers to a depth of 74.0 cm where excavation was terminated on bedrock. Covering the surface of the unit were roughly 27 brown and clear-colored glass bottles, remnants of two 55-gallown drums, and one piece of wood with plastic attached. The glass bottles extended into Layer I and the top of Layer II (see Table B-3 in Appendix B).

Layer II contained all the faunal remains recovered from TU-1; less than 3.0 grams (see Table C-6 in Appendix C). Faunal remains recovered include sparse amounts of small mammal, bird, and unidentified vertebrate remains.

In addition, 82 pieces of historic artifacts were recovered in Layer I during excavations. The artifacts included one whole clear-colored bottle, one glass bottle fragment, 42 pieces of metal, and 38 pieces of roofing material (see Table B-3 in Appendix B).

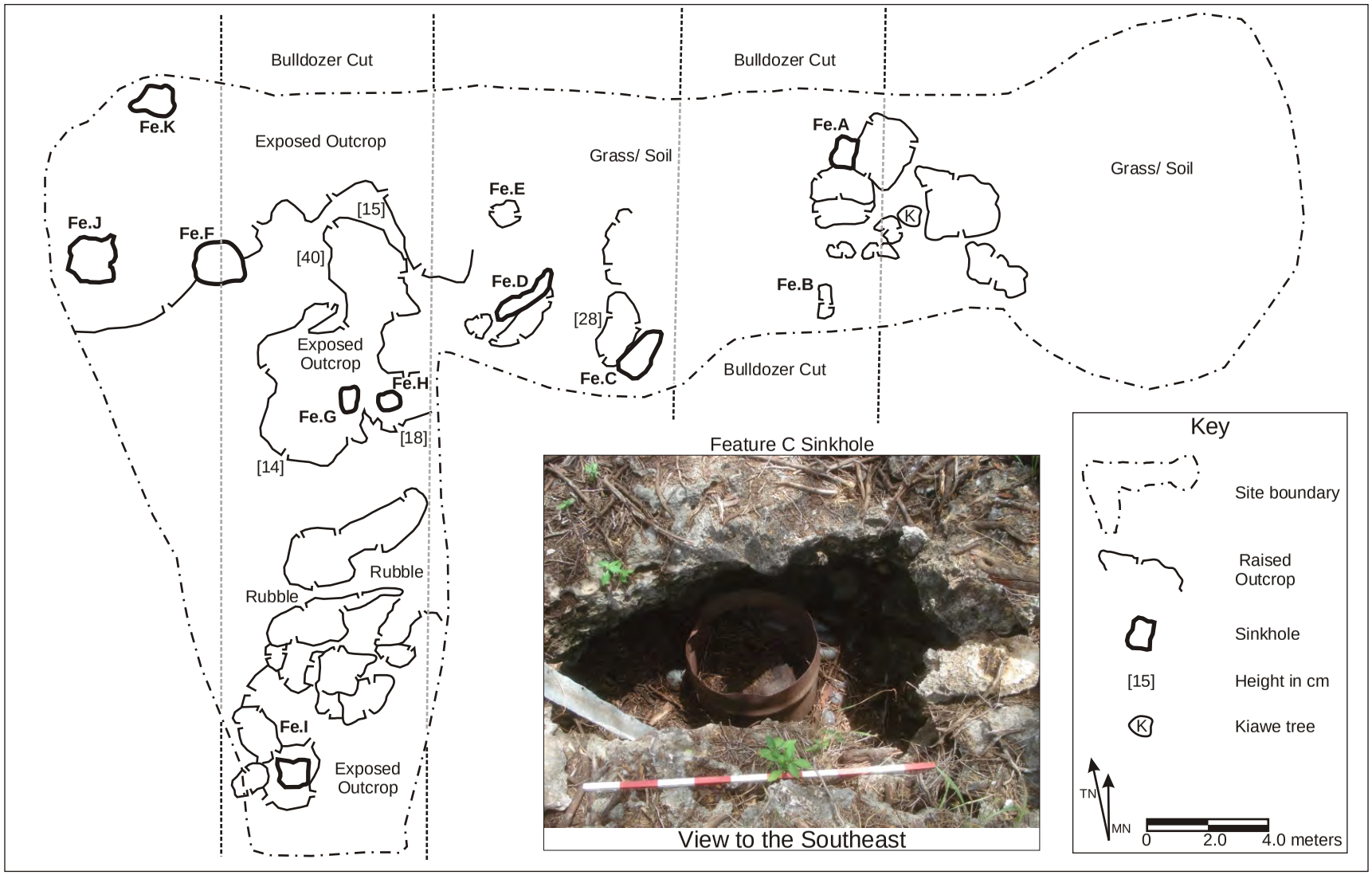


Figure 4-29. Site 7182, Features A through K, Plan View and Photograph.

Site 7182 Feature C; view to southeast.

Site 7182 Feature F; view to south southeast.

Figure 4-30. Photographs of Site 7182, Feature C and F.

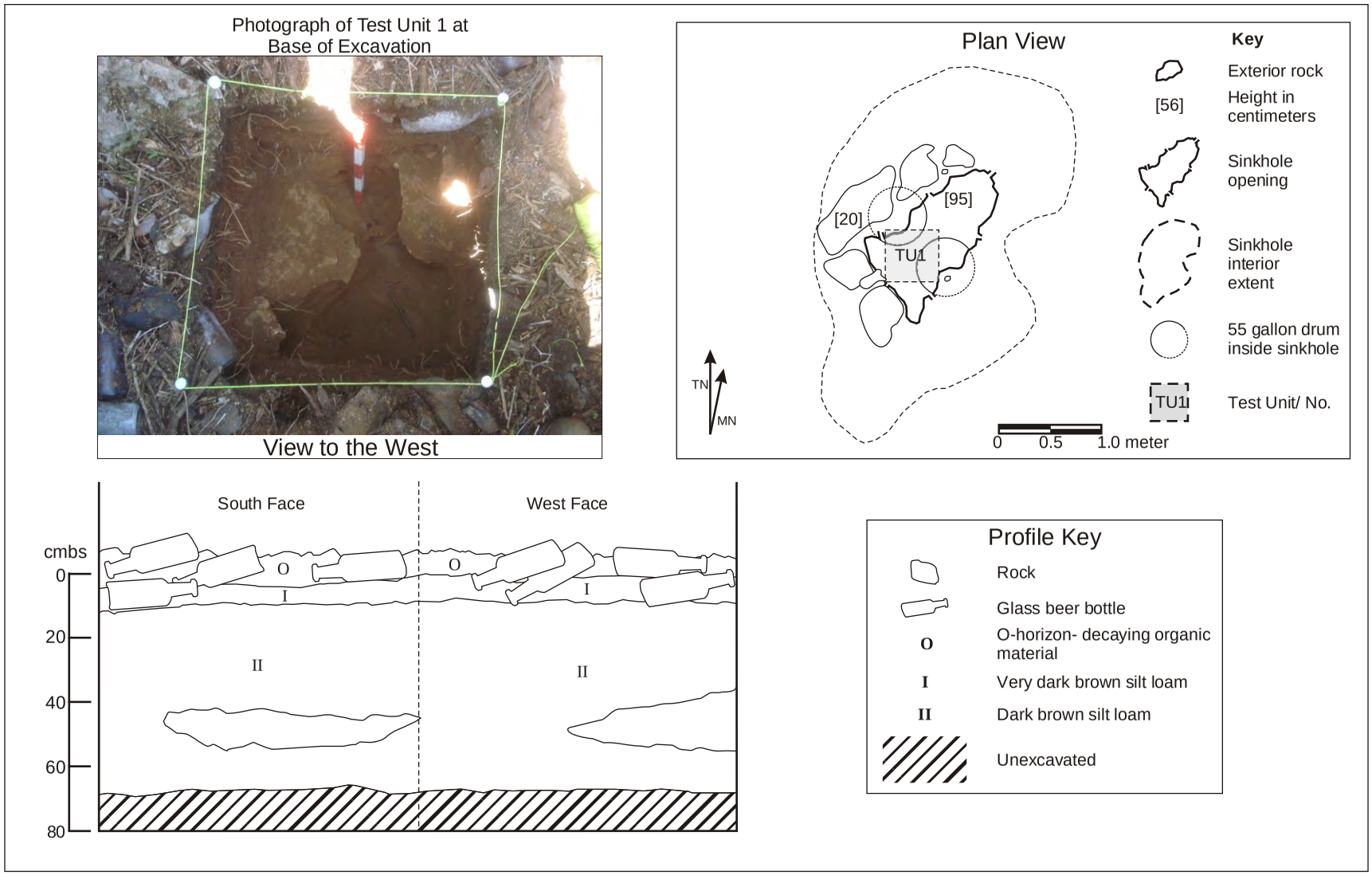


Figure 4-31. Site 7182, Feature C Plan View, Showing Location of TU-1, with Profiles and Photograph.

The stratigraphy in TU-1, Feature C is as follows:

Stratigraphy, north and west wall profiles:

I 8 cm thick; very dark brown (10YR 2/2, moist); silty loam; structureless, non-sticky, non-plastic consistency; many fine roots, abrupt smooth boundary; cultural.

II 59 cm thick; dark brown (10YR 3/3, moist); silty loam; slightly sticky, slightly plastic consistency; fine to medium roots; non-cultural.

Feature D is located 3.0 m west of Feature C (see Figure 4-29) and measures 1.85 m by 0.47 m with a depth of 1.1 m. The interior ground surface is littered with at least 50 clear and brown glass bottles and tin cans (see Table B-4 in Appendix B). The feature is in good condition and has been altered by historic activities.

Feature E is located approximately 2.0 m northwest of Feature D (see Figure 4-29) and measures 0.95 m by 0.78 m with a depth of 0.9 m. The interior ground surface is littered with miscellanous metal debris, a light fixture, metal screen mesh, rubber fragments, and a canteen (collected; (see Table B-4 in Appendix B). The feature is in good condition and has been altered by historic activities.

Feature F is located approximately 9.0 m west of Feature E (see Figure 4-29) and measures 1.5 m by 1.05 m with a depth of 0.25 m. The interior ground surface is relatively level and covered with grass and partially covered by a fallen *kiawe* tree (see Figure 4-30). No cultural material was observed. The feature is in good condition and unaltered.

A single excavation unit, TU-1, was placed in the northern quadrant of the sinkhole (Figure 4-32). The unit measured 0.5 m by 0.5 m and was excavated in three layers to a depth of 50.0 cm where excavation was terminated on bedrock. An “O” horizon extends 10.0 cm above the surface of Layer I. No faunal or floral remains were recovered from TU-1. The surface of the unit was covered in 5.0 cm of *kiawe* leaves which were removed prior to excavation.

The only artifacts recovered during excavation were historic and included an historic license plate recovered in Layer I/1 at 5.0 cm below surface and 16 bottle glass fragments (see Table B-3 in Appendix B). The plate measures 30.0 cm by 10.0 cm and reads “Kaneohe Bay” on the first line and “411” and “1942” on the second line.

Stratigraphy, north and west wall profiles:

O 10 cm thick; *kiawe* leaf litter

I 15 cm thick; very dark brown (7.5YR 3/4, dry); silty loam; non-sticky, non-plastic consistency; many fine to course roots, irregular wavy boundary; non-cultural.

II 33 cm thick; dark brown (7.5YR 3/4, dry); silt; slightly sticky, slightly plastic consistency; fine to course roots; non-cultural.

Feature G is located approximately 5.0 m southeast of Feature F and 5.0 m west/ southwest of Feature D (see Figure 4-29). It measures 0.75 m by 0.7 m with a depth of 1.3 m. The interior ground surface is littered with glass bottles and tin cans. The feature is in good condition and has been altered by historic activities.

Feature H is located approximately 1.5 m east of Feature G (see Figure 4-29), and measures 0.5 m by 0.4 m with a depth of 0.7. The interior is relatively level and covered with

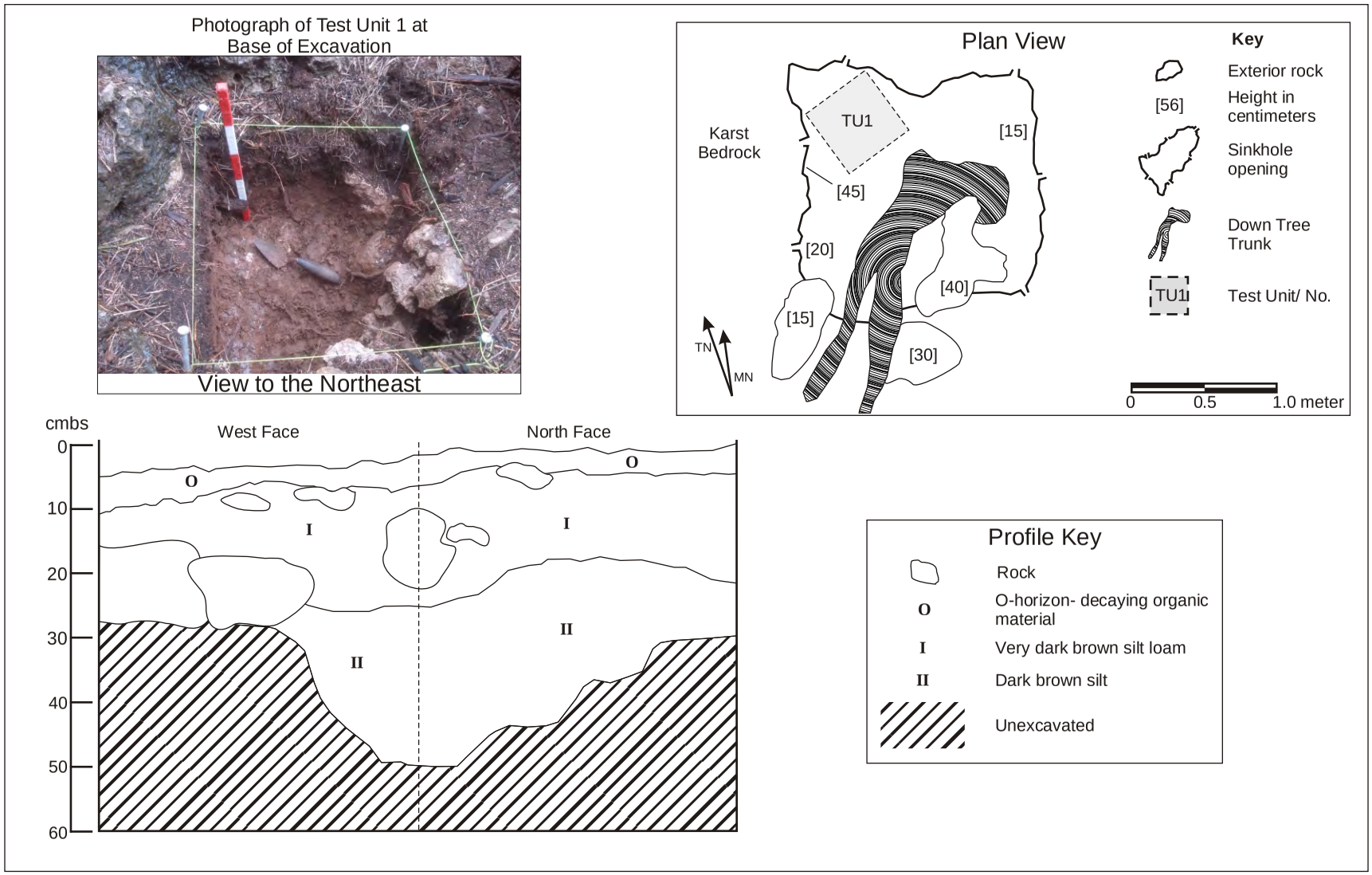


Figure 4-32. Site 7182, Feature F Plan View, Showing Location of TU-1 with Profiles and Photograph.

soil and leaf litter. No surface cultural material was observed. The feature is in good condition and unaltered.

Feature I is located at the southwestern corner of the site, approximately 12.0 m south of Feature G (see Figure 4-29). The opening measures approximately 1.3 m by 1.05 m and 1.3 m deep (Figure 4-33). The interior of the sink is irregular in shape and measures 5.5 m by 5.0 m. The feature is ion good condition and unaltered.

A single excavation unit, TU-1, was placed approximately 0.5 m north of the sinkhole opening and in the west side of the interior (Figure 4-34). The unit measured 0.5 m by 0.5 m and was excavated in two layers to a depth of 70.0 cm where excavation was terminated due to the size of the unit and the depth making it inaccessible. The surface of the unit is covered with small limestone cobbles and a few pieces of basalt which were removed prior to excavation. A charcoal lens, 4.0-7.0 cm thick, was observed in the northern quadrant of the unit within Layer I/2 (see Figure 4-34). Material from this lens was excavated separately; no cultural materials were present. Two charcoal samples were obtained but not submitted for carbon-carbon dating.

Layer I contained a majority of the faunal remains recovered from TU-1; more than 69.0 grams. Faunal remains recovered include gastropods, bivalves, miscellaneous marine shell fragments, fish, and a trace amount of small mammal and bird (see Table C-5 in Appendix C). Wood charcoal was recovered from Layer I/1 and 2 and trace amounts in Layer II/1 and 2.

In addition, both traditional and historic artifacts were recovered from Layer I. The traditional artifacts include three pieces of volcanic glass, five volcanic glass fragments, and two cores. The historic artifacts include one clear-colored glass bottle and metal fragments. Layer II contained one metal can fragment (see Table B-3 in Appendix B).

Stratigraphy, north and east wall profiles:

I 8 to 20 cm thick; dark yellowish brown (10YR 4/4, moist); silt loam; single grain structure, slightly sticky, non-plastic consistency; medium roots, clear wavy boundary; cultural.

II 55 cm thick; yellowish brown (10YR 5/8, moist); silt loam; single grain structure, slightly sticky, non-plastic consistency; medium roots; non-cultural.

Feature J is located in the northwest corner of the site, approximately 3.0 m west of Feature F (see Figure 4-29). It measures 1.6 m by 1.0 m with a depth of 1.4 m. The interior ground surface is littered with at least 30 brown and clear glass bottles and numerous rusted tin cans (see Table B-4 in Appendix B). The feature is in good condition and has been altered by historic activities.

Feature K is located 4.0 m north/northeast of Feature J (see Figure 4-29) and measures approximately 1.3 m by 0.7 m with a depth of 0.5 m. The interior ground surface is littered with glass bottles, tin cans, and a ceramic jar (collected). The feature is in good condition and has been altered by historic activities (see Table B-4 in Appendix B).

Interpretation, Significance, and Recommendations

Based on the 11 features described above, as well as the analysis of artifacts and midden (see Section 5), Site 1782 may have been occupied during the pre-Contact period, but it appears that historic use has diminished the integrity of the subsurface pre-Contact components. Through mapping, data collection, and material analysis the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7182 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

Site 7182 Feature I; view to northwest.

Site 7182 Feature I; view to southwest.

Figure 4-33. Photographs of Site 7182, Feature I.

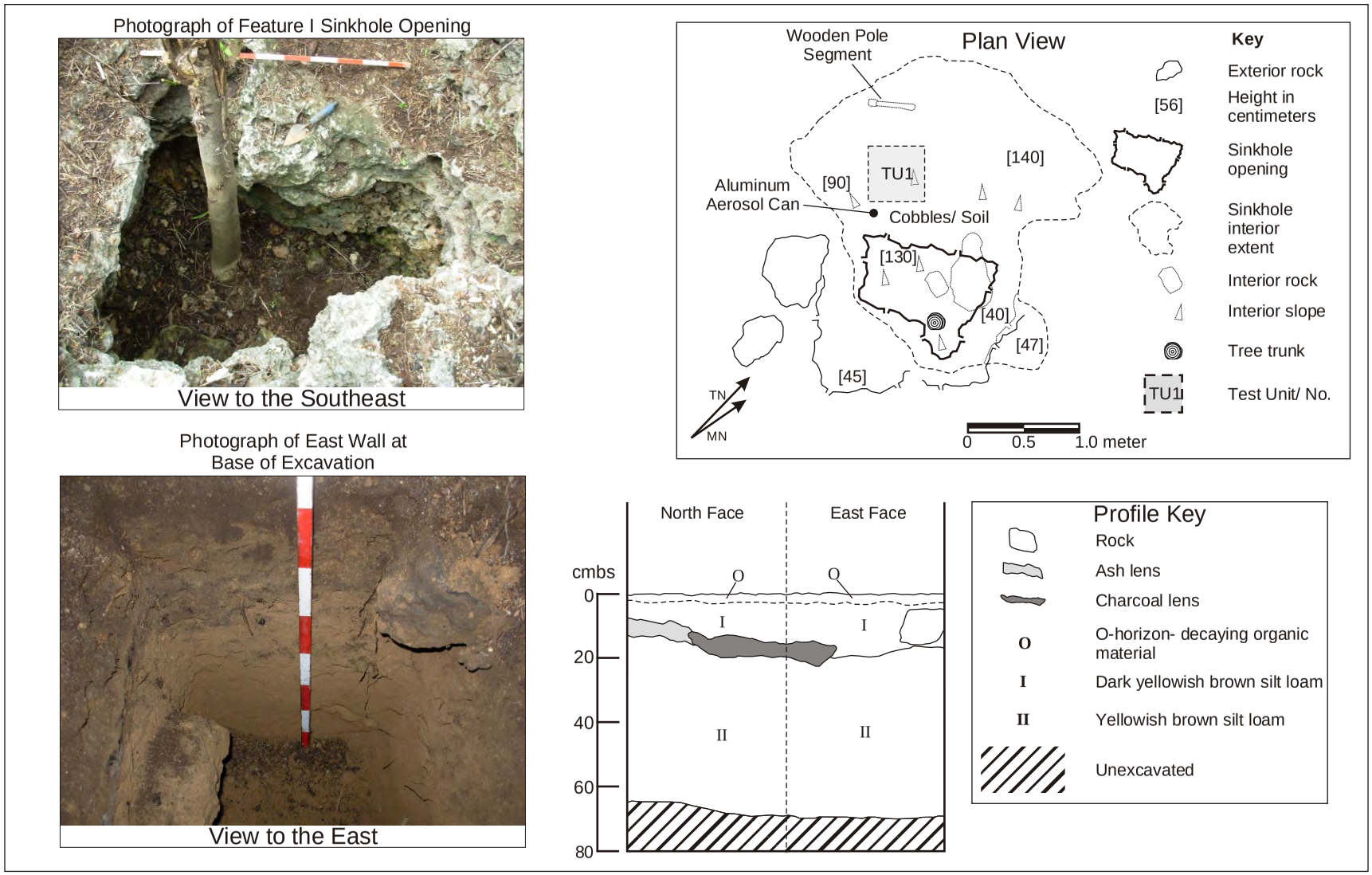


Figure 4-34. Site 7182, Feature I Plan View, Showing Location of TU-1, with Profiles and Photographs.

State Site 50-80-12-7184

Temporary Site Number: T-3
Site Type: Limestone Sinkhole
Site Function: Agriculture
Site Dimensions: 17.0 m by 8.0 m
Number of Features: 1
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 434-437
Current Status: New Site

Description:

Site 7184 is located on a raised limestone outcrop measuring 17.0 m by 8.0 m and is situated near the southeastern corner of the KS1 project area and approximately 180 m south of Site 7182 (see Figure 4-1). The site consists of a single limestone sinkhole measuring 3.2 m by 1.6 m and has a maximum depth of 2.4 m (Figure 4-35). A *koa-haole* and an unidentified tree are growing in the sinkhole. The interior ground surface appears to be soil, leaf and branch debris as well as a few scattered limestone cobbles. No cultural material was observed inside the sinkhole or outside on the surrounding raised limestone outcrop. The feature is in good condition and unaltered.

A single excavation unit, TU-1, was placed slightly north of the central portion of the sinkhole (Figure 4-36). The unit measured 0.5 m by 0.5 m and was excavated in one layer to a depth of 60.0 cm where excavation was terminated due to inaccessibility. The layer contained less than 1.0 gram faunal material, including marine shell, unidentified fish, and small mammal bone (see Table C-7 in Appendix C).

Stratigraphy, north wall profile:

I 60 cm thick; dark reddish brown (5YR 3/2, moist); silt loam; single grain structure; loose, very friable, non-sticky, non-plastic consistency; many roots, boundary not reached due to depth; cultural.

Interpretation, Significance, and Recommendations

Site 7184 consists of one probable pre-Contact sinkhole feature. Excavations within the sinkhole recovered minimal faunal material and no artifactual material, suggesting that the site was used expediently, probably for agricultural purposes. Through mapping, data collection, and material analysis the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7184 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

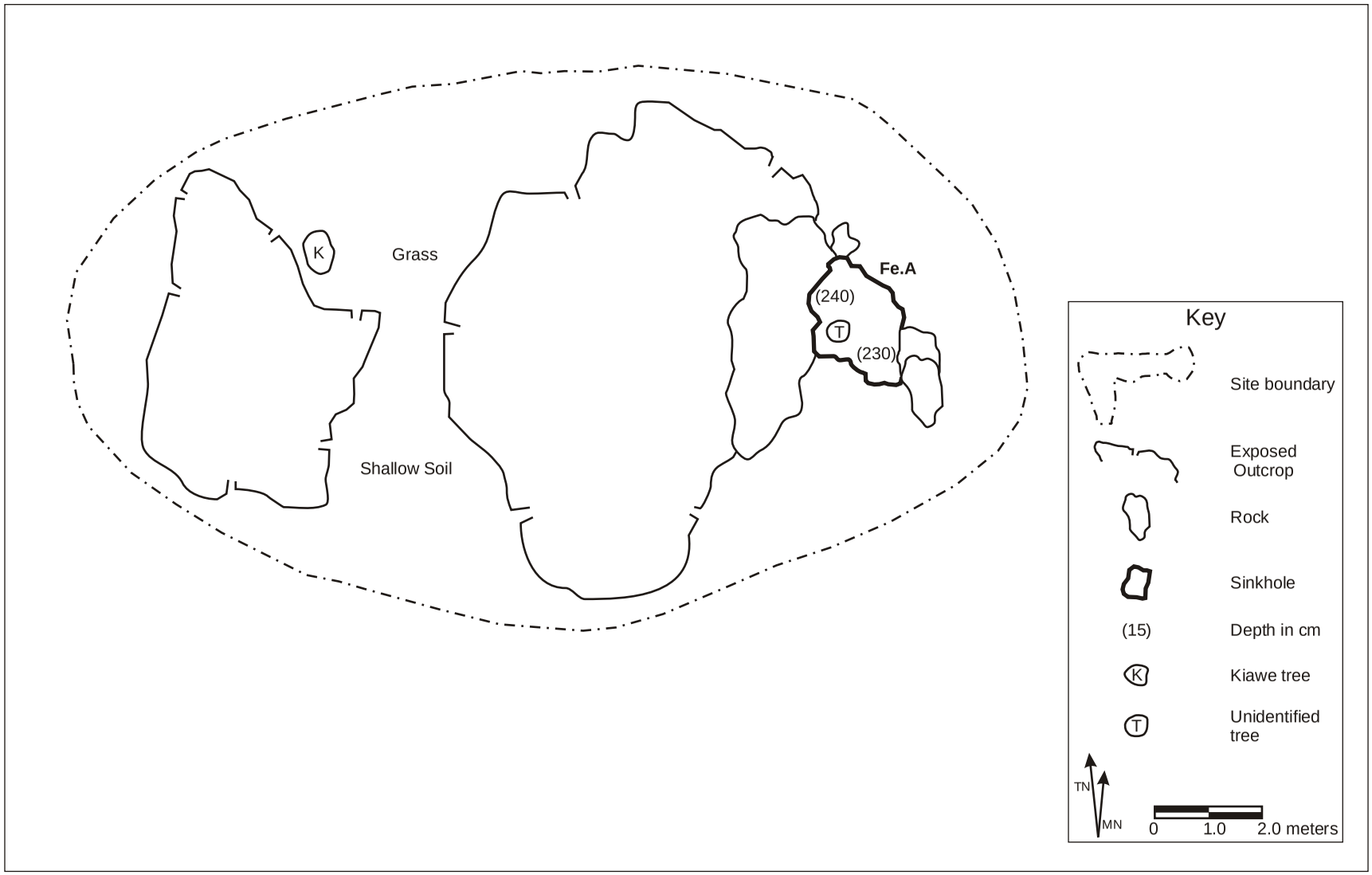
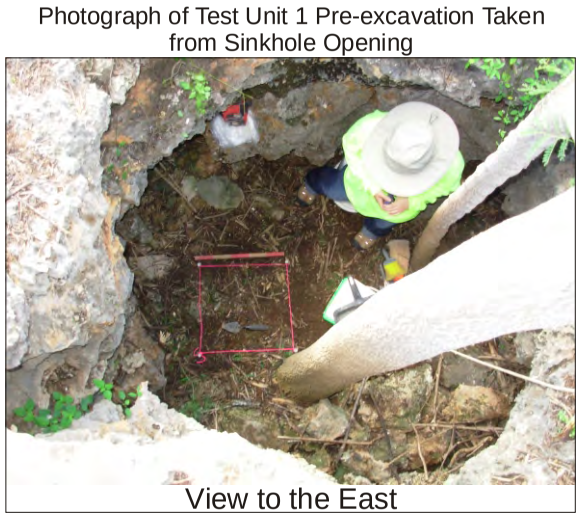
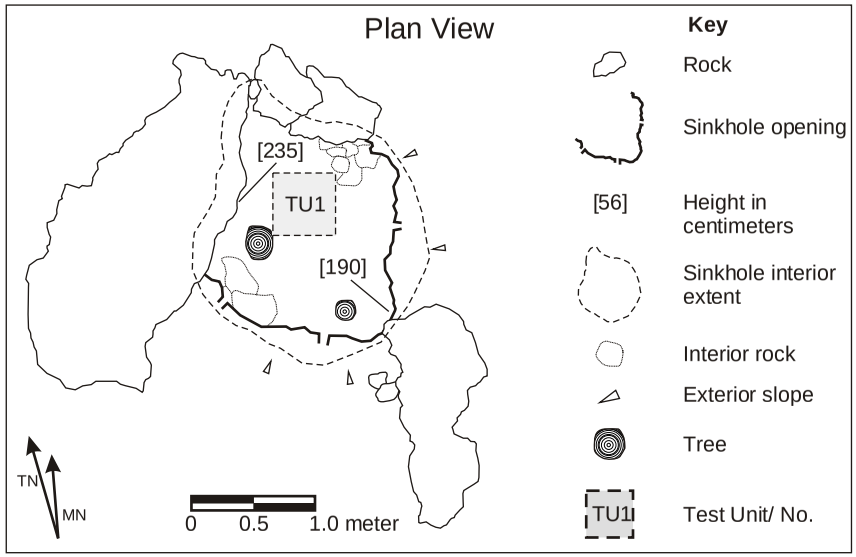
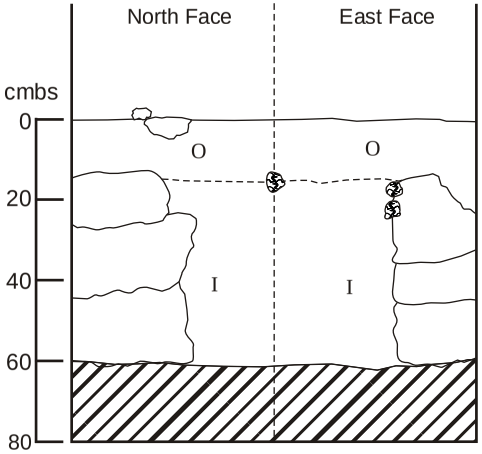


Figure 4-35. Site 7184 Feature A, Plan View.







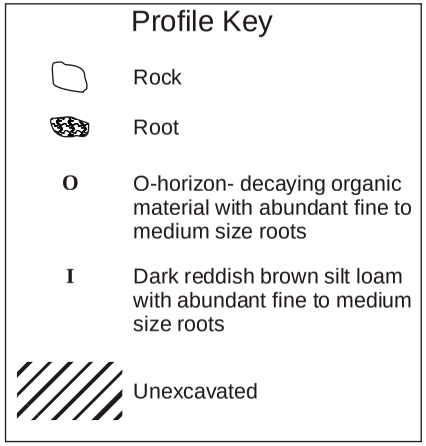


Figure 4-36. Site 7184, Feature A Plan View, Showing Location of TU-1, with Profiles and Photographs.

State Site 50-80-12-7185

Temporary Site Number: T-4
Site Type: Limestone Sinkholes
Site Function: Agriculture
Site Dimensions: 19.0 m by 10.0 m
Number of Features: 5
Topography: Relatively level with some uplifted coral limestone
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 430-433
Current Status: New Site

Description:

Site 7185 is located in the southeast corner of the project and consists of five sinkholes (Features A-E) located on a raised limestone outcrop measuring 19.0 m by 10.0 m (see Figure 4-1). Located approximately 38.0 m south/southeast of Site 7184 the sinkholes are irregularly-shaped with the smallest measuring 1.0 m by 1.0 m and 1.7 m deep to the largest measuring 4.0 m by 2.0 m and 0.86 m deep (Figure 4-37). Large *kiawe* trees are growing in two of the largest sinkholes. The interior ground surface of the five sinkholes consists of soil and leaf and branch debris. No cultural material was observed. Additional sinkholes are located in this area but were not considered to be cultural features due to their small size. The components associated with this site are in good condition and unaltered.

Two excavation units were placed in two sinkholes (Features C and D) to determine the presence or absence of traditional cultural materials.

A single excavation unit, TU-1, was placed in the eastern portion of Feature C (Figure 4-38). The unit measured 1.0 m by 0.5 m and was excavated in three layers to a depth of 75.0 cm where excavation was terminated on bedrock. No cultural material was recovered during excavation.

Stratigraphy, south wall profile:

I 6 cm thick; very dark brown (10YR 2/2, moist); silty loam; granular structure; non-sticky, non-plastic consistency; many roots, abrupt wavy boundary; non-cultural deposit.

II 19 cm thick; dark yellowish brown (10YR 4/4); silty loam; granular structure; non-sticky, non-plastic consistency; many roots, gradual wavy boundary; non-cultural deposit.

III 50 cm thick; very pale brown (10YR 7/4); sandy loam; granular structure; non-sticky, non-plastic consistency; many roots, non-cultural deposit.

A test unit, TU-1, was placed in the western edge of Feature D (Figure 4-39). The unit measured 1.0 m by 1.0 m and was excavated in two layers to a depth of 75.0 cm where excavation was terminated on bedrock. Layer I/2 contained a 15.0 cm thick charcoal lens (see Figure 4-39). The contents of this lens were excavated and screened separately. A charcoal sample was obtained and submitted for radiocarbon dating.

Layer I contained all of the faunal material recovered during excavation; more than 12.0 grams. A majority of the faunal material came from Layer I/1 and included gastropods, small mammal, and unidentified bird (see Table C-8 in Appendix C). Wood charcoal was recovered from Layer I/1 and I/2. One wood charcoal sample (Beta No. 302262) was submitted for radiocarbon dating and produced a date of calAD 1659-1954 (see Section 6).

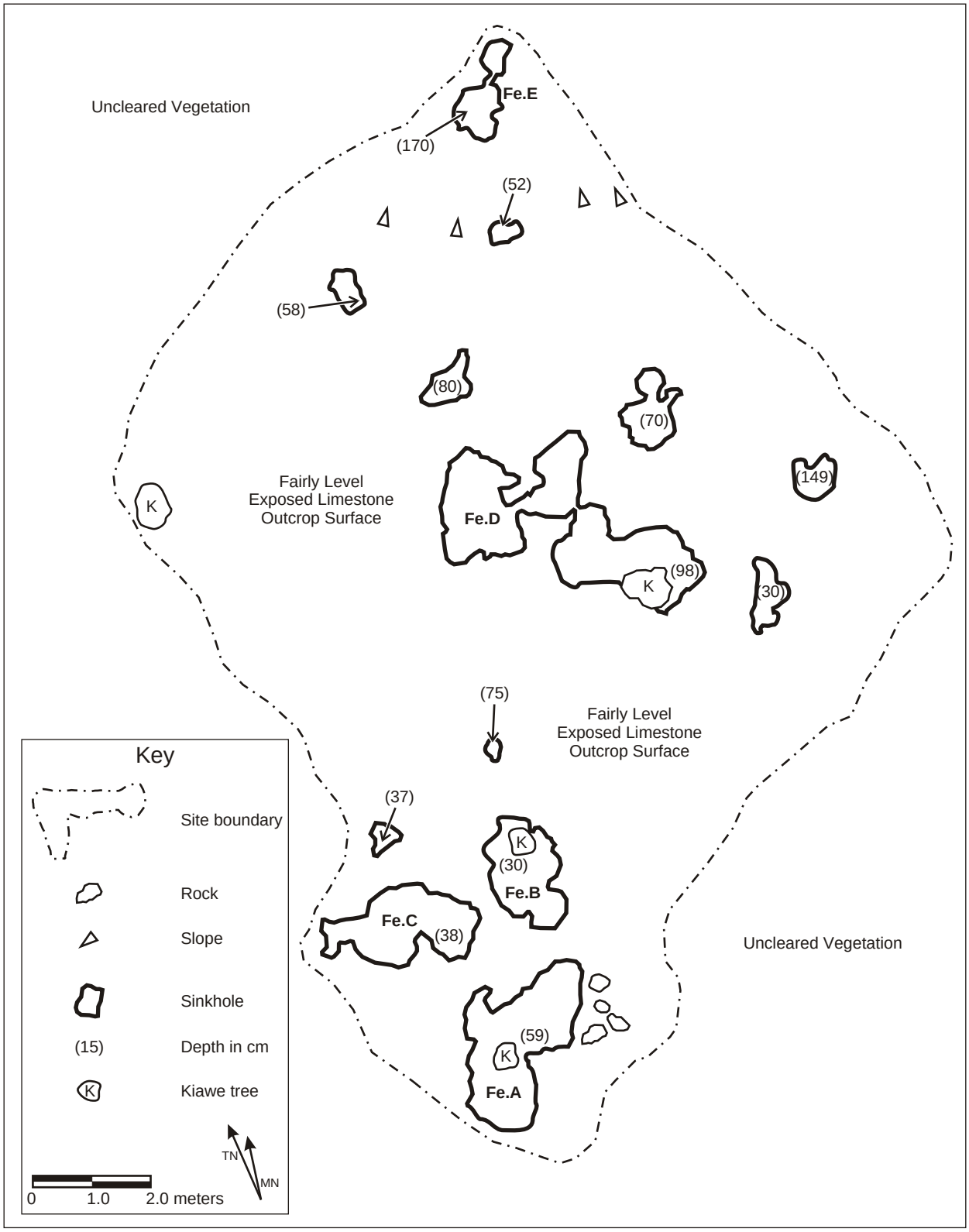


Figure 4-37. Site 7185, Features A through E, Plan View.

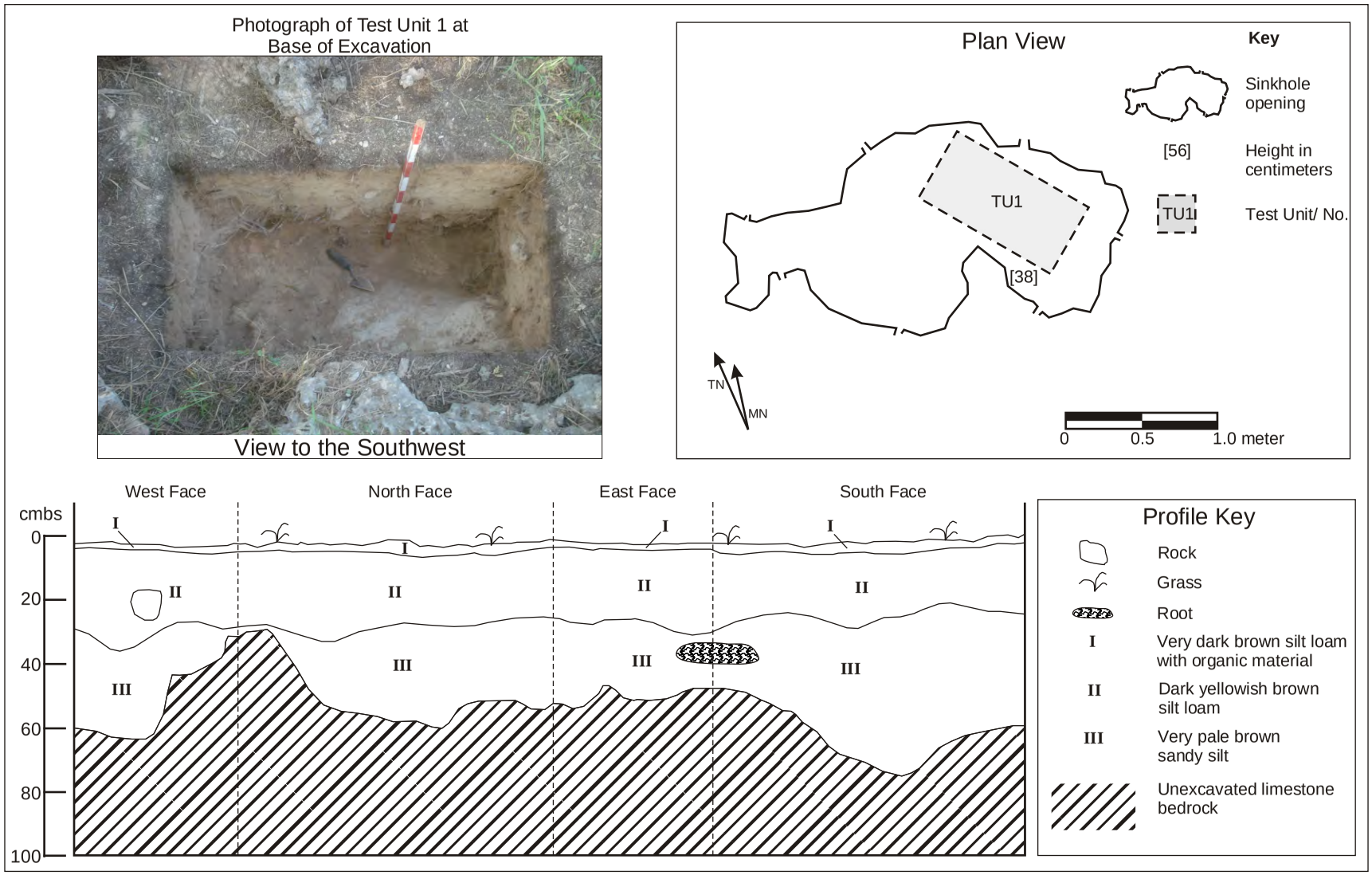


Figure 4-38. Site 7185, Feature C Plan View, Showing Location of TU-1, with Profiles and Photograph.

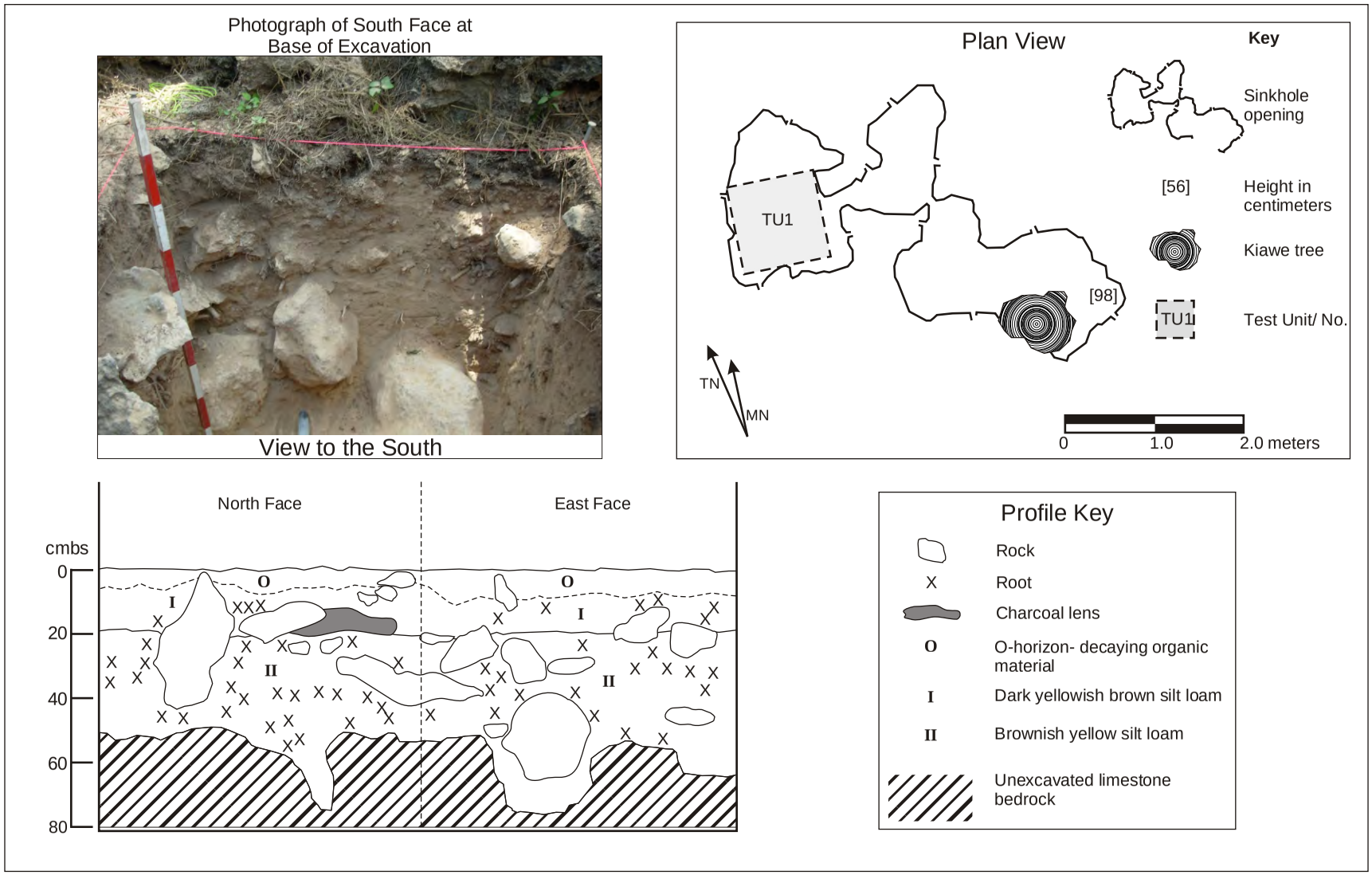


Figure 4-39. Site 7185, Feature D Plan View, Showing Location of TU-1, with Profiles and Photograph.

The stratigraphy observed in TU-1 in Feature D is as follows:

Stratigraphy, East Wall Profile:

I 19 cm thick; dark yellowish brown (10YR 3/6, moist); silt loam; granular structure; soft, very friable, slightly-sticky, non-plastic consistency; fine to medium roots, wavy boundary; cultural.

II 56 cm thick; brownish yellow (10YR 6/8, moist); silt loam; granular structure; soft, very friable, slightly-sticky, slightly-plastic consistency; medium to course roots, wavy boundary; non-cultural.

Interpretation, Significance, and Recommendations

Site 7185 consists of five probable pre-Contact sinkhole features. Excavations within the sinkhole recovered minimal faunal material and no artifactual material, but a dense charcoal lens in Feature D was recorded. The site likely served an agricultural function. The site represents a good example of pre-Contact use of sinkholes on the ‘Ewa Plain and is recommended as eligible for inclusion on the NRHP under Criterion D. Feature D is recommended for preservation and a Historic Preservation Plan (HPP) should be developed to address the short-term preservation, long-term preservation, and interpretation of Site 7185. The remaining features of Site 7185 are recommended for provisional or passive preservation because they will likely be located within the permanent buffer for Feature D.

State Site 50-80-12-7186

Temporary Site Number: T-5
Site Type: Limestone Sinkholes
Site Function: Agriculture
Site Dimensions: 15.0 m by 10.0 m
Number of Features: 2
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 424-429
Current Status: New Site

Description:

Site 7186 consists of two sinkholes (Features A and B), and is situated near the southeastern corner of the project area and approximately 25.0 m northeast of Site 7185 and 45.0 m southeast of Site 7184 (see Figure 4-1). Seven other sinkholes are present in this locale, four of which are quite small (Figure 4-40). Feature designations were given only to the two sinkholes that were selected for test excavations. Test excavations were conducted to determine the presence or absence of traditional cultural materials.

Feature A is a modified sinkhole located in a tree stand between two bulldozer cuts (see Figure 4-40). The sinkhole measures approximately 1.6 m by 1.0 m and has a maximum depth of 0.7 m. The exterior edge of the sinkhole is modified with limestone cobbles (Figure 4-41). The interior ground surface of the sinkhole is relatively level and consists of soil and a few scattered cobbles. Several *koa-haole* roots are extending down into the sinkhole. No cultural surface material was observed within the sinkhole. The feature is in fair to good condition and has been altered by a *kiawe* tree growing out of the center.

A single excavation unit, TU-1, was excavated within the Feature A sinkhole, along the interior western end (Figure 4-42). The unit measured 1.0 m by 1.0 m and was excavated in three layers to a depth of 90.0 cm where excavation in the southwest quadrant of the unit was terminated on bedrock. The remainder of the unit excavation was terminated at a depth of 60.0 cm due to the lack of cultural material observed in the screen.

Layers I and III contained no cultural material while the upper level of Layer II contained all of the faunal material recovered during excavation; less than 1.0 gram. Faunal remains recovered include small to medium sized mammal. Wood charcoal, *Aleurites moluccana* (k*ukui)* nutshell was also recovered the upper level of Layer II. Also present in Level 2 of Layer II was Subsurface Feature 1, a charcoal stained area in the southeast quadrant of the unit (see Figure 4-42). The contents of the feature were excavated and screened separately.

Two charcoal samples were collected *in situ* and one from screened material (see Table C-9 in Appendix C). One sample (Beta No. 302263) from Layer II, Level 1 was submitted for radiocarbon dating and produced a date of calAD 1682-1935 (see Section 6).

Stratigraphy, southeast wall profile:

I — 10 cm thick; very dark brown (10YR 2/2, moist); silty loam; single grain structure; slightly-sticky, slightly plastic consistency; fine to medium roots, abrupt wavy boundary; non-cultural.

II — 17 cm thick; brown (7.5YR 4/3, moist); silty loam; single grain structure; non-sticky, non-plastic consistency; fine to course roots, gradual boundary; cultural.

III — 60 cm thick; light yellowish brown (10YR 6/4, moist); sandy slit; non-sticky, non-plastic consistency; fine to medium roots, non-cultural.

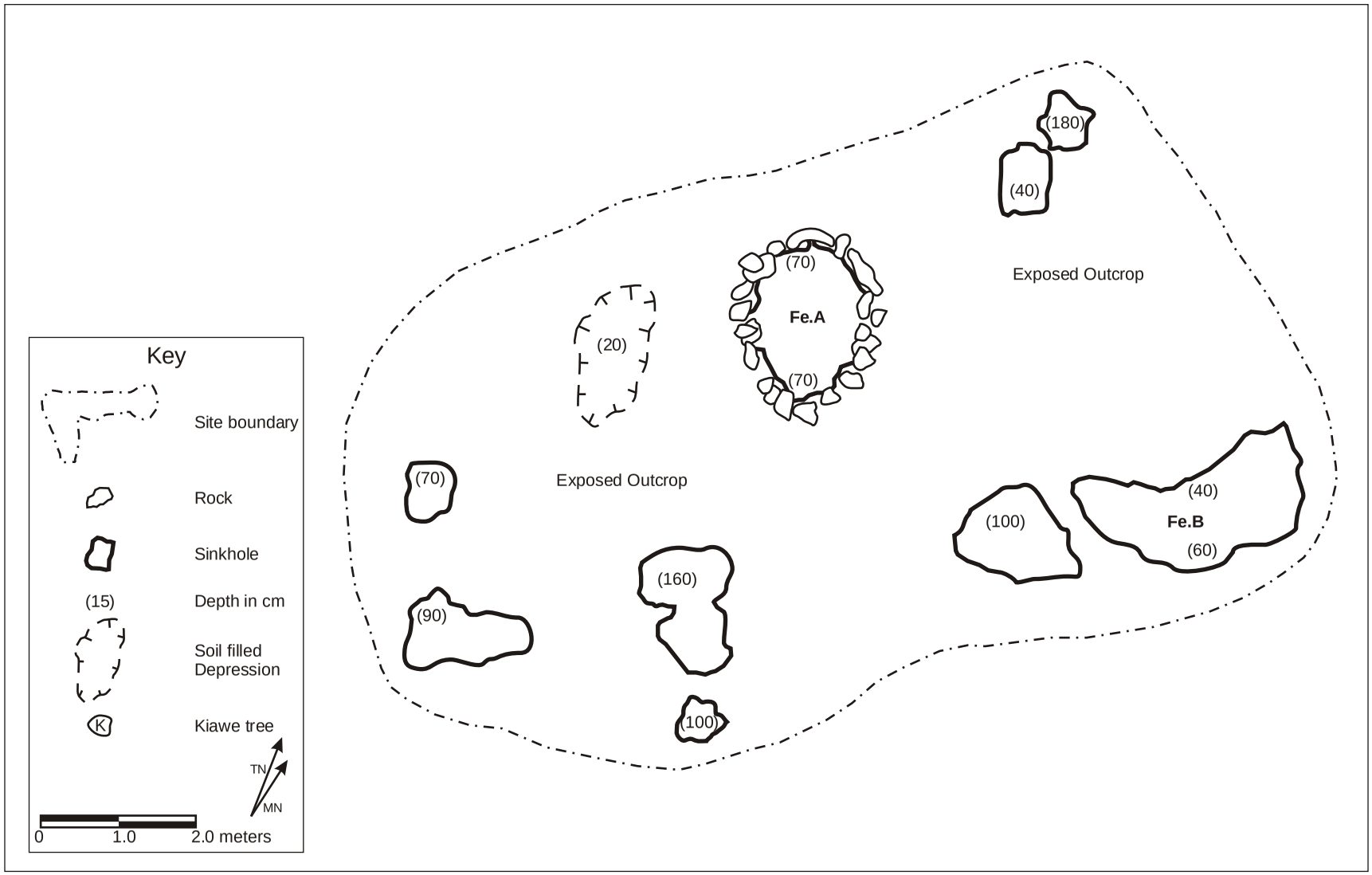


Figure 4-40. Site 7186, Features A and B, Plan View.

Site 7186 Feature A; view to south/southwest.

Site 7186 Feature A; view to east.

Figure 4-41. Photographs of Site 7186, Feature A, Modified Sinkhole.

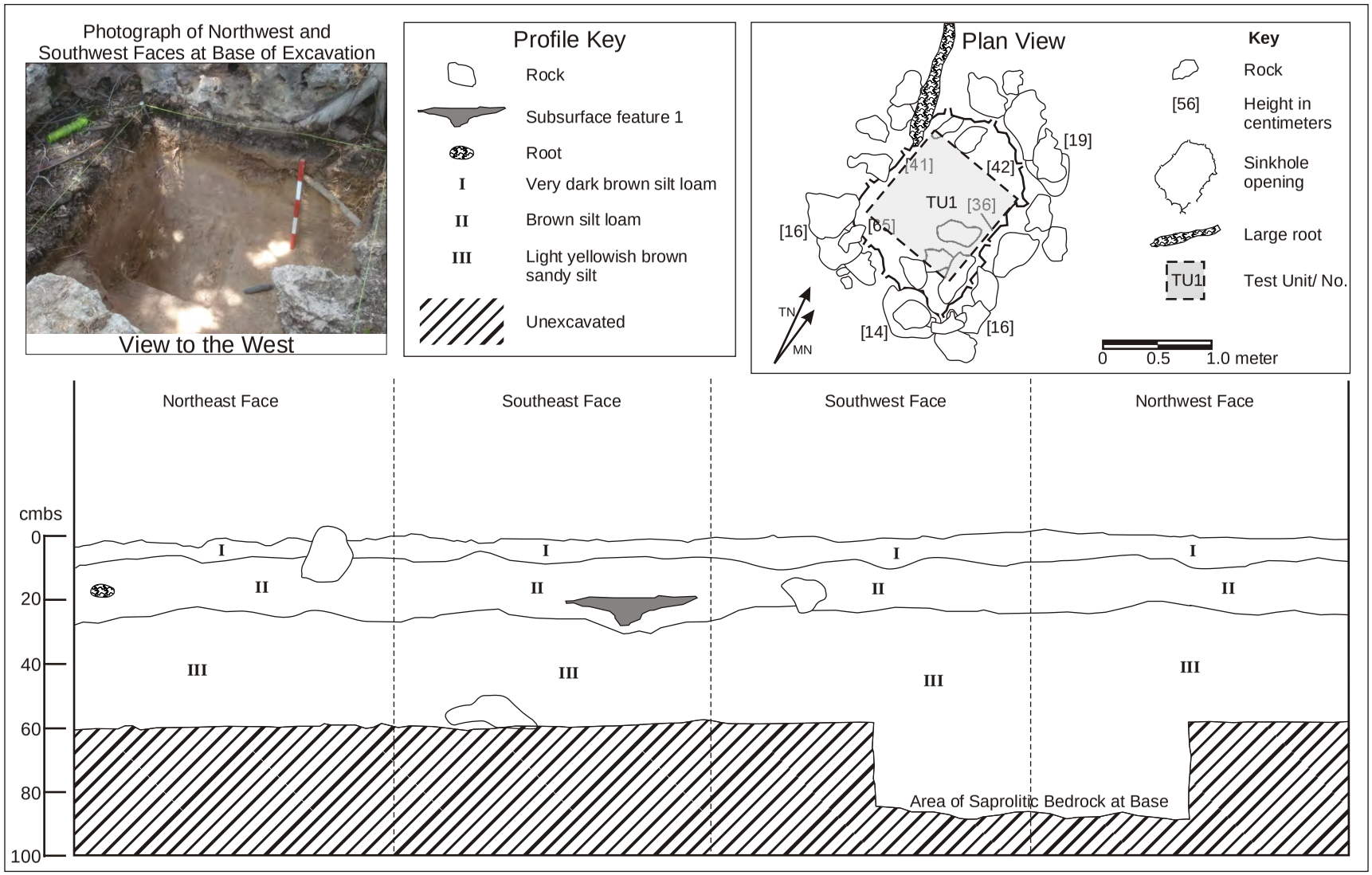


Figure 4-42. Site 7186, Feature A Plan View, Showing Location of TU-1, with Profiles and Photograph.

Feature B is located approximately 3.0 m east of Feature A and measures 3.0 m by 1.0 m and has a maximum depth of 0.6 m (see Figure 4-40). The interior ground surface is relatively level and consists of soils and scattered cobbles. No cultural material was observed. The feature is in good condition and unaltered.

A single excavation unit, TU-2, was placed in the central portion of Feature B (Figure 4-43). The unit measured 0.5 m by 0.5 m and was excavated in two layers to a depth of 65.0 cm where excavation was terminated due to lack of cultural material. Bedrock was not reached.

Layer I contained all of the faunal material recovered during excavation; slightly more than 2.0 grams. The faunal remains included sparse amounts of gastropods, bivalves, unidentified bird bone, and unidentified vertebrate remains.

Stratigraphy, north wall profile:

I 20 cm thick; dark brown (7.5YR 3/3, moist); silt loam; single grain structure; slightly-sticky, slightly plastic consistency; common fine to medium roots, clear wavy boundary; non-cultural.

II 30 cm thick; dark yellowish brown (10YR 3/4, moist); silty clay loam; single grain structure; moderately sticky, slightly plastic consistency; moderate to few roots, boundary not reached; non-cultural.

Interpretation, Significance, and Recommendations

Site 7186 consists of two probable pre-Contact sinkhole features. Excavations within the sinkhole recovered minimal faunal material and no artifactual material, suggesting that the site was used expediently, possibly for agriculture. Through mapping, data collection, and material analysis the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7186 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

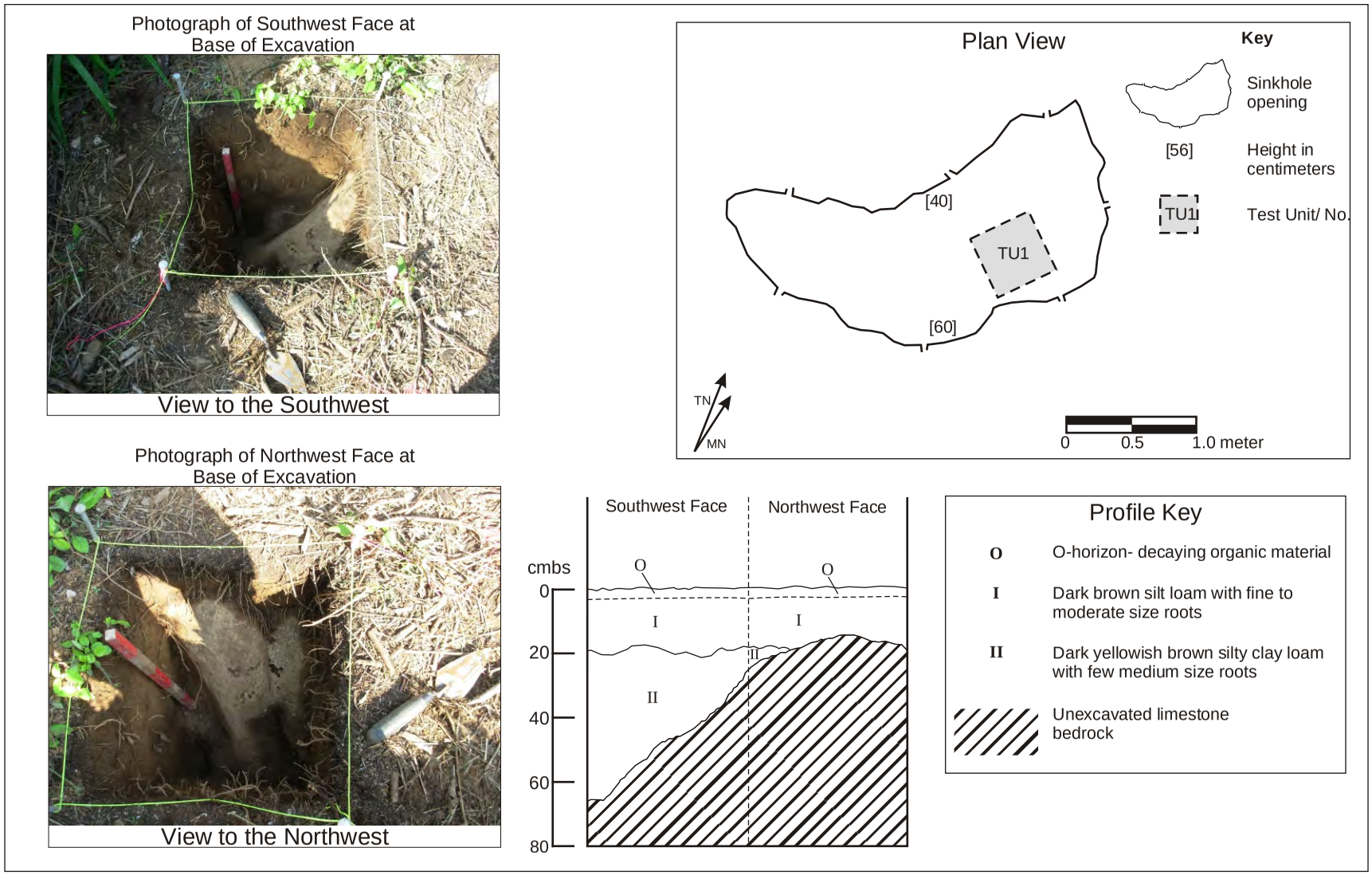


Figure 4-43. Site 7186, Feature B Plan View, Showing Location of TU-1, with Profiles and Photographs.

State Site 50-80-12-7187

Temporary Site Number: T-6
Site Type: Feature complex
Site Function: Transportation/industrial/agricultural
Site Dimensions: 36.0 m by 18.0 m
Number of Features: 3
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 402-423
Current Status: New Site

Description:

Site 7187 consists of three features located at the southern end of the project area (see Figure 4-1), approximately 29.0 m north of a fence line that surrounds a former storage bunker (Figure 4-44).

Feature A consists of a parallel alignment of cobbles and boulders of various sizes (see Figure 4-44). The alignments are oriented northwest/southeast and measure roughly 27.0 m long and 3.2 m wide. The alignments range in height from 10.0 cm to 50.0 cm high. The area between the two alignments is level soil with scattered cobbles. Two pieces of plexi-glass were observed along north alignment. The feature is in fair condition and appears to be altered.

Feature B is an oval-shaped mound located at the southwest end of the west alignment. The mound is constructed of piled cobbles and boulders of various sizes and measures 2.0 m in diameter with a maximum height of 0.2 m (see Figure 4-44). No cultural material was observed. The feature is in fair to good condition and appears to be altered.

Feature C is an L-shaped mound located at the southeastern end of the north alignment. The mound is constructed of piled cobbles and boulders of various sizes (see Figure 4-44). The long axis of the mound is oriented roughly east/west and measures 5.0 m long; at the west end of the mound it bends to the south for approximately 2.0 m. The mound averages 0.3 m high. A metal sickle blade was observed on top of the mound. The feature is in good condition and unaltered.

Interpretation, Significance, and Recommendations

Site 7187 consists of three probable historic features, including a possible road curbing. No cultural material was observed on the site other than modern debris. Through mapping, the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7187 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

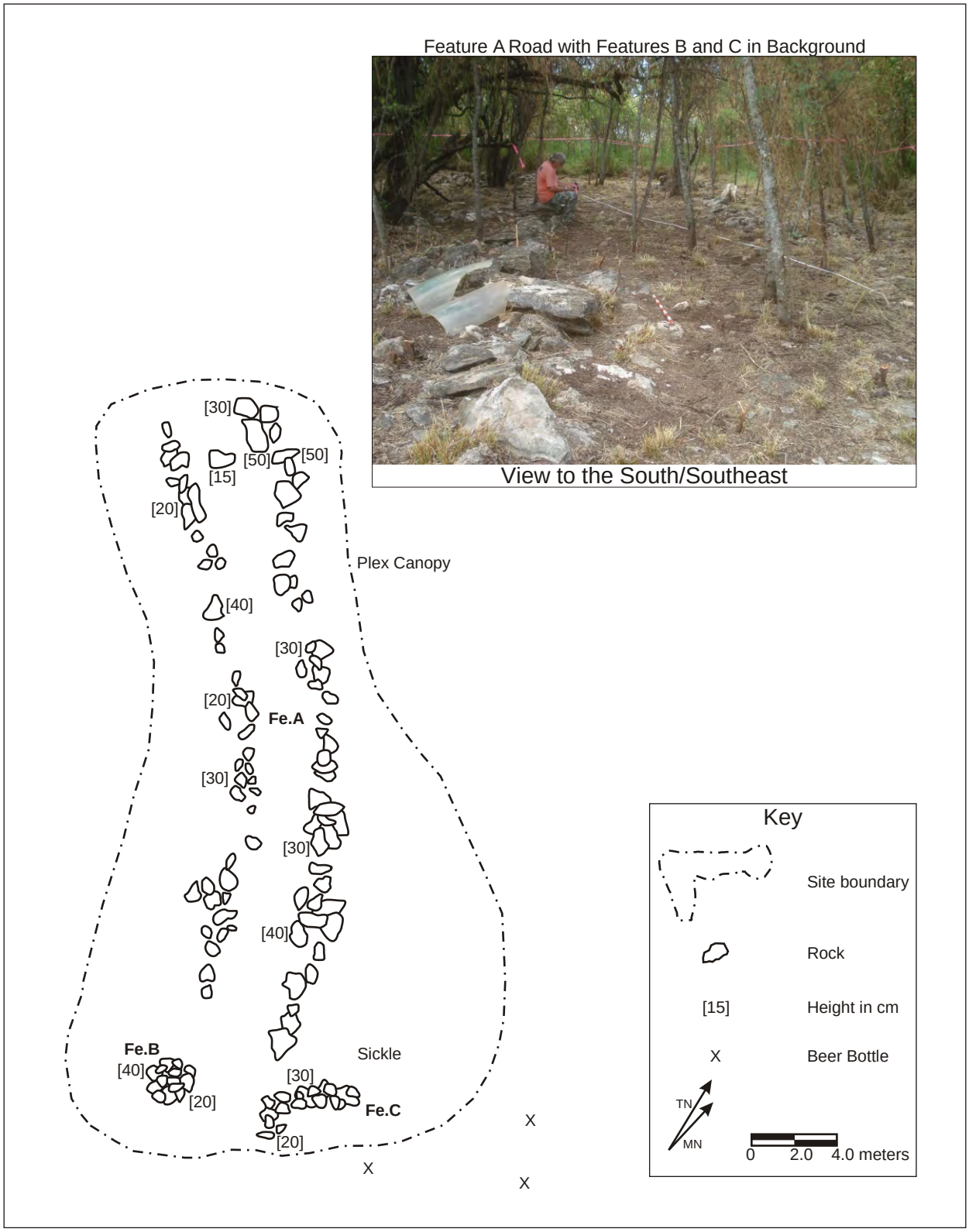


Figure 4-44. Site 7187, Feature A through C, Plan View and Photograph.

State Site 50-80-12-7188

Temporary Site Number: T-7
Site Type: Concrete vault
Site Function: Storm water runoff
Site Dimensions: 15.0 m by 10.0 m
Number of Features: 1
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 001
Current Status: New Site

Description:

Site 7188 consists of a subterranean concrete vault (Feature A) located near the northeast corner of the project area, and approximately 80.0 m southeast of Site 1719 and 80.0 m east of Site 7182 (see Figure 4-1). Site 7188 is situated in an excavated basin approximately 0.4 m below the surrounding topography (Figure 4-45).

Feature A is a circular-shaped concrete vault comprised of three components. The first component is a thick concrete cap, or lid, covering a subterranean vault of unknown depth. The cap measures approximately 2.8 m in diameter and is 40.0 cm thick and rests on top of a series of concrete blocks. The blocks measure roughly 20.0 cm high providing a gap between the cap and Component 2, a concrete apron (see Figure 4-45). A square metal lid measuring 0.56 m^2 is located in the center of the cap and held secure by four bolts. Also on the cap are three pairs of rebar hooks placed along the north, south, and east sides of the cap. The feature is in good to excellent condition and is unaltered.

Component 2 is a concrete apron that occupies the space between the excavated limestone bedrock and the cap (see Figure 4-45). The outer perimeter of the apron abuts the base of the excavation and extends to lip of the subterranean vault, beneath the cap. The apron measures approximately 1.0 m wide.

Component 3 is an excavated drainage channel located southwest of the cap and extending southwest for a distance of more than 5.0 m from the edge of the excavated basin which Feature 1 rests (see Figure 4-45). The channel is roughly 1.7 m wide and 0.5 m deep and is currently filled with grasses and fallen tree branches.

Interpretation, Significance, and Recommendations

Site 7188 consists of one Historic or possibly modern feature that likely served as a dry well for storm runoff. The feature was likely associated with other infrastructure in the area that has been destroyed. Through mapping, the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7188 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

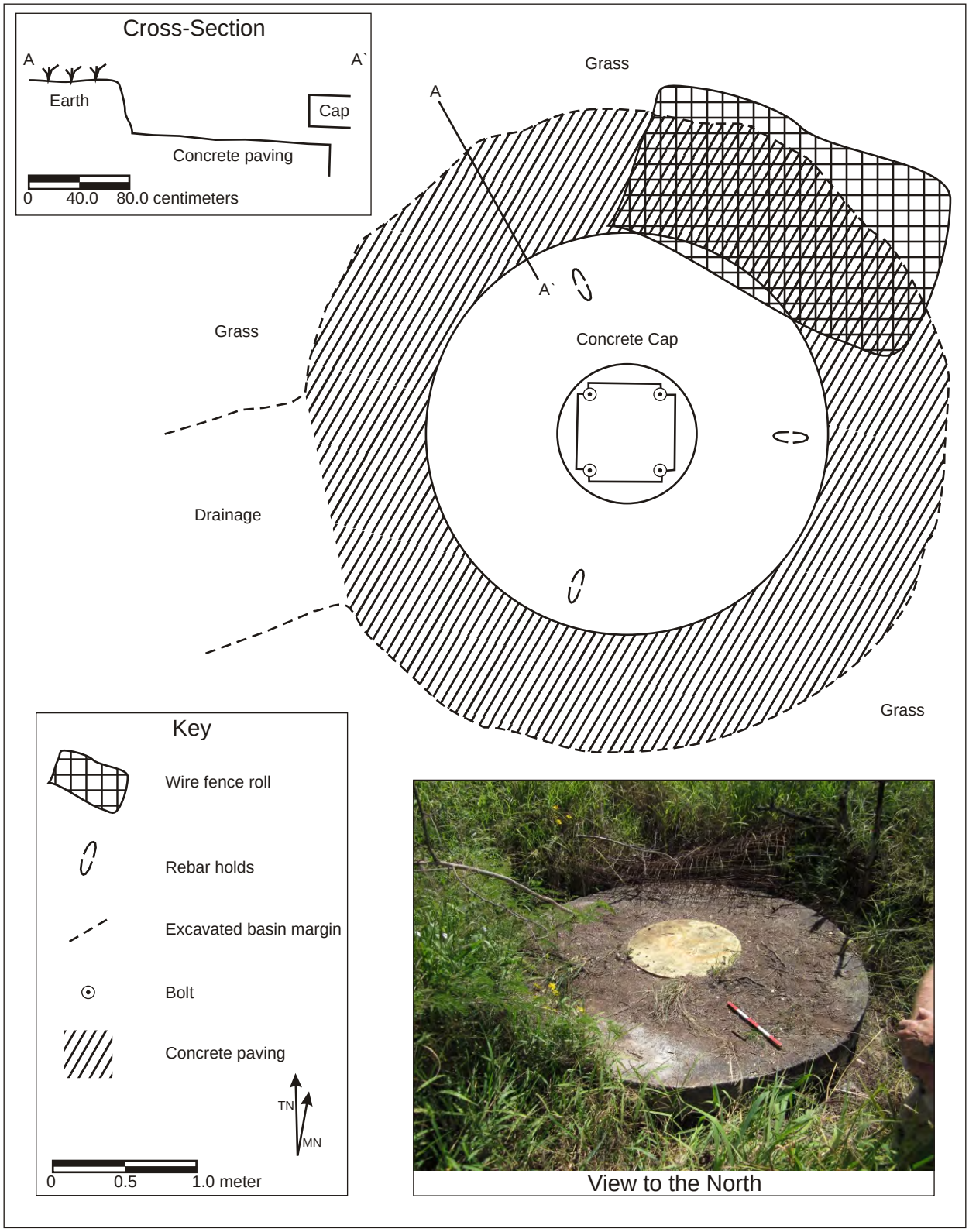


Figure 4-45. Site 7188, Concrete Vault, Plan View, Cross-Section, and Photograph.

ARCHAEOLOGICAL SITES IN THE KS2 PROJECT AREA

A total of five (5) archaeological sites consisting of 20 features were documented in the KS2 project area (see Figure 4-2). Site and feature descriptions and results of test excavations are presented below.

State Site 50-80-12-1721

Temporary Site Number: BPBM 238
Site Type: Feature Complex
Site Function: Habitation, agricultural complex, and possible burial
Site Dimensions: 70.0 m by 60.0 m
Number of Features: 8
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 054-066
Current Status: Unchanged

Description:

This site is a habitation complex located north of Mumba Street and approximately 75.0 m southeast of Feature A of Site 7177 (see Figure 4-2). The site appears to be undisturbed and has not changed since the work conducted by Beardsley (2001).

Haun (1991:43) originally recorded Site 1721 as a habitation complex of five features (Features A-E) that included a sinkhole with a possible platform in the interior. No excavations were conducted at this site as part of the Haun (1991) study.

The current survey efforts did not locate any of the features in Site 1722, and it is assumed that this site has been destroyed by bulldozing.

In 1995, Beardsley (2001:IV.20) recorded the five original features at Site 1721 as well as three additional features (see Figure A-9 in Appendix A). Single excavation units were placed in Features A, C, D, and E. Faunal material was recovered from all of the excavations. In addition, 41 traditional artifacts including bone fishhooks, worked bone, and lithics were recovered from the surface and a single excavation unit in Feature A (sinkhole/cave). Excavations at Features C, D, and E recovered sparse faunal material. Two charcoal samples from Feature A were submitted for radiocarbon dating. Beta No. 85054 from Layer I produced a date of calAD 1521-1955, while Beta No. 85055 from Layer II produced a date of calAD 1468-1955.

Fragmentary human remains of two or three individuals (two probable infants) were recovered from Feature A (Beardsley 2001). Two soil samples from excavations at Feature A (sinkhole) were submitted for pollen, phytolith, and macrofloral analysis to determine if there were possible vegetation differences between upper and lower layers. Scott-Cummings and Puseman (2001:D-5) note that:

> [t]he lower layer (Layer II) exhibited evidence of Antidesma trees, palm trees, some grasses and Cheno-ams, as well as Sida, Canthium, and members of the Asteraceae family. The upper layer (Layer I) contained large quantities of Cheno-am pollen and grass short cell phytoliths.

Beardsley did not relocate a series of cairns/cairn remnants recorded by Haun (1991: Site 1722, Features F, G, I, and J), and interpreted as possible burial/storage features (Features F and G) or possible burial/agricultural mounds (Features I and J); she surmised that these features were destroyed by bulldozing sometime between the early 1980s and 1995.

Feature A, measuring approximately 7.8 m by 5.0 m and 1.1 m deep, is a large bell-shaped sink with an opening 1.8 m by 1.1 m in diameter (see Figure A-9 in Appendix A). The ground surface slopes sharply down to the sink opening for 2.0 to 3.0 m around the sinkhole opening (Figure 4-46); Feature B, a long, discontinuous wall is constructed upslope 5.0 to 7.0 m from the sink opening, as a measure for controlling soil accumulation in and around sink. A metal pot and can were noted on the edge of the sink lip. Within the sink, the surface, the floor is covered with cobbles and boulders along the perimeter; the central portion of the sink floor (about 5.6 m by 2.5 m) was cleared of rubble, except for a few slabs-like boulders, which may have been used as seats. One iron bar and a tin can were noted on the floor surface. The remainder of the area was covered with a dense midden of marine shells, echinoid remains, bones, a coral abrader, and stone flakes. The feature appears to be in good condition and unaltered.

The sink floor was gridded off into 1.0 m by 1.0 m square for a controlled surface collection; 17 squares fell with the cleared area. All surface materials were collected from these 17 squares. A few human skeletal remains (HSR #5) were recovered, but did not seem to be part of an intact burial. Recovered artifacts include flaked stone (5) and two coral abraders, and invertebrate faunal remains.

A single excavation unit, EU-44, was placed in the eastern end of the sink, in the same area as Surface Collection Grid 16 because it contained the most artifacts (2) and a relatively substantial amount of faunal remains compared to the other surface collection units (see Figures A-9 and A-10 in Appendix A). A 1.0 m by 1.0 m unit was excavated in two layers to 133 cmbd, where it was terminated upon encountering bedrock. Both layers contained faunal material as well as artifacts. A total of 34 historic artifacts were recovered, including bone fishhooks, flaked stone, a modified bone, and ornaments. One subsurface feature was encountered, HF-7 (20 to 28 cmbd), in Layer I. It is a hearth consisting of fire-altered cobbles and a concentration of ash. Two radiocarbon dates were run on charred material from Layers I (Beta-85054, 170±90 BP, calAD1515-1585, 1625-1950) and II (Beta-85055, 250±60 BP, calAD1495-1696, 1725-1815, 1920-1950). Dates quoted here and above are at the 2 sigma range. Given the radiocarbon calibration curve at the interception points, the two dates are virtually identical, with the first intercept at calAD 1680 and 1655 respectively. Wood charcoal samples were submitted for identification (see Section 6 of this report), and constant volume samples were submitted for analysis.

Stratigraphy, west wall profile:

I 15 to 27 cm thick; dark brown (7.5YR 3/2, moist) to brown (7.5YR 5/4, dry); loamy sand; moderate, fine crumb structure; soft, friable, slightly sticky, non-plastic consistency; common, very few vesicular roots; abrupt, smooth boundary; cultural.

II 54 to 112 cm thick; brown (10YR 5/4, moist) to strong brown (10YR 5/6, dry); loamy fine sand; strong, medium granular structure; soft, friable, slightly sticky, non-plastic consistency; very few, fine vesicular roots; cultural deposit.

Feature B is a long discontinuous wall surrounding the opening of Feature A on the north, west, and south sides (see Figure A-9 in Appendix A). It measures approximately 16.0 m by 10.0 m with a maximum height of 0.7 m. At its northernmost terminus, it abuts an exposed bedrock outcrop. From this point, it bends to the west, south, and then east, where it terminates at Feature D. In effect, it encloses the sloping ground around the sink and may have acted to keep soil from washing into the sink. The wall is constructed with multiple courses of limestone cobbles, boulders, and slabs, ranging from 30.0 to 70.0 cm in maximum diameter. A series of

Site 1721 Feature A; view to south.

Site 1721 Feature A; view to north.

Figure 4-46. Photographs of Site 1721, Feature A.

upright vertical slabs have been placed on-end throughout the wall; some elements have been placed parallel to the wall, others perpendicular. Cavities occur throughout the construction, although with no pattern or regularity. Wall width varies from 0.5 m to 1.0 m. The feature has been altered by *kiawe* trees but is in fair to good condition.

Feature C is an L-shaped wall measuring 4.7 m by 3.5 m with a maximum height of 0.6 m (Figure 4-47; see Figure A-9 in Appendix A). It consists of a rubble-filled core between two retaining walls constructed with limestone cobble, boulders and slabs. The interior wall is faced with upright, vertical, on-edge slabs; wall width is 1.3 m. Another, detached wall segment with a vertically faced interior wall is located east of the structure. It is mostly dismantled, the fill is gone and the total width of the remaining section is 80 cm; yet, it is similar in form to the L-shape. The two could have been connected at some point, forming a U-shaped enclosure with the opening to the south. The feature was in fair to poor condition and altered prior to excavation.

A single excavation unit, EU-41, was placed in the southern terminus of the L-shape, in the western wall. It is a 1.0 m by 1.0 m unit that was excavated in two layers to 54 cmbd, where it was terminated upon encountering bedrock. The upper layer is the architecture layer; the lower layer contained a sparse amount of faunal material. From the profile, it is apparent that the architecture is deeply embedded in the soil layer, only 1.0 to 2.0 cm above the underlying bedrock.

Stratigraphy, east wall profile:

I 11 to 45 cm thick; limestone cobbles and pebbles; architectural.

II 1 to 39 cm thick; dark yellowish brown (10YR 3/4, moist) to dark yellowish brown (10YR 4/4, dry); silt loam; moderate, medium granular to angular blocky structure; soft, very friable, non-sticky, non-plastic consistency; common, very fine to medium vesicular to tubular roots; cultural deposit.

Feature D is a L-shaped feature with a rubble-filled core between two retaining wall of multiple courses built with limestone cobbles, boulders and slabs (see Figure 4-47; see Figure A-9 in Appendix A). The wall measures approximately 7.5 m by 6.0 m with a maximum wall height of 0.7 m. Both the interior and exterior of the walls are faced with upright, vertical, on-edge slabs; these are more visible in the southern wall. A 2.5 m alignment of boulders extends to the west from the northern terminus of the structure. Charcoal and fire-cracked rock were observed in this area, and may mark the location of a hearth. There is also a second area with the remains of a potential hearth in the southeastern corner, in the junction of the L-shape. The uprights in both these areas are blackened with smoke. Both *kiawe* and *koa-haole* are growing in and near the feature, and pose one possible agency for the distortion and displacement of wall components. The feature is in fair condition and appears to have been altered prior to excavation.

A single excavation unit, EU-43, was placed in the northern hearth area (see Figure A-9 in Appendix A). It is a 1.0 m by 1.0 m unit that was excavated in two layers to 31 cmbd, where it was terminated when bedrock covered over 60% of the unit. Both layers contained a sparse amount of faunal material; Layer I also contained a coral abrader. The architecture was embedded into the upper soil layer. There was no indication of a hearth in this area.

Site 1721 Feature C; view to north.

Site 1721 Feature D; view to southwest.

Figure 4-47. Photographs of Site 1721, Feature C and D.

The stratigraphy in EU-43 in Feature D is as follows:

Stratigraphy, north wall profile:

I 1 to 3 cm thick; black (10YR 2/1, moist) to very dark brown (10YR 2/2, dry); loamy coarse sand; weak, medium to coarse crumb structure; loose, non-sticky, non-plastic consistency; very few, very fine to coarse vesicular roots, smooth boundary; cultural.

II 22 to 23 cm thick; light yellow brown (10YR 6/4, moist and dry); fine silty loam; weak, very fine to fine granular structure; loose, very friable, non-sticky, non-plastic consistency; very few, fine to medium vesicular roots; cultural deposit.

Feature E is an elongated, lozenge-shaped mound measuring approximately 3.2 m by 1.5 m with a maximum height of 0.8 m (see Figure A-9 in Appendix A). It is a multiple-course (one to five) construction of limestone cobbles, boulders and slabs (from 40.0 to 60.0 cm in maximum diameter); it appears to be a rubble-filled core construction, although the general distortion and collapse of the feature makes it difficult to discern with any certainty. The feature is oriented northwest-southeast; Feature G is immediately adjacent to the southern end and continues in the same alignment. Feature F is about 1.5 m to the north, and Feature H is immediately to the east. The feature was in fair to good condition and appeared to be unaltered prior to excavation.

A single excavation unit, EU-42, was placed in the center of this feature (see Figure A-9 in Appendix A). It is a 1.0 m-by 0.5 m unit that was excavated in three layers to 21 cmbd, where it was terminated after a sterile level. The uppermost layer contains the architectural elements; the lower two were sterile. The architectural elements rest on the surface of the upper soil layer.

Stratigraphy, north wall profile:

I 36 to 40 cm thick; limestone; abrupt, wavy boundary; architectural.

II 5 to 10 cm thick; black (10YR 2/1, moist) to very dark brown (10YR 2/2, dry); loam; strong, fine to coarse crumb structure; soft to slightly hard, very friable to friable, slightly sticky, slightly plastic consistency; common, fine to medium vesicular and tubular roots; abrupt, wavy boundary; non-cultural deposit.

III 10 cm thick; dark yellowish brown (10YR 4/6) to yellowish brown (10YR 5/6); silty loam, slightly sandy; weak, very fine to fine granular structure; loose, slightly sticky, slightly plastic consistency; few, medium tubular roots; non-cultural.

Feature F is a relatively short span of wall, measuring approximately 5.0 m long by 1.6 m with a maximum height of 0.3 m. It is aligned roughly northeast/southwest and built one to two courses high with limestone cobbles, boulders, and slabs. Wall width varies from 0.5 to 1.0 m. Feature E is approximately 1.5 m to the south. The feature is in fair condition and appears to be unaltered.

Feature G is a singular alignment extending southward from Feature E, along the same alignment (see Figure A-9 in Appendix A). It measures approximately 5.0 m by 1.2 m with a maximum height of 0.6 m. It is one to two courses high construction built with limestone cobbles, boulders, and slabs (ranging from 20.0 to 90.0 cm in maximum diameter). A vertical slab is embedded at the north end of the wall, probably in situ. Several trees are growing out of the wall, distorting its shape and displacing the construction elements. The feature is in fair condition and appears to be unaltered.

Feature H is a modified sinkhole measuring approximately 2.6 m by 1.0 m with maximum depth of 0.4 m (see Figure A-9 in Appendix A). The sink is a rubble-filled, amorphic sinkhole surrounded by fragmented limestone slabs that create an indistinct edge. This, in turn, is surrounded by an area of rubble 4.0 m in diameter, and likely the result of bulldozing; mechanical alteration of the general area is evident to the east and north. The sinkhole is filled with limestone rubble averaging approximately 40.0 cm in diameter. The feature is in poor condition and is altered.

Interpretation, Significance, and Recommendations

Based on the eight features described above, as well as Beardsley's (2001) analysis of artifacts and midden, Site 1721 appears to have functioned predominantly as a pre-Contact habitation complex. The construction style, workmanship, and use of material are typical of other sinkhole features on the 'Ewa Plain with similar functions (Tuggle and Tomonari-Tuggle 1997b). While the integrity of most other sites in the APE has been compromised by extensive ground altering activity, Site 1721 retains a reasonable number of integral features such as location and setting, and exhibits cohesive elements of style, workmanship, and material use to be considered significant using the guidelines established to determine NRHP eligibility (National Register Bulletin 15).

Beardsley (2001:IV.11) recommended Site 1721 as eligible for the NRHP under Criterion D. It appears that all extant features of Site 1721 contribute to the site's significance. It is recommended that Features A through H be considered eligible for inclusion on the NRHP and HRHP under Criterion D and that a Historic Preservation Plan (HPP) be developed to address the short-term preservation, long-term preservation, and interpretation of Site 1721.

State Site 50-80-12-7176

Temporary Site Number: T-2
Site Type: Feature complex
Site Function: Possible Ranching
Site Dimensions: 21.0 m by 15.0 m
Number of Features: 2
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 043-052
Current Status: New Site. Feature A was disturbed by vandals after the site was cleared of vegetation

Description:

Site 7176 is located approximately 12.0 m east of a north/south extending coral road located on the west side of the property and 200 m south of Saratoga Road (see Figure 4-2). The site consists of two stacked limestone features (Features A and B) recorded during the current survey (Figure 4-48).

Feature A is a linear rock alignment with a circular-shaped enclosure at the east end of the alignment (Figure 4-49; see Figure 4-48). The linear alignment is constructed of piled limestone cobbles and small boulders and measures approximately 4.5 m long with a maximum height of 44.0 cm. At the west end of the alignment is a cavity forming a possible cupboard within the alignment. The opening to the cavity measures roughly 0.5 m by 0.3 m and is 0.33 m deep. The cavity measures 0.8 m deep. No cultural material was observed.

The circular-shaped enclosure is constructed of piled and stacked limestone cobbles and small to medium-sized boulders with at least one limestone slab placed on end. The exterior of the structure measures roughly 2.0 m by 2.0 m with a maximum height of 0.41 m. After the site was photographed, the next day it was noted that the site had been disturbed or perhaps vandalized. The walls of the circular enclosure had been collapsed inwardly. Prior to the vandalism the interior was roughly circular and measured roughly 1.0 m in diameter, 0.62 m deep, and contained several circular metal hoops. The vandalism has caused the south wall to collapse filling in much of the interior and covering the metal hoops.

Off the south end of the circular structure is a low-lying soil area between two limestone outcrops measuring 1.0 m wide and 0.14 m deep. A limestone slab placed on-end defines the soil area on the south (see Figure 4-48). The feature is in good condition and was altered recently.

A single excavation unit, TU-1, was placed in the center of the Feature A enclosure (Figure 4-50). The unit measured 0.5 by 0.5 m and was excavated in two layers to a depth of 40.0 cm. Excavation was terminated due to lack of accessibility inside the enclosure feature.

Layers I and II both contained cultural material. Historic materials included 67 barrel hoop fragments and 10 wire nails (see Table B-7 in Appendix B). Faunal remains recovered include 12.4 g of gastropods and 1.5 g of bivalve shell (see Table C-10 in Appendix C).

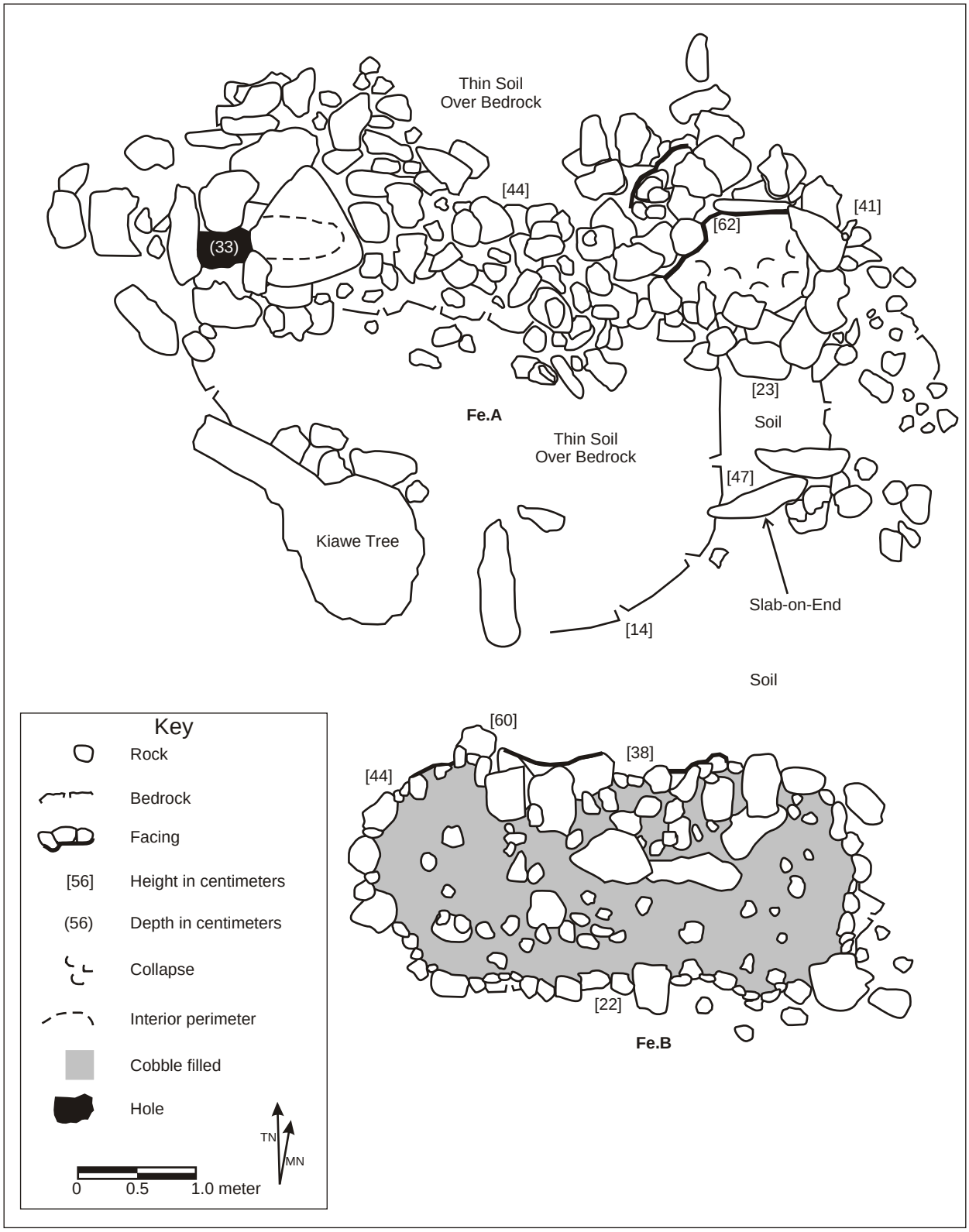


Figure 4-48. Site 7176, Features A and B, Plan View.

Site 7176 Feature A; view to northwest.

Site 7176 Feature B; view to southeast.

Figure 4-49. Photographs of Site 7176, Feature A and B.

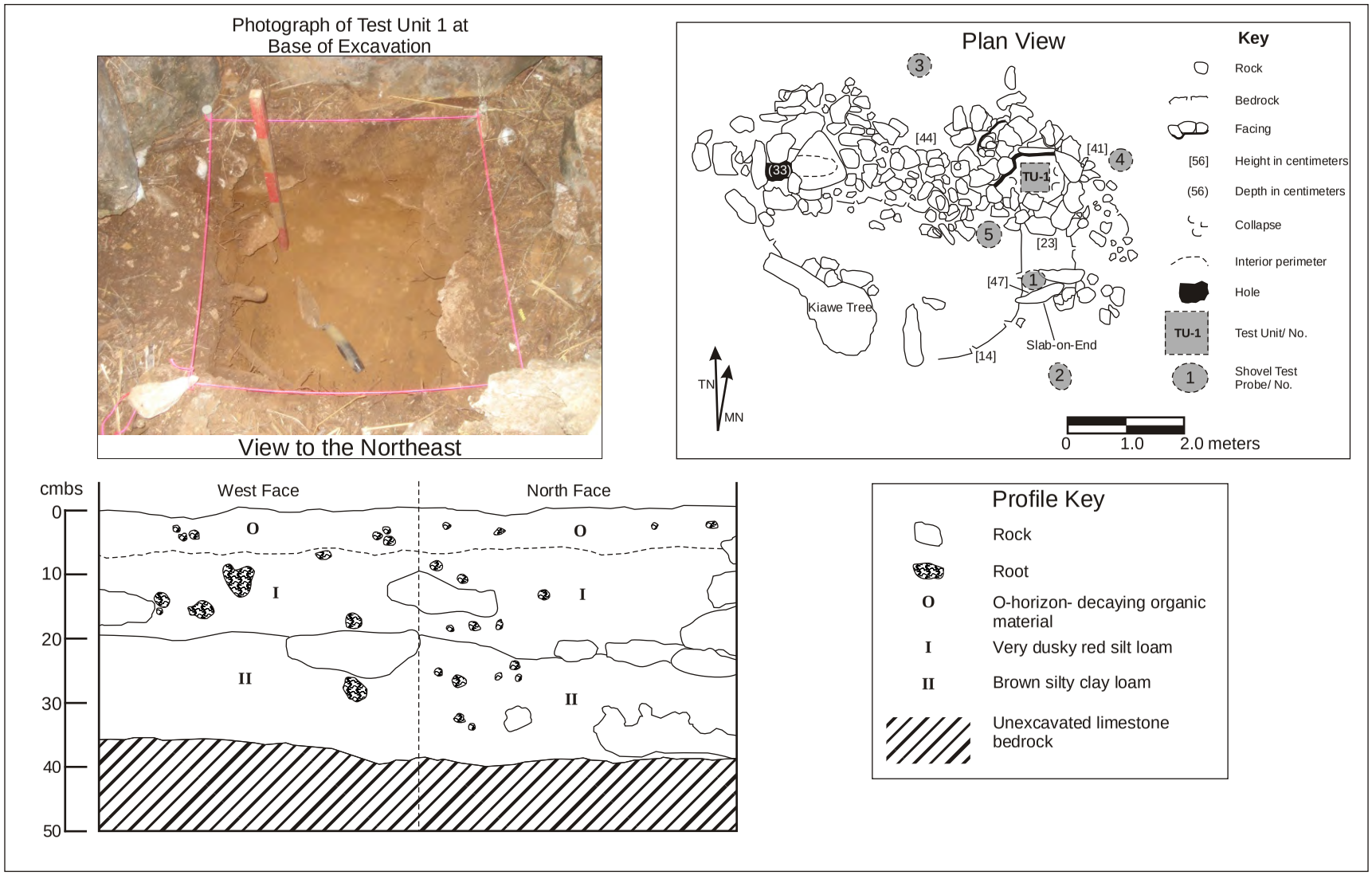


Figure 4-50. Site 7176, Feature A, Plan View Showing Locations of TU-1 and STP1-5, with Profiles and Photograph.

The stratigraphy observed in TU-1 in Feature A is as follows:

Stratigraphy, west wall profile:

I 13 cm thick; very dusky red (2.5 YR 2.5/2 dry); silty loam; single grain structure; non-sticky, non-plastic consistency; many fine roots, abrupt wavy boundary; cultural deposit.

II 20 cm thick; brown (7.5YR 4/4); silty clay loam; single grain structure; non-sticky, non-plastic consistency; few fine to medium roots, gradual boundary; cultural deposit.

In addition to TU-1, a total of five shovel test probes (STP1, 3, 4 and 5) were excavated in areas adjacent to Feature A (Figure 4-51; see Figure 4-50). All STP's were approximately 40.0 cm in diameter. The stratigraphic sequence of the STPs is similar to the test unit stratigraphic sequence observed throughout the site. Cultural material included 1.8 g of gastropods (see Table C-10 in Appendix C) in STP1.

Feature B is a terrace located approximately 3.5 m south of Feature A (see Figure 4-48). It measures roughly 4.5 m by 2.0 m and ranges in height from 0.22 m along the south side and 0.6 m along the north (see Figure 4-49). The mound is constructed of piled and stacked limestone cobbles and boulders of various sizes along the perimeter. The interior portion, or surface, of the mound has the appearance of a core-fill consisting of limestone cobbles. The feature is in fair to good condition and possibly altered historically.

A single excavation unit, TU-1, was placed in the central portion of the Feature B (Figure 4-52). The unit measured 1.0 m by 1.0 m and was excavated in two layers to a depth of 40.0 cm. Excavation was terminated at bedrock.

Layer I contained an intact milk bottle, copper wire, a nail, and two wire staples (see Table B-7 in Appendix B). No faunal remains were recovered. Layer II was non-cultural.

Stratigraphy, north wall profile:

I 30 cm thick; dark reddish brown (5 YR 3/2 dry); silty loam; single grain structure; non-sticky, non-plastic consistency; many fine roots, abrupt wavy boundary; cultural deposit.

II 10 cm thick; dark reddish brown (5YR 3/3 dry); silty clay loam; single grain structure; non-sticky, non-plastic consistency; few fine to medium roots. No cultural materials were present in Layer II.

Interpretation, Significance, and Recommendations

Site 7176 consists of two adjacent stacked rock features. The features were likely associated with the remains of additional ranching structures in the area that have been destroyed. Feature A has been altered recently, and the area has been impacted by bulldozing. Through mapping, detailed recording, and test excavations, the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7176 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

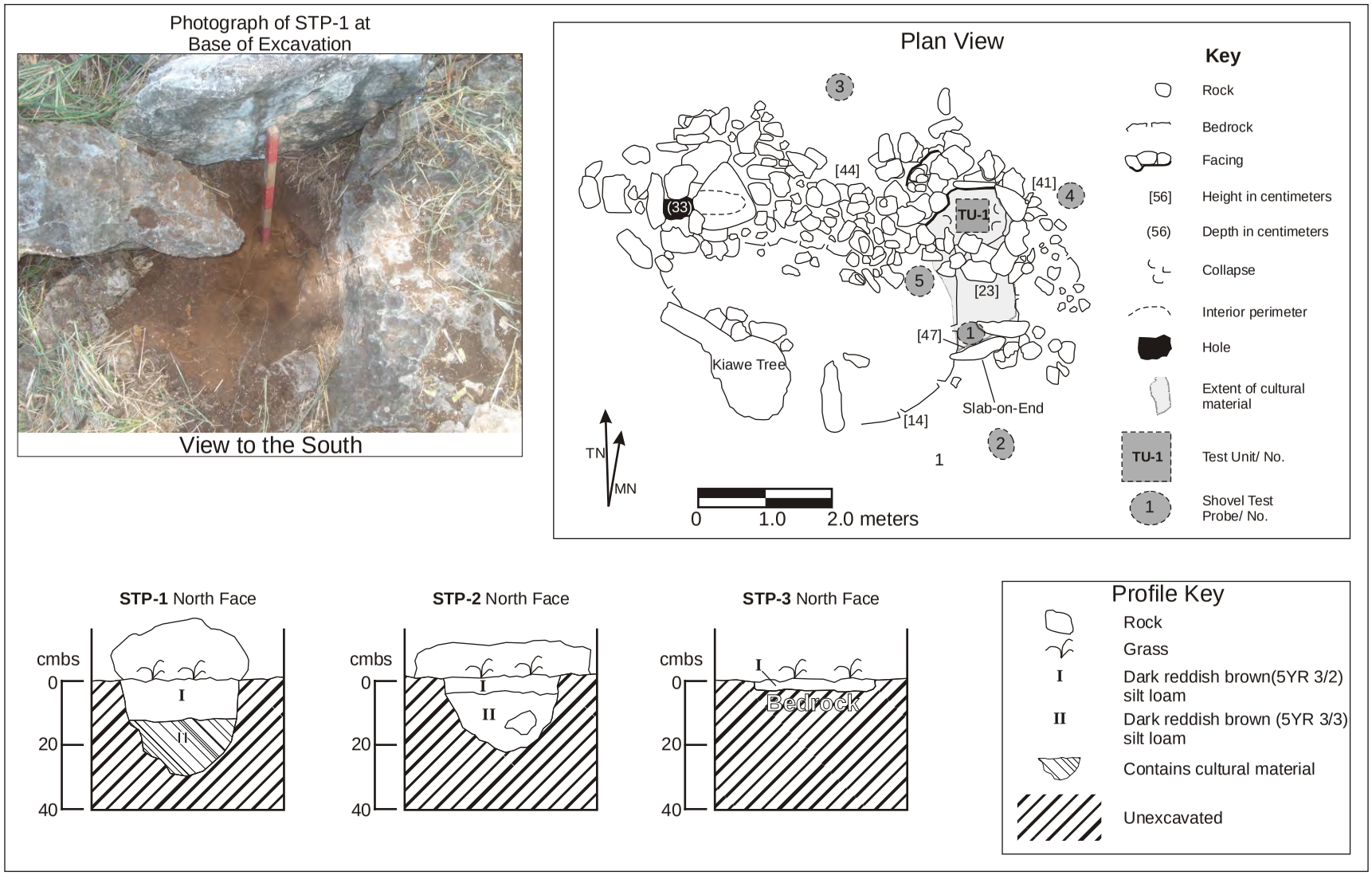


Figure 4-51. Site 7176, Feature A Plan View, Showing Location of STP1-5, with Profiles of STP1-3 and STP1 Photograph.

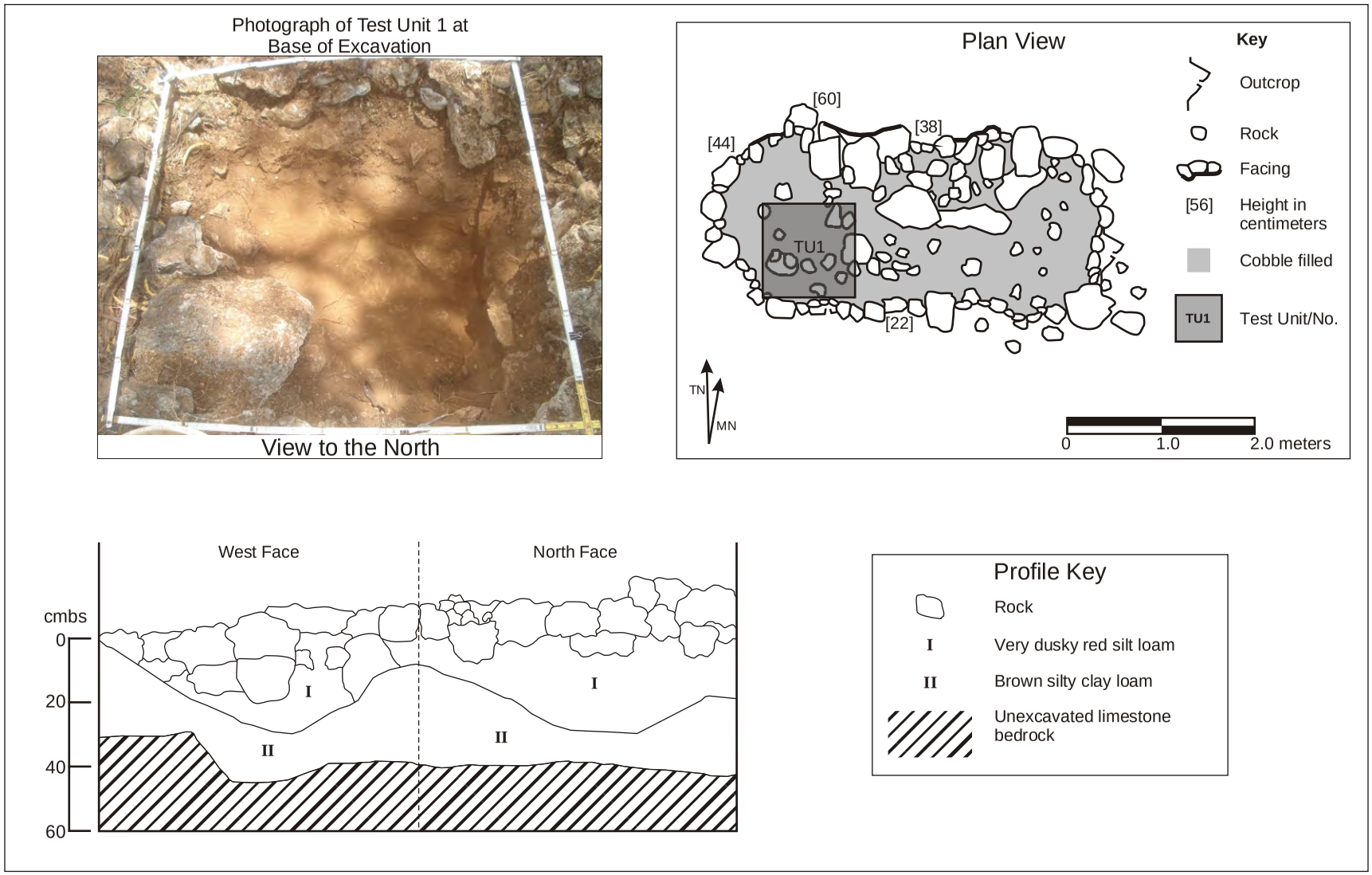


Figure 4-52. Site 7176, Feature B Plan View, Showing Location of TU-1, with Profiles and Photograph.

State Site 50-80-12-7177

Temporary Site Number: T-3, T-4, T-5, T-6
Site Type: Feature complex
Site Function: Military/industrial
Site Dimensions: 180 m by 75.0 m
Number of Features: 7
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various grasses
2011 GPS File No.: 004-013, 023-052
Current Status: New Site

Description:

Site 7177 is located approximately 35.0 m east of a north/south extending coral road located on the west side of the property and starts about 100 m north of Mumba Road. The position configuration of the site (see Figure 4-2). The site consists of five concrete features (Features A, B, E, F, and G) and two concrete vaults (Features C and D). The locations of the features are shown on Figure 4-2.

Feature A is a large rectangular-shaped concrete foundation measuring approximately 23.6 m by 12.1 m and 27.0 cm thick with the long axis oriented roughly north/south (Figures 4-53 and 4-54). The foundation is made of several quadrangular-shaped pours with a gentle slope towards the west. Two concrete footings are present on the foundation, one along the east side and the other near the south end: each measure approximately 35.0 cm by 35.0 cm and 23.0 cm high. The feature is in fair condition and has been altered.

Also present on the foundation are three areas of graffiti (Figure 4-55). The first is located in the northwest corner of the foundation and reads: "1st SGT BTRY D 870."

The second area is located approximately 4.0 m east/southeast of the first and consists of a less visible and hard to read set of letters. The letters that can be made out include: "PO?FOSE."

The third area is located approximately 4.0 m south of the second and consists of the letters: "REN."

Feature B appears to be a small, trapezoidal-shaped concrete foundation located approximately 9.0 m northwest of the northwest corner of Feature A (see Figures 4-2 and 4-53). The foundation appears to be in a slightly depressed area and is heavily disturbed. The foundation measures approximately 2.7 m by 2.4 m with a thickness of 10.0 cm. The feature is in fair condition and has been altered.

The only artifacts observed at the site were one brown colored and two clear colored glass fragments.

Feature C is a rectangular-shaped concrete subterranean vault located approximately 30.0 m northwest of Feature B (see Figure 4-2; Figure 4-56). It measures approximately 4.0 m by 1.0 m with two concrete and metal hatches present on both ends of the surface of the vault (Figure 4-57). The hatches both measure roughly 0.6 m square and have two bent rebar handles. The interior of the vault was not entered but photographs were taken. The interior measures approximately 3.5 m by 0.8 m and is at least 3.5 m deep (soil accumulation on the floor prevented an accurate depth measurement). The interior of the vault contains two iron pipes, one at each hatch opening, and a cinder block wall at the west end (Figure 4-58). The

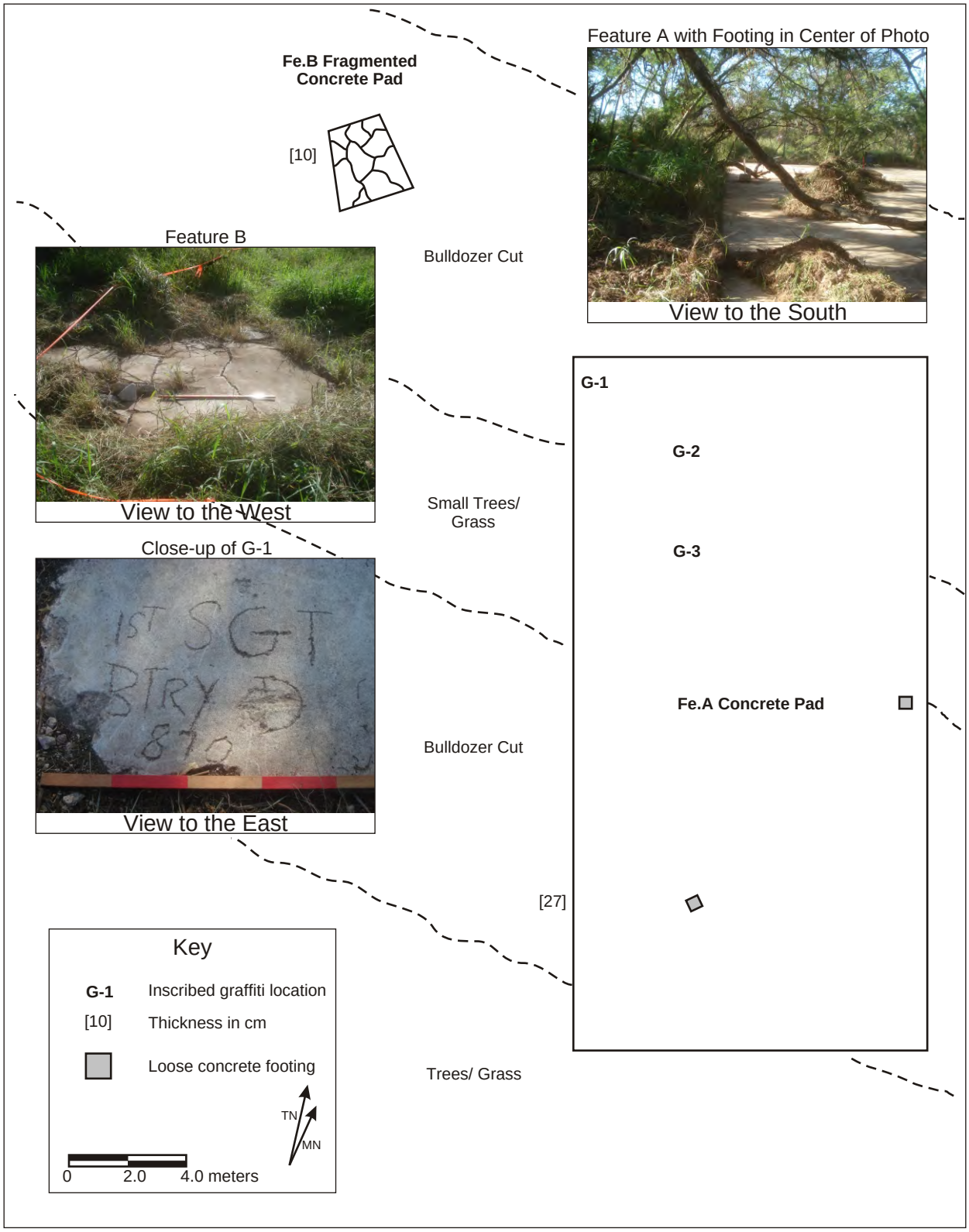


Figure 4-53. Site 7177, Features A and B, Plan View and Photographs.

Site 7177, Feature A, concrete foundation; view to south.

Site 7177, Feature A, concrete foundation, view to southeast.

Figure 4-54. Photographs of Site 7177, Feature A.

Site 7177, graffiti on Feature A concrete foundation,

Site 7177, graffiti on Feature A concrete foundation.

Figure 4-55. Photographs of Graffiti on Feature A Concrete Foundation.

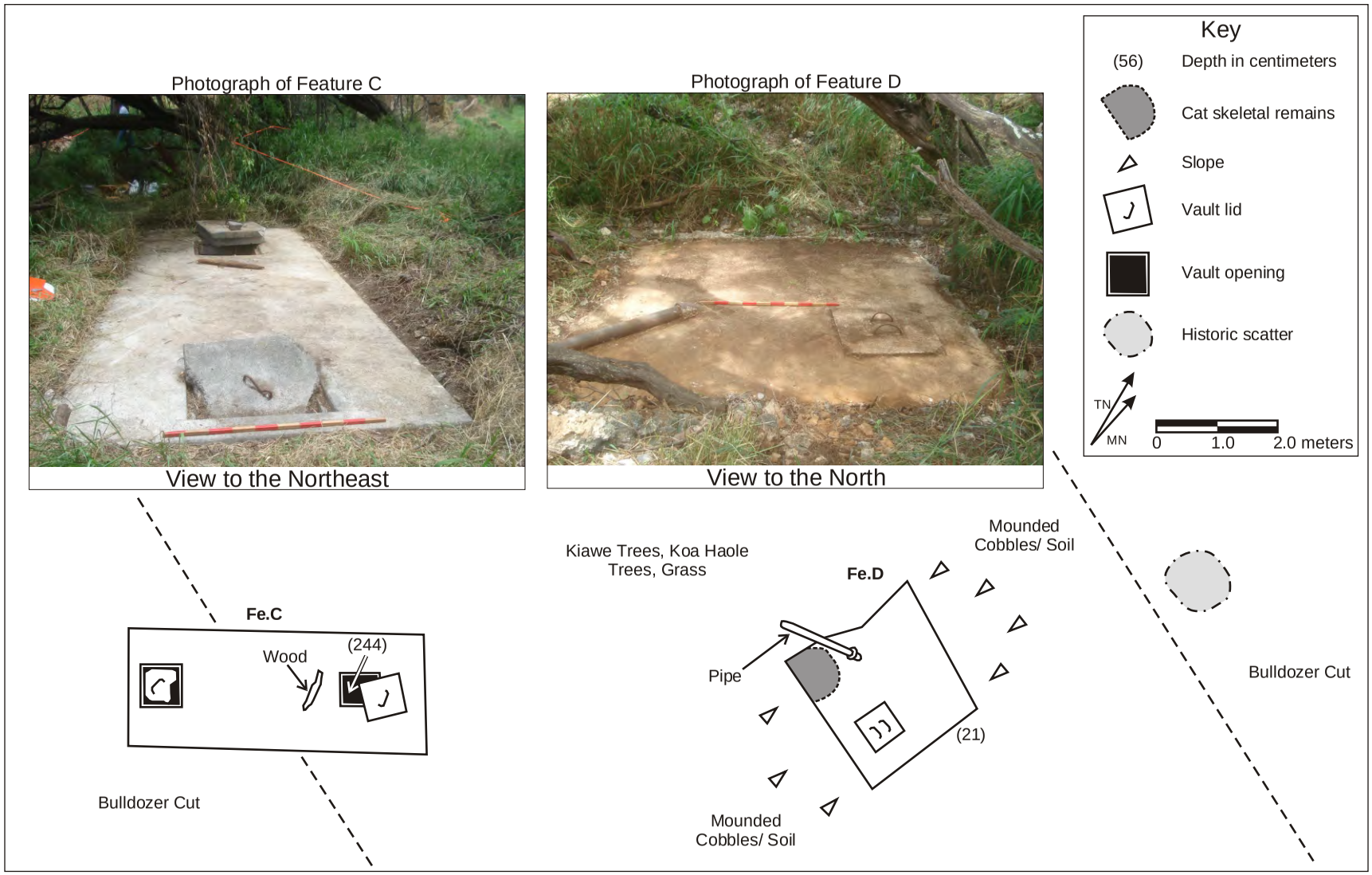


Figure 4-56. Site 7177, Features C and D, Plan View and Photographs.

Site 7177, Feature C; top surface of concrete vault with two hatches; view to east.

Site 7177, Feature C; close-up of hatch on surface of vault; view to east.

Figure 4-57. Photographs of Site 7177, Feature C Concrete Vault.

Site 7177, Feature C; interior of vault on east side (view straight down).

Site 7177, Feature C; interior of vault with pipe on east wall.

Figure 4-58. Photographs of Site 7177, Feature C Subterranean Interior.

pipes extend out of the wall with a T-joint extending vertically with both ends of the T-joint open. The pipe in the west wall appears to be placed higher than the pipe in the east wall. The cinder block wall starts about 0.3 m from the ceiling and extends down approximately 1.0 m down (Figure 4-59). The feature is in good condition and unaltered.

Feature D is a second subterranean concrete vault situated about 6.0 m northeast of Feature C (see Figure 4-2). This vault is roughly square-shaped, measuring about 2.5 m square (see Figure 4-56). In the southeast quadrant of the vault a metal and concrete hatch is present; an iron pipe is present in the southwest (see Figure 4-59). The hatch is closed and could not be opened. The pipe measures about four inches (10.0 cm) and appears to extend into the vault's interior. In the northwest corner of the vault a concentration of limestone cobbles was found and underlying the cobbles was a skeleton of a cat. Scattered broken glass and metal bottle caps were found on the vault's surface. A small scatter of historic glass artifacts (mostly glass bottle fragments and two whole bottles) is present to the northeast of the feature (see Table B-6 in Appendix B). The feature is in good condition and unaltered.

Feature E is a square-shaped concrete foundation located approximately 35.0 m northwest of Feature G and 2.4 m west of Feature F (Figures 4-60 and 4-61; see Figure 4-2). It measures approximately 4.8 m by 4.8 m and is 40.0 cm thick. The foundation has scratch marks on the surface. The concrete has gravel "temper" but no internal rebar is apparent. Form molds are present on perimeter and exterior walls. Nails or nail holes are present in the eastern and southern end. There are two metal posts present in the southern end. The foundation's west side is cracked and damaged. The feature is in fair condition and has been altered.

Feature F is a rectangular-shaped concrete foundation with an extension, or notch, on the north side (see Figures 4-2, 4-60, and 4-61). The foundation measures approximately 8.4 m by 8.0 m and appears to have been constructed with multiple concrete pours and has cinder blocks along perimeter of the foundation. There is threaded rebar in the northeastern, southeastern, and southwestern corners of the foundation. The northwest corner probably was an enclosed space with finished floors painted with a bluish gray paint. The northwest portion of the foundation is 4.0 m by 3.2 m and 25.0 cm thick. Nails are present in all four corners of the northwest portion of the foundation. Southwest and east walls include rough form as well as pre-form blocks. The rough form is 11.0 cm thick. Some patterns differ based on pour events and may indicate additions to the original structure. The feature is in fair condition and altered.

Feature G is a single concrete foundation located roughly 35.0 m north of Feature D (Figure 4-62; see Figure 4-2). It measures approximately 9.2 m by 7.6 m and has a thickness range of 10.0 to 25.0 cm. The foundation appears to be made with a single concrete pour with sand in concrete matrix. On the north, east, and south sides, a 10-cm-wide curb is present on the edge of the foundation's surface (Figure 4-63). The interior portion of the curb is beveled (i.e., 45 degree slope) (see Figure 4-62). The northeast corner of the foundation is broken. The feature is in fair condition and has been altered.

Interpretation, Significance, and Recommendations

Site 7177 consists of seven dispersed concrete military/industrial features likely associated with other destroyed infrastructure. All above-ground elements associated with the concrete foundations have been removed or destroyed. Through mapping and detailed recording, the significance of the site at the Criterion D level has been realized and any potential adverse impacts to the site have been mitigated. It is recommended that Site 7177 is not eligible for inclusion on the NRHP or HRHP. Because potential impacts have been mitigated, no further work is recommended.

Site 7177, Feature C; subterranean interior of west sides of vault; view to west.

Site 7177, Feature D; surface of second vault with hatch and pipe; view to north.

Figure 4-59. Photographs of Site 7177, Feature C and Feature D.

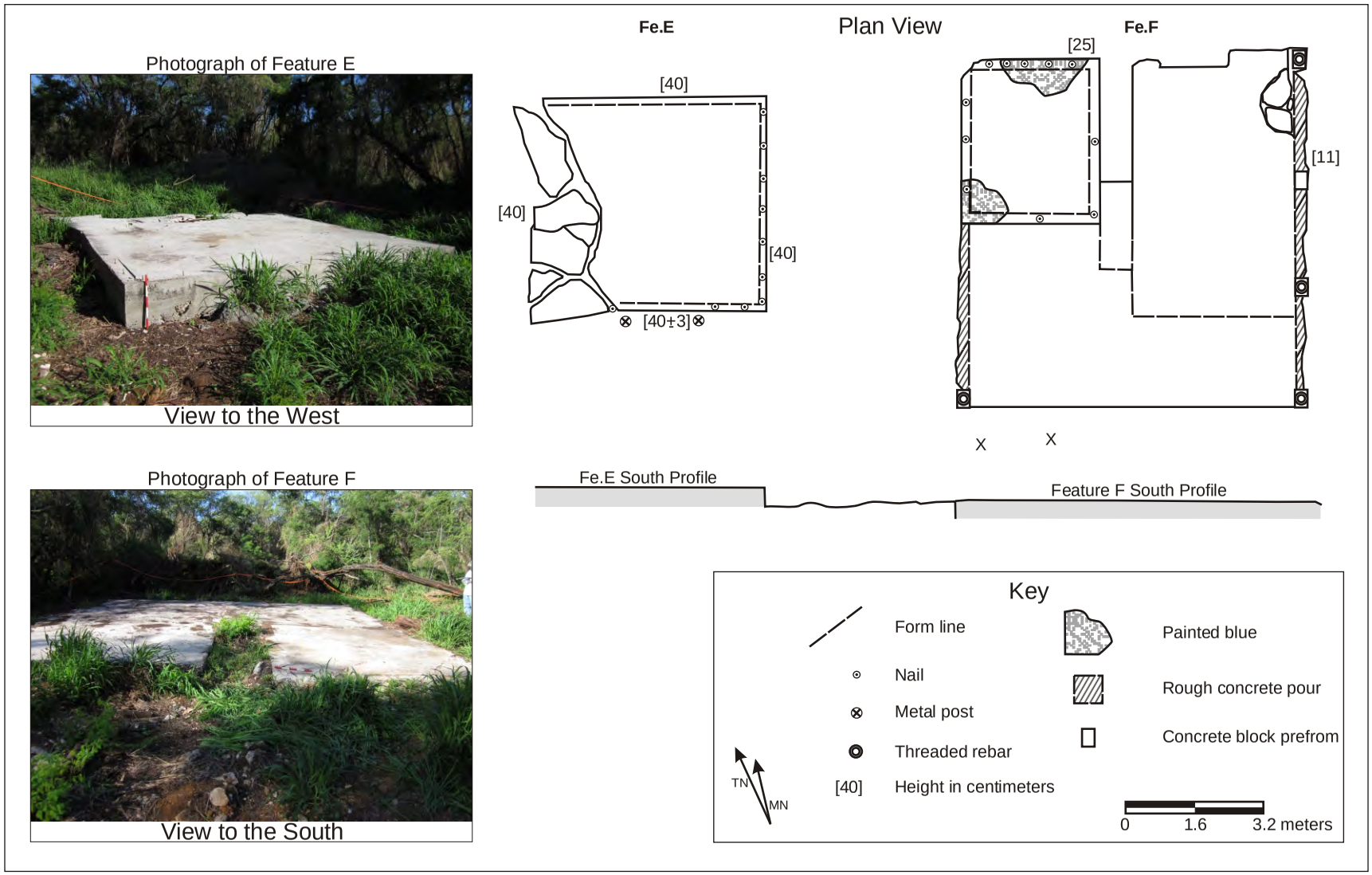


Figure 4-60. Site 7177, Features E and F, Plan View, Profile, and Photographs.

Site 7177, Feature E; concrete foundation, view to northwest.

Site 7177, Feature F; concrete foundation, view to south.

Figure 4-61. Photographs of Site 7177, Features E and F.

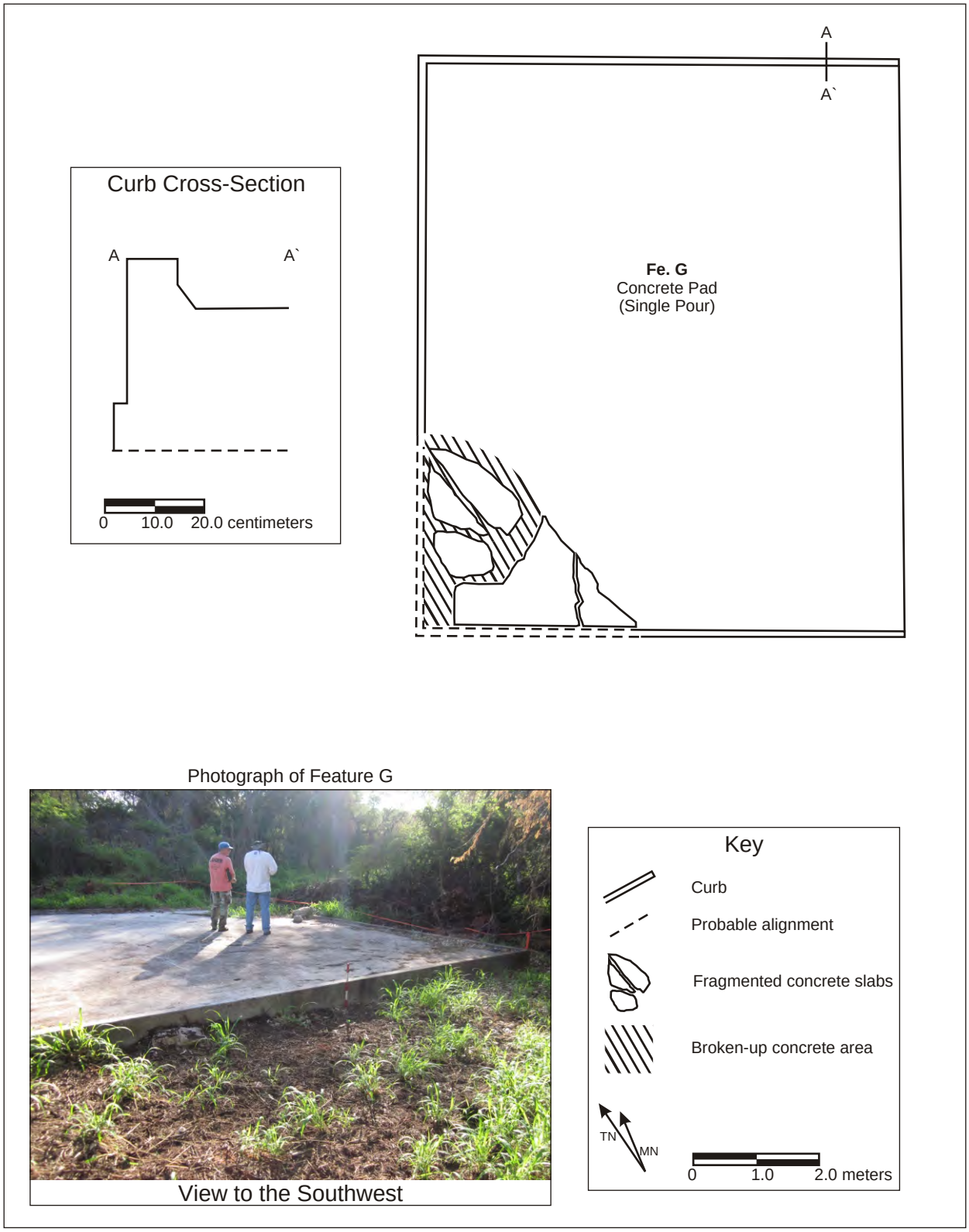


Figure 4-62. Site 7177, Feature G, Plan View, Cross-Section, and Photograph.

Site 7177, Feature G concrete foundation; view to north.

Site 7177, concrete foundation; close-up of southeast corner showing curb.

Figure 4-63. Photographs of Site 7177, Feature G.

State Site 50-80-12-7181

Temporary Site Number: T-7
Site Type: Historic artifact scatter
Site Function: Military dump
Site Dimensions: 44.0 m by 20.0 m
Number of Features: 2
Topography: Relatively level, upraised coral limestone reef
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 007-015
Current Status: New Site.

Description:

Site 7181 is located approximately 32.0 m east of Feature G of Site 7177 (see Figure 4-2). The site consists of surface scatter of historic artifacts from around 1945. Site 7181 is situated adjacent to an east/west bulldozer cut, and contains two areas of surface artifact scatters, designated as Features A and B (Figure 4-64). The site includes two features.

Feature A consists of a roughly oval area that measure approximately 20.0 m north/south and 10.0 m east/west (see Figure 4-64). The historic artifacts observed at Feature A are glass bottles, some ceramic material and metal material (see Table B-6 in Appendix B). The feature is in good condition.

Feature B consists of a roughly circle area that measure approximately 5.0 m in diameter (see Figure 4-64). Feature B located approximately 27.0 m east of Feature A along the north margin of bulldozed cut. The historic artifacts observed at Feature B are glass bottles (see Table B-6 in Appendix B). The feature is in good condition.

The glass bottle assemblage consists primarily of beer bottles (brown with crown cap) and appears to represent the period around 1945 ± 5 years. Maker marks on the beer bottles include the Anchor Hocking Corporation (anchor with a superimposed H) and Owens-Illinois Glass Company (Duraglas/diamond with superimposed oval and I). A representative sample of diagnostic bottles were taken from surface of both Feature A and Feature B (see Section 5 Results of Laboratory Analyses). Cultural material not collected includes a porcelain toilet fragments and miscellaneous metal fragments. Approximately 30 of the glass bottles observed in Feature A and Feature B were not collected.

Interpretation, Significance, and Recommendations

Site 7181 consists of two historic bottle dump locations dating to around World War II. The features likely represent individual dumping events rather than prolonged use of the area. The site lacks sufficient historic context or integrity to be considered for NRHP significance and any significance associated with the site has been realized through mapping and data collection. Site 7181 is recommended not eligible for inclusion on the NRHP or HRHP. No further work is recommended.

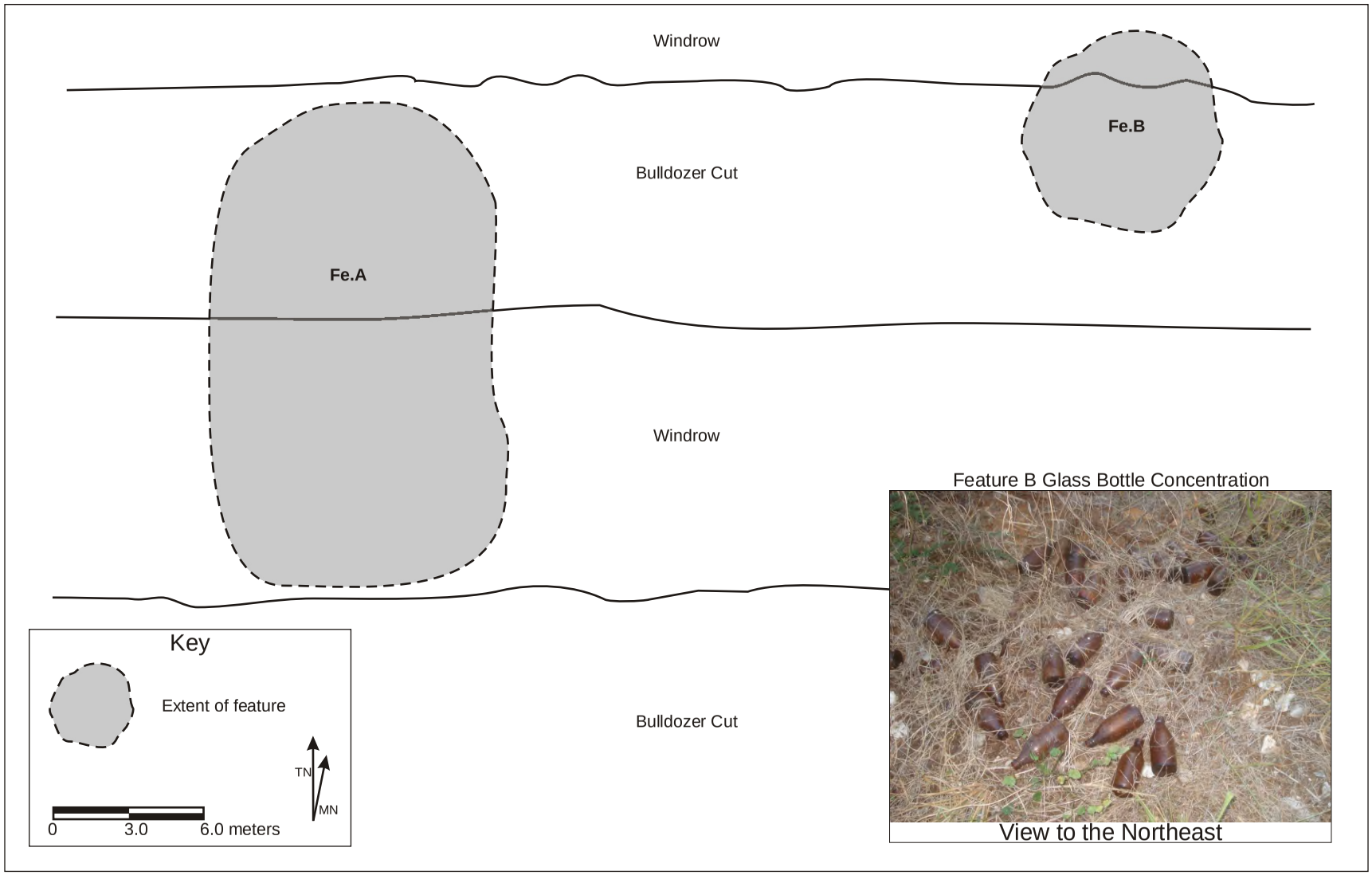


Figure 4-64. Site 7181, Features A and B, Plan View and Photograph..

State Site 50-80-12-7180

Temporary Site Number: Gun Emplacement
Site Type: Concrete dome
Site Function: Gun emplacement
Site Dimensions: 3.0 m by 3.0 m
Number of Features: 1
Topography: Relatively level, upraised coral limestone reef with scattered cobbles and small boulders
Vegetation: *Koa-haole*, *kiawe*, various vines and grasses
2011 GPS File No.: 137
Current Status: New Site

Description:

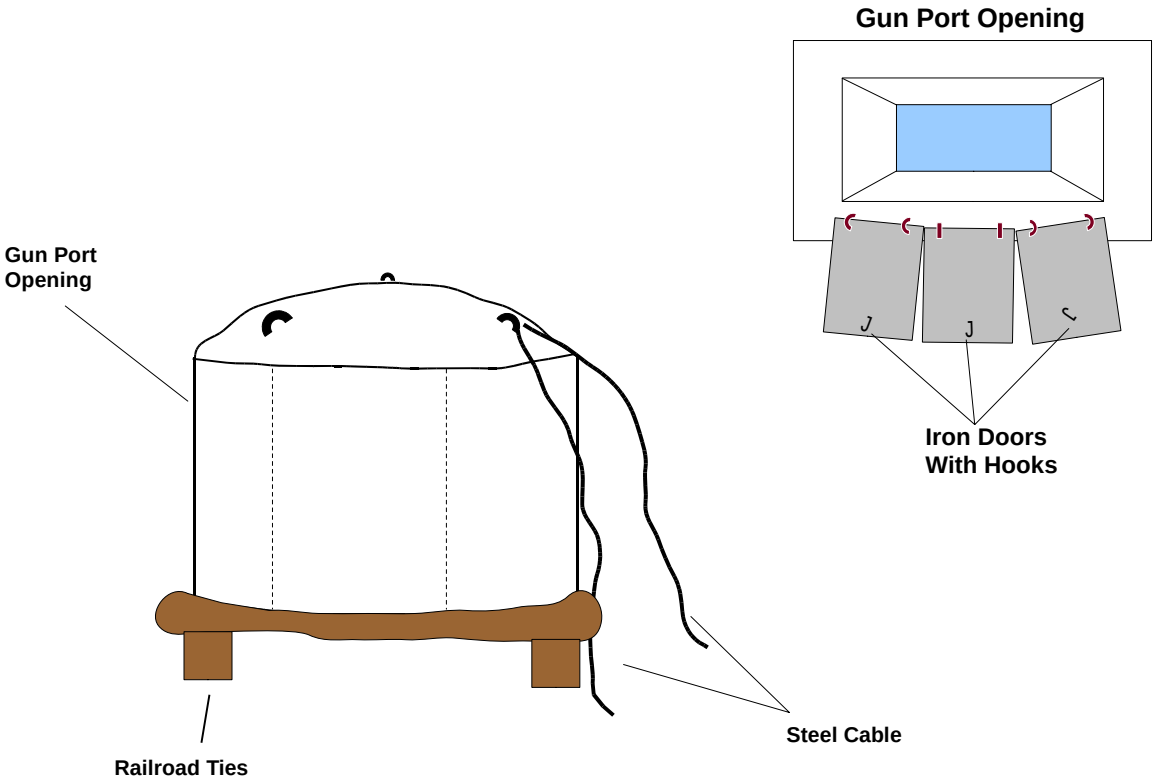
Site 7180 is a circular domed concrete structure situated approximately 7.0 m north/northwest of Mumba Road (see Figure 4-2). The structure is approximately 2.0 m in diameter and is 1.1 m high to the base of the dome; the dome is an addition 0.31 m high (Figure 4-65). The structure is supported off the ground by a series of railroad ties. A metal cable is attached to one or more of these railroad ties and extends up to the dome where there are three rebar bent in half forming a half circle. The cable passes through one of these rebar and extends back down towards the ground.

Located on the southwest side of the structure is an opening (window) with three iron doors, each measure 34.0 cm long by 25.0 cm wide and 4.0 cm thick. The doors are hinged at one end and have iron hooks at the other end (see Figure 4-65). Peering through the window a vertically placed threaded iron bar is visible. The feature is in good to excellent condition and is unaltered.

According to a local expert in WWII military defense structures, Mr. John Bennett, this site is a portable machine gun pill box (see Appendix F).

Interpretation, Significance, and Recommendations

Site 7180 consists of one portable gun emplacement removed from its original position. The site lacks historic context and does not qualify for inclusion on the NRHP or the HRHP. No further work is recommended. Some interest has been expressed in seeing this portable structure donated to the Barbers Point Naval Air Station Museum.



View to North

View to Northwest

Figure 4-65. Site 7180, Concrete Machine Gun Pillbox.

Boring Locale 1

During geo-technical core sampling in the KS2 project area, Boring Locale 1, located at the northern end of KS2 (see Figure 4-1; Figure 4-66), yielded fragmented mammal bone in the sediments brought up with the coring device. The geotechnical contractor provided PCSI with the fragmented bone which was subsequently identified as Medium Mammal. Because of the presence of this bone, the Boring Locale 1 area was subjected to subsurface testing to determine if a subsurface cultural deposit was present associated with bone. No above-ground architecture was present in the locale.

A single excavation unit, TU-1, was placed in the designated area in a bulldozed cut (Figure 4-67). The unit measured 1.0 m by 1.0 m that was excavated in one layer to a depth of 28.0 cm. Excavation was terminated on bedrock.

Layers I contained a single glass fragment.

Stratigraphy, southeast wall profile:

I 12-15 cm thickness; reddish brown (5YR 4/4, dry); silt; granular structure; slightly sticky, slightly plastic; few medium roots.

In addition to TU-1, a total of three shovel test probes were excavated in probed areas that indicated loose soil approximately 10.0 m from TU-1 (see Figure 4-66). STP1 measured approximately 60.0 cm diameter and 40.0 cm depth. STP2 measured approximately 30.0 cm diameter and 40.0 cm depth. STP3 measured approximately 50.0 cm and 50.0 cm depth.

STP1, located east/southeast of TU-1, contained a single small mammal bone possibly a rat; STP2, located northeast of STP1, contained a fragments of glass, plastic, yarn, aluminum foil, and metal (modern rubbish); and STP3, located adjacent to the southwest of STP2, contained a relatively recent dog burial, fragments of marine shell, and modern trash, including a possible dog collar. A larger fragment of the collar was observed in the grass adjacent to STP3.

Significance Evaluation and Recommendations

The cultural material and dog remains found in the vicinity of Boring Locale 1 appear to be modern in origin and do not qualify for inclusion on the NRHP or HRHP. No further work is recommended.

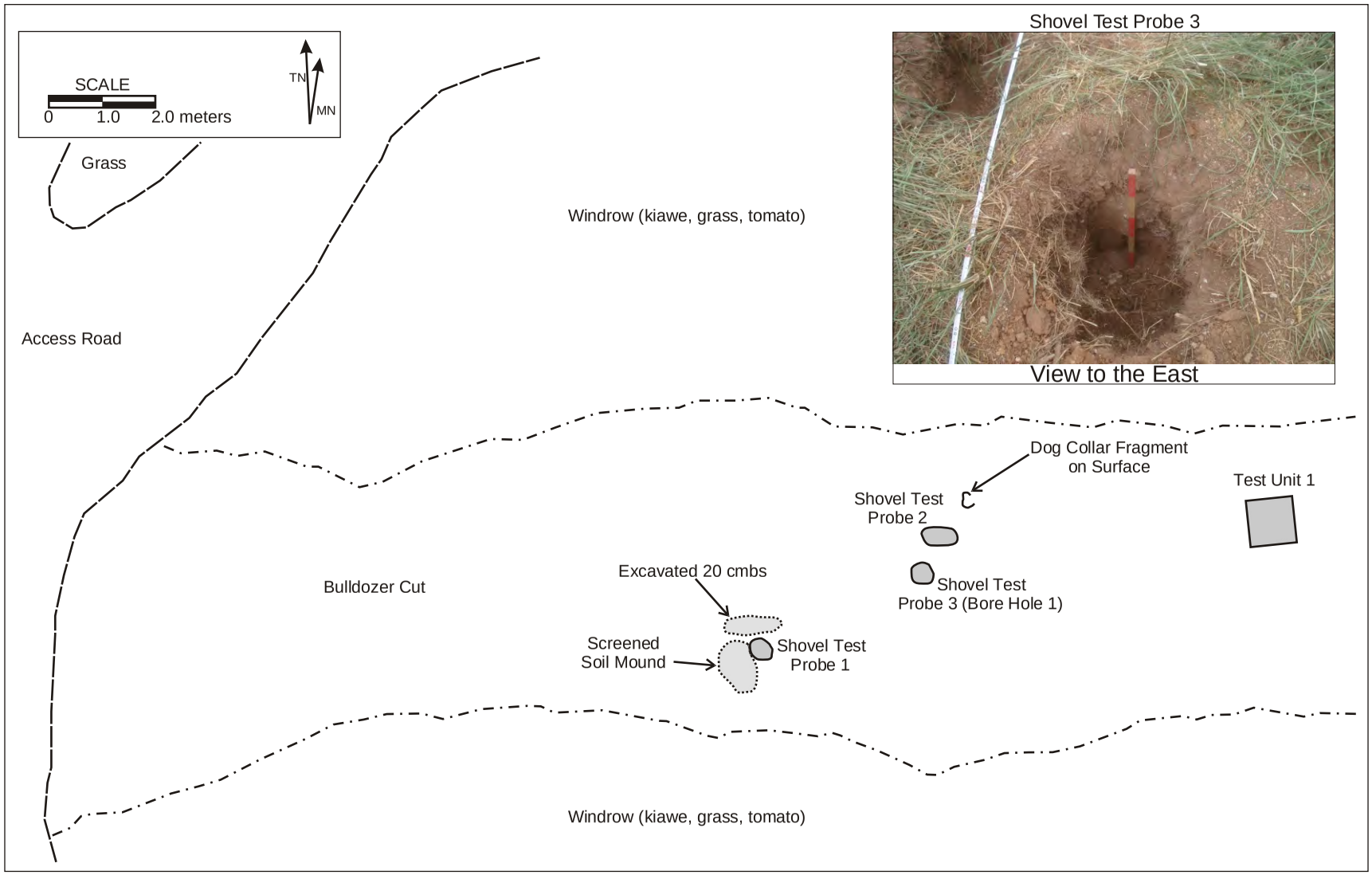


Figure 4-66. Boring Locale 1, Plan View Showing Locations of TU-1 and STP1-3 with Photograph.

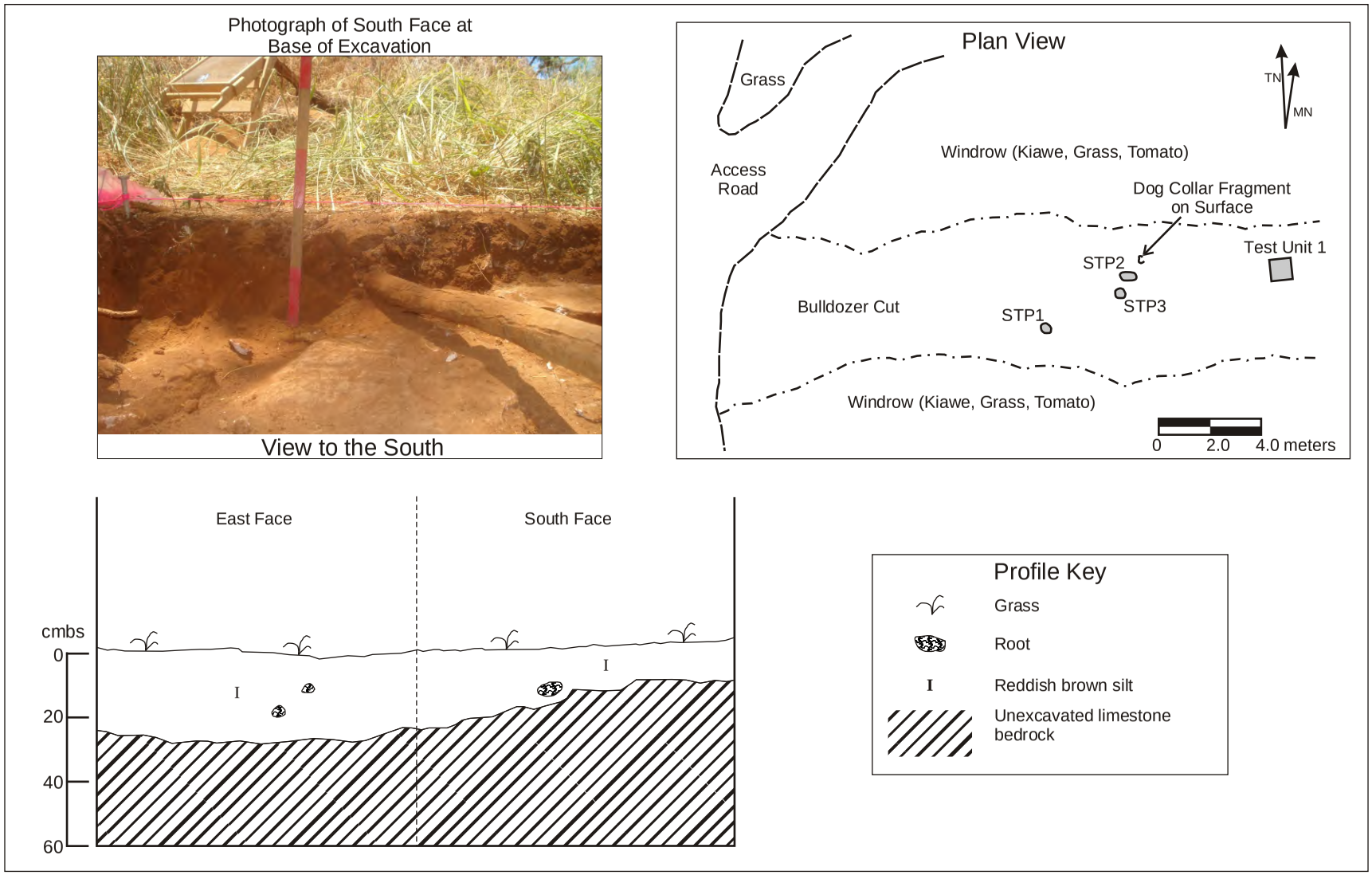


Figure 4-67. Boring Locale 1, Plan View and Profiles of TU-1.

SECTION 5 RESULTS OF LABORATORY ANALYSIS

This section summarizes the identification and analysis of cultural materials collected during 1995 test excavations conducted by PHRI (Beardsley 2001) at sites in KS1 and KS2 project areas, including Sites 1717, 1718, 1719, 1720, 1721, and 1722. It also presents the identification and analyses of cultural materials collected during the 2011 test excavations at selected archaeological sites on the KSP1 and KSP2 project areas, including Sites 1717, 1718, 7182, 7184, 7185, and 7186. The cultural materials discussed include sections on artifacts, faunal remains, paleontological remains from sinkholes, and floral remains. In each of these sections, a summary of the laboratory results of recovered cultural materials from Beardsley's (2001) 1995 excavations are presented first.

SUMMARY OF ARTIFACTS RECOVERED IN 1995 TEST EXCAVATIONS

A total of 116 artifacts were recovered from test excavations in selected features from six sites located in the KS1 and KS2 project areas during the 1995 test excavations by Beardsley (2001:Table V-1). The six sites and features are listed in Table 5-1. The features in Table 5-1 are all interpreted as habitation features with the exception of Feature A of Site 1721, where fragments of human bone were recovered during the 1995 test excavations. It is possible that a complete burial may be present. Site types include four enclosures, two L-shaped walls, one C-shaped wall, a cairn, and a modified sinkhole.

Table 5-1. Sites and Features with Recovered Artifacts from 1995 Testing.

Site	Feature	Feature type	Feature . Function	Test Unit	Area Excavated m3	2011 Area
1717	D	Enclosure	Habitation	EU-52	1.0	KS1
1717	F	Enclosure	Habitation	EU-53	1.0	KS1
1718	C	L-shaped wall	Habitation	EU-37	1.0	KS1
1719	B	Enclosure	Habitation	EU-28, EU-33	2.0	KS1
1719	C	Enclosure	Habitation	EU-31	1.0	KS1
1720	B	C-shaped wall	Habitation	EU-34	0.5	KS1
1722	O	Cairn	Habitation	EU-50	0.25	KS1
1721	A	Modified sinkhole	Habitation, possible burial	EU-44	1.0	KS2
1721	D	L-shaped wall	Habitation	EU-43	1.0	KS2

Table 5-2 presents the distribution of traditional and historic artifacts by sites and features from the 1995 excavations. The artifacts are briefly summarized below.

Traditional Artifacts

Of the 116 artifacts, 66 were identified as indigenous or traditional, artifacts. Traditional artifacts recovered by Beardsley's (2001) test excavations at these six sites include items fashioned from basalt, volcanic glass, limestone, coral, shell, and mammal bone. A majority of the artifacts were recovered from Site 1721, Feature A, a modified sinkhole (see Table 5-2).

Table 5-2. Distribution of Artifacts from 1995 Test Excavations.

	KS1							KS2		
Site	**1717**	**1717**	**1718**	**1719**	**1719**	**1720**	**1722**	**1721**	**1721**	**Total**
Feature	**D**	**F**	**C**	**B**	**C**	**B**	**O**	**A**	**D**	
Artifacts										
Basalt Adze						1				1
Basalt flakes				1				5		6
Volcanic glass flakes								15		15
Flaked limestone	15	3		1				11		30
Coral abrader				1				3	1	5
Shell gourd stopper								1		1
Bone Fishhook								4		4
Bone fishhook tab								1		1
Modified bone								1		1
Bone ornament								2		2
Total Indigenous Artifacts	**15**	**3**	**0**	**3**	**0**	**1**	**0**	**43**	**1**	**66**
Non-diagnostic glass fragments	12					34	1			47
Metal fragment						1				1
Lead pellet			1		1					2
Total Historic Artifacts	**12**	**0**	**1**	**0**	**1**	**35**	**1**	**0**	**0**	**50**
Total Artifacts	**27**	**3**	**1**	**3**	**1**	**36**	**1**	**43**	**1**	**116**

Adze

Adzes were the principal wood working implement in the pre-Contact Hawaiian toolkit. They were used for felling trees, rough and fine shaping of wooden implements, hollowing out logs for canoes, shaping posts, and other related woodworking tasks. A single basalt adze was recovered from Site 1720, Feature B (EU-34, Layer I/2). This specimen is an untanged adze with a rectangular cross-section (Beardsley 2001: Table V-4). It measured about 5.3 by 2.1 cm and was about 1.3 cm thick. The cutting edge is V-shaped in profile and the poll is rounded.

Flaked Stone

Beardsley (2001:V.17) noted that flaked stone artifacts were the most abundant artifacts among the traditional artifact categories. She evaluated flaked stone artifacts (or debitage) according to flake and core type, following procedures for cataloguing flaked stone material outlined in Sullivan and Rozen (1985). The debitage was divided into four categories based on the presence or absence of three variables: a single interior surface, a point of applied force, and intact margins. She defined complete flakes as pieces exhibiting all three of these variables. Six basalt flakes, 30 limestone flakes, and 15 volcanic glass flakes were recovered in test excavations at Sites 1717, 1719, and 1721. Based on Table 5-2, the modified sinkhole at Site 1721 (Feature A) yielded a majority of the flaked stone from the six sites Beardsley (2001; Table V-1) tested in the KS1 and KS2 project areas.

It is not surprising that limestone flakes were more abundant than basalt or volcanic glass. Because the architectural features are constructed with limestone boulders, slabs, and

cobbles, Beardsley (2001:V.17-V.19) carefully inspected the limestone debitage to determine if it was naturally or artificially sheared material, if it was a bi-product of the architecture or other activities that makes use of limestone cobbles (such as cooking). Limestone can spall from either natural causes (e.g., weathering) or artificial means (e.g., heating). In an analysis of fire-cracked limestone cobbles, Tuggle (1995:18) noted that spalls or fragments from these cobbles can share many of the same attributes as intentionally produced flakes and shatter.

After analyzing the flaked stone (presence/absence of cortex, dorsal ridges, direction of dorsal scars, types of force bulbs, flake termination type, platform type and general shape of flakes in plan), Beardsley concluded that there was no consistent patterning of attributes within or between the basalt, volcanic glass, or limestone debitage that would imply homogeneous or specialized lithic production was occurring in the project area (Beardsley 2001:V.19).

Coral Abraders

Coral abraders were likely manufactured, and used, as fine wood shaping and sanding tools, and occur in a wide range of sizes and shapes. Five coral abraders were recovered during the 1995 test excavations in Sites 1719 (Feature B) and 1721 (Features A and D) (see Table 5-2). Of these five, three were recovered from excavations at the modified sinkhole in Site 1721 (Feature A), and one each from Feature D at Site 1721 and Feature B (enclosure) at Site 1719.

Beardsley (2001: evaluated coral abraders according to their overall shape in plan view, following the classification system and nomenclature set forth by Suggs (1961) to describe coral abraders found at Nuku Hiva, in the Marquesas Islands. This classification includes data such as completeness (whole versus fragmentary), number of facets, cross-section shape, plan view shape, and size. Beardsley, however, did not present the results of her analysis in the context of provenience for each abraders (Beardsley 2001:Table V-5). We therefore cannot present detailed information for the five coral abraders recovered from Sites 1719 and 1721. Because of the presence of bone fishhooks recovered from excavations at Site 1721, Feature A (modified sinkhole), however, it is likely that among the three coral abraders from this site are types that were used in the manufacture of fishhooks (Beardsley 2001: Figure V-5 in Appendix I). These abraders would likely be multi-faceted (2 to 4 facets), more pointed than blunt, and on the smaller end of the size range in length and width (Beardsley 2001: Table V.5).

Fishhooks, Tabs, and Modified Bone

Bone and shell fishhooks in Hawaii were studied and described by Buck (1957:324-342), and further described and classified by Emory et al. (1968). Their classification system for coding Hawaiian fishhooks was revised in the early 1990s (Sinoto 1991). In the KS1 and KS2 project areas, only Site 1721, Feature A, the modified sinkhole in KS2, yielded fishhooks and the residues of their manufacture (see Table 5-2).

According to Beardsley (2001:Table V-3), four bone fishhooks, one bone fishhook tab, and one piece of modified bone were found in excavations at Site 1721, Feature A. The four fishhooks include a single one-piece hook of indeterminate head type, a single one-piece rotating hook, and a pair of two-piece fishhooks (shank is separate from the point) with indeterminate head types.

The bone tab, also referred to as a fishhook blank (Emory et al.: 1968: Plate V) found in test excavations (EU-44) at the Feature A modified sinkhole is a triangular-shaped piece made from mammal bone. It is cut and abraded, and measures 0.8 by 1.5 cm. The tab represents initial stages of fishhook manufacture (Buck 1957:324; Emory et al. 1968: Plate V).

One piece of modified bone was also found at the Feature A modified sinkhole. Beardsley discussed artifact category of modified bone under “Miscellaneous Prehistoric Artifacts.” She identified items that:

> …are either so fragmentary or in such poor condition that they could not be identified other than by material. Items included modified basalt, shell, coral and bone. The materials were generally abraded in some fashion, or showed signs of being notched, polished, cut, or in the case of worked shell, drilled or perforated (Beardsley 2001:V.20)

Considering that the piece of modified bone was found in excavations in the Feature A modified sinkhole at Site 1721, in association with bone fishhooks and a bone fishhook tab, the modified bone could represent bone detritus associated with fishhook manufacture.

Bone Ornaments

The only two bone ornaments recovered from Beardsley’s 1995 excavation program were from the Feature A modified sinkhole at Site 1721 in KSP2. The ornaments consist of two drilled dog teeth. According to Buck (1957:545), the canine teeth of dogs (`īlio) were drilled through the root and strung on a cord, and worn as necklaces (lei`īlio). Buck indicates that the lei`īlio may have been used temporarily, but it is more likely that they were so strung until a sufficient number had been collected to make the dog-tooth leg ornament characteristic of Hawaii (Buck: 1957:345).

Shell Gourd Stopper

A single shell gourd stopper was recovered from excavations at the Feature A modified sinkhole at Site 1721. It measures 4.7 by 1.8 cm and has a drilled hole near the apex of the shell (Beardsley 2001: Appendix I, Figure V-8). While the species of marine shell was not identified by Beardsley, based on Figure V-8, it could be a member of the Cerithidae family.

Shell gourd stoppers were placed into the top of gourd water containers to prevent spillage (Buck 1957:56-57). A piece of cord was threaded through the hole for support (Buck 1957:57). A variety of shells have been identified in archaeological collections as gourd stoppers, including Terebra shells (Buck 1957:57; Kirch 1979:172; Han et al. 1986:124).

Historic Artifacts

Based on Beardsley (2001:V20-V.24; TableV-11), a total of 50 historic artifacts were recovered from excavations at Sites 1717, 1718, 1719, 1720, and 1722. The historic artifacts from these sites are manufactured from glass and metal.

Glass

Forty-three (43) of the 50 historic artifacts include pieces of fragmented historic glass from Sites 1717, 1720, and 1722 (see Table 5-2). Although Beardsley identified 5 bottle bases in Site 1720, Feature B (EU-34, Layer I; Beardsley 2001:Table V-11), she does not provide details of the bottle bases in terms of color or the presence/absence of manufacturer, or maker, marks.

She noted that glass was by far the most numerous category of material remains in the project area as a whole. Historic glass and traditional faunal materials and/or traditional artifacts were found mixed together in Site 1717, Feature D, Site 1720, Feature B (enclosure) Site 1722, Feature O (cairn).

Metal

Beardsley (2001:V-20) observed that metal artifacts in the project area range in age from historic to recent, and none are considered temporally diagnostic. Metal artifacts noted by Beardsley include (but not limited to) such items as keys, utensils, bath fixtures, cups, hose nozzle, aluminum bottle caps, ball bearings, rusted can fragments, office supplies, wire fragments, bolts, nails, rivets, screen fragments, screws, tacks and unidentified objects.

Three metal artifacts recovered from 1995 excavations at Sites 1718, 1719, and 1720 in the KSP1 project area sites. The largest category of metal artifacts identified by Beardsley (2001:V.20) consisted of metal components associated with weapons. Artifacts in this category included bird shot, centerfire cartridge fragments, shotgun shell fragments, bullet fragments, and pellets. Two lead pellets (one each) were recovered from excavations at Site 1718 (Feature C) and 1719 (Feature C). It is not certain what type of metal fragment was recovered from Site 1720 (Feature B).

ARTIFACTS RECOVERED FROM THE 2011 EXCAVATIONS

A total of 325 traditional Hawaiian and historic/recent artifacts were recovered during the 2011 surface collections and test excavations at five sites located in the KSP1 and KSP2 project areas. The sites include four from the KSP1 project area, Sites 1717, 1718, 1719, and 7182, and one site, Site T2, from the KSP2 project area. Table 5-3 summarizes the distribution of the 325 recovered traditional and historic artifacts by sites and features.

Traditional Artifacts

Of the 325 artifacts, 66 were identified as indigenous or traditional artifacts. Traditional artifacts recovered include one adze fragment, 64 pieces of basalt, volcanic glass, and limestone debitage, and one volcanic glass nodule (see Table 5-3). The stone artifacts recovered in 2011 excavations do not reveal patterns that are different from those discussed by Beardsley (2001:V.19). Tables B-1 through B-3 in Appendix B provide distribution information (test unit/layer/level) for sites where traditional artifacts from 2011 excavations were recovered.

Adze

One fragment of a basalt adze was recovered from the Feature J circular enclosure at Site 1718, TU-1, Layer II/1 (see Table B-2 in Appendix B). This specimen is a fragment of a polished adze that exhibits a rectangular cross-section. It is made from dark gray, dense basalt. It measures 3.5 m by 2.3 cm and is 1.2 cm thick (maximum). It has polished surfaces on all four sides. The bevel and the poll are missing.

Flaked Stone

Sixty-four (64) of the 66 traditional artifacts consisted of stone debitage (see Table 5-3; see Tables B-1 and B-2 in Appendix B). The debitage was evaluated according to flake and core type using similar procedures followed by Beardsley (2001). The debitage was divided into two categories (flakes and flake fragments) based on the presence or absence of three variables: a single interior surface, a point of applied force, and intact margins.

The debitage was comprised of basalt, volcanic glass and limestone. Unlike the 1995 excavations where limestone debitage was the most abundant debitage material type, volcanic glass was the most abundant debitage material type recovered in the 2011 excavations.

Three (3) basalt flake fragments were recovered from Site 1717 Feature E (see Table B-2 in Appendix B). These were recovered from Layer II/1 deposits in TU-1.

Table 5-3. Distribution of Artifacts from 2011 Test Excavations and Surface Collections.

	KS1									KS2			
Site	**1717**	**1718**	**1718**	**1719**	**7182**	**7182**	**7182**	**7182**	**7181**	**7177**	**7178**	**7178**	**Total**
Feature/Surface	**E**	**J**	**K**	**Surface**	**Surface**	**C**	**F**	**I**	**B**	**D**	**A**	**B**	
Traditional Hawaiian Artifacts													
Basalt adze fragment		1											1
Basalt flake fragment	3												3
Volcanic glass flake		13	9					3					25
Volcanic glass flake fragment		1	4					5					10
Volcanic glass core		7	2					2					11
Volcanic glass nodule		1											1
Limestone flake	1	6											7
Limestone flake fragment	2	6											8
Total Traditional Artifacts	**6**	**35**	**15**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**66**
Historic Artifacts													
Glass													
Whole bottles				12	3	27		1	9	1		1	54
Bottle Fragments				4		1	16			5		2	28
Jar				1									1
Window pane				3									3
Total Glass Artifacts	**0**	**0**	**0**	**20**	**3**	**28**	**16**	**1**	**9**	**6**	**0**	**3**	**86**
Ceramic													
Insulator				1									1
Total Ceramic Artifacts	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Metal													0
Whole can (rusted)				2	1								3
Can fragments (rusted)						4		2					6
Canteen					2								2
Screen fragment						4							4

Table 5-3. Distribution of Artifacts from 2011 Test Excavations and Surface Collections.

	KS1									KS2			
Site	**1717**	**1718**	**1718**	**1719**	**7182**	**7182**	**7182**	**7182**	**7181**	**7177**	**7178**	**7178**	**Total**
Battery						1							1
Rusted fragment						33							33
License plate							1						1
Wire				1								3	4
Nails											10	1	11
Barrel hoop fragments											67		67
Total Metal Artifacts	**0**	**0**	**0**	**3**	**3**	**42**	**1**	**2**	**0**	**0**	**77**	**4**	**132**
Miscellaneous													
Wood with plastic						1							1
Roofing material						36							36
Fiber board						2							2
Leather boot sole				1									1
Total Miscellaneous Artifacts	**0**	**0**	**0**	**1**	**0**	**39**	**0**	**0**	**0**	**0**	**0**	**0**	**40**
Total Historic Artifacts	**0**	**0**	**0**	**25**	**6**	**109**	**17**	**3**	**9**	**6**	**77**	**7**	**259**
Total Artifacts	**6**	**35**	**15**	**25**	**6**	**109**	**17**	**13**	**9**	**6**	**77**	**7**	**325**

A total of 47 volcanic glass artifacts were recovered from the 2011 excavations (see Table 5-3; see Tables B-1, B-2, and B-3 in Appendix B). Volcanic glass debitage, cores, and a volcanic glass nodule were recovered from excavations at Sites 1718 and 1782. At Site 1718, Feature J, 13 volcanic glass flakes, one flake fragment, and seven cores were recovered from Layer II deposits within and outside of the feature, a circular enclosure. At Site 1718, Feature K, a mound situated adjacent to Feature J, nine volcanic glass flakes, four flake fragments, and two cores were recovered. A majority (13 of 15) of these were recovered from Layer I deposits. Two volcanic glass flakes were recovered from Layer II deposits.

At Site 7182, Feature I, a sinkhole cluster, three volcanic glass flakes, five flake fragments and two cores were recovered from Layer I deposits.

One volcanic glass nodule was recovered from excavations in the Feature J circular enclosure at Site 1718. Glass nodules are unmodified pieces of volcanic glass, and thus can be considered to be manuports.

A total of 15 pieces of limestone debitage were recovered at Sites 1717 (Feature E) and 1718 (Feature J). These were recovered from Layer II deposits.

Historic Artifacts

This section provides a description and analysis of historic material recovered during 2011 surface collections and test excavations at sites in KS1 and KS2 project areas. A total of 259 historic artifacts were recovered from the 2011 excavations (see Table 5-3). Historic materials were recovered in KS1 at Site 1719 and Site 7182; and in KS2 in Site 7176, Site 7177, and Site 7181 (see Table 5-3). A descriptive catalogue of collected historic artifacts is provided in Appendix B (Tables B-8 and B-9). Historic artifacts are also presented by provenience in Tables B-3 through B-7 and B-10 in Appendix B.

The discussion is arranged by material categories: Glass, including bottles, jars, and window glass; Metal, which includes barrel hoops, tin cans, canteens, a license plate, nails and wire; Ceramic; and a Miscellaneous category which includes plastic, leather, wood, fiber-board and composite asphalt shingles.

Glass

A total of 86 glass artifacts were recovered during the 2011 surface collections and excavations. The historic assemblage is dominated by glass bottles and bottle fragments. The bottle assemblage consists primarily of complete bottles, several wide-mouth containers which may be considered jars, and a number of bottle base fragments all of which exhibit specific temporal attributes. Based on the presence of diagnostic mold seams, all of the bottles and jars in the assemblage were manufactured by the fully automated bottle machine after the standardization of a wide range of bottle finishes and closures which took place between 1930 and 1935 (Berge 1980). Prior to this period, mold seam analysis provided significant temporal information. Since this period of standardization, mold seams have remained unchanged. For dating relatively modern (yet historic) bottles, such as those in the present assemblage, the primary diagnostic temporal attribute is the presence of embossed product names or maker marks of bottle manufacturers. It is through the analysis of the changes through time of manufactures maker marks that the present assemblage of bottles may be dated.

Beer bottles are the most frequently represented in the assemblage. Eight distinctive types are identified and are described below as Types B-1 through B-8. Additionally, twelve specialty bottles types, containing primarily products such as cologne and hair tonic, of which a single example of each was recovered, are described as Types S-1 through S-12. For each

bottle type, a manufacture year date or date range is provided through diagnostic maker marks or a combination of embossed temporal attributes (see Table B-9 in Appendix B).

Beer Bottle Types

Type B-1 is an amber, cylindrical, crown cap, beer bottle. This is the most frequently beer bottle type represented in the assemblage with 21 examples (see Appendix B, Table B-8 and B-9). This type averages about 17.0 cm in height and about 6.5 cm in diameter. Height may vary by several centimeters.

The body and base of the Type B-1 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED” (Figure 5-1). On the base of the bottle appears the maker mark of the Owens Illinois Glass Co., and trade mark “Duraglas” in script (Figure 5-1). The maker mark, an “I” encircled by an “O” centered in a horizontal diamond is the mark used by the Owens Illinois Glass Co., between 1929 and 1954 (Toulouse 1971:403). Numbers representing the plant and the year the bottle was made are located to the left and right of the diamond. Mold details are represented by a number under the diamond (see Figure 5-1). The year date is represented as a single digit, for example “5”, but it remains unclear whether this number applies only to the decade of 1940. The term “Duraglas” was added in 1940 (Toulouse 1971:403). The instructions “NO DEPOSIT NO RETURN” appears on bottles after 1940 (Berge 1980). The presence of the "Duraglas" trademark, post 1940, and the Owens Illinois maker mark which was changed in 1954 provides the potential date range of between 1940 and 1954 for the manufacture of Type B-1 bottles.

Type B-2 is an amber, cylindrical, crown cap, beer bottle. Ten examples are present in the assemblage (see Appendix B). Type B-2 averages about 16.5 cm in height and 6.1 cm in diameter.

The body and base of the Type B-2 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. The base of the bottle exhibits the maker mark of the Anchor Hocking Glass Corporation, an anchor with a superimposed “H”, which has been in use since 1938 (Toulouse 1971:46-48). On the Type B-2 bottles the maker mark includes four sets of numbers located at the left and right and top and bottom of the maker mark. The right side numbers represent the year of manufacture and are represented in two digits such as “45” (see Figure 5-1). This allows the assignment of a specific year of manufacture for each of the Type B-2 examples (see Appendix B). The years of manufacture range from 1942 to 1945.

Type B-3 is a clear, cylindrical, crown cap, beer bottle. Only one example is represented in the assemblage (see Appendix B). Type B-3 is 17.2 cm in height and 6.5 cm in diameter.

The body and base of the Type B-3 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. The base of the bottle exhibits the maker mark of the Anchor Hocking Glass Corporation, an anchor with a superimposed “H”, in use since 1938 (Toulouse 1971:46-48). On the Type B-3 bottle the maker mark includes four sets of numbers located at the left and right and top and bottom of the maker mark. The right side numbers, representing the year of manufacture, indicate the bottle was made in 1943 (see Figure 5-1).

Type B-4 is a clear, cylindrical, crown cap, beer bottle. Only one example is represented in the assemblage (see Appendix B, Table B-9). Type B-4 is 17.0 cm in height and 6.5 cm in diameter.

Glass beer bottles; types B-1, B-2 and B-3; side view.

Glass beer bottles; types B-1, B-2 and B-3; bottom view.

Figure 5-1. Photographs of Beer Bottle Types B-1, B-2 and B-3.

The body and base of the Type B-4 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. The base of the bottle exhibits the maker mark of the Brockway Glass Co., A “B” in a circle, in use since 1925 (Toulouse 1971:59). In script, to the right of the circle “B” is the letters “rownie” which in combination spell “brownie” (Figure 5-2). No data has been found for a “brownie” trade or maker mark. On the Type B-4 bottle the maker mark includes two sets of numbers located at the top and bottom of the maker mark. The number 44 appears in the top position indicating the year of manufacture was 1944.

Type B-5 is a clear, cylindrical, crown cap, beer bottle. Six examples are represented in the assemblage (see Appendix B). Type B-5 averages about 17.0 cm in height and 6.5 cm in diameter.

The body and base of the Type B-5 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. On the bottle base appears the maker mark of the Owens Illinois Glass Co., an “I” encircled by and “O” centered in a horizontal diamond, used by the Owens Illinois Glass Co., between 1929 and 1954 (Toulouse 1971:403). Numbers representing the plant and year date are located to the left and right of the diamond. Mold details are represented by a number under the diamond. The year date is represented as a single digit, for example “5”, but it remains unclear whether this number applies only to the decade of 1940. The term “Duraglas” is not present on this bottle type. The instructions “NO DEPOSIT NO RETURN” which appears on bottles after 1940 (Berge 1980), and the Owens Illinois maker mark which was changed in 1954 provides the potential date range of between 1940 and 1954 for the manufacture of Type B-5 bottles.

Type B-6 exhibits the same diagnostic characteristics as Type B-5 with the addition of the “Duraglas” trade mark on the bottle base. Six examples are present in the assemblage (see Appendix B, Table B-9). The presence the trade mark “Duraglas” and the instructions “NO DEPOSIT NO RETURN” both appearing on bottles after 1940 (Berge 1980), and the Owens Illinois maker mark which was changed in 1954 provides the potential date range of between 1940 and 1954 for the manufacture of Type B-6 bottles.

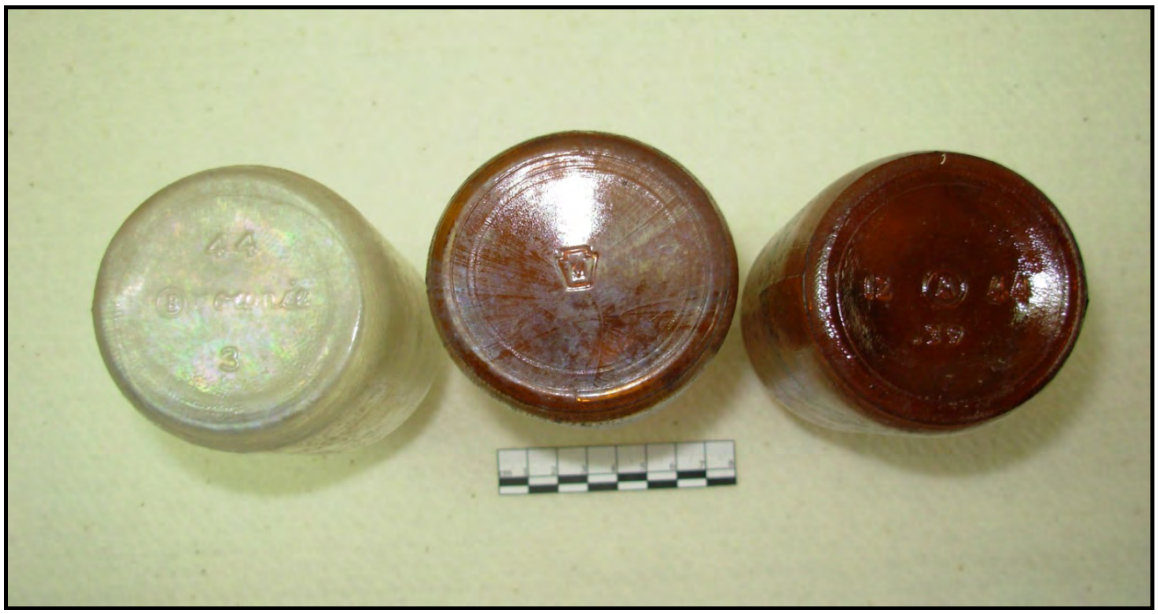
Type B-7 is an amber, cylindrical, crown cap, beer bottle. A single example is represented in the assemblage (see Appendix B). Type B-7 is 16.9 cm in height and 6.5 cm in diameter.

The body and base of the Type B-7 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. The base of the bottle exhibits the maker mark of the Metro Glass Bottle Company which consists of an “M” within a keystone (see Figure 5-2). This maker mark was used by the Metro Glass Bottle Co., between 1935 and 1949 (Toulouse 1971:342). The presence of “NO DEPOSIT NO RETURN” and the change of the Metro maker mark in 1949, indicates a date of between 1940 and 1949 for Type B-7 bottle.

Type B-8 is an amber, cylindrical, crown cap, beer bottle. A single example is present in the assemblage (see Appendix B). Type B-8 is 17.0 cm in height and 6.5 cm in diameter.

The body and base of the Type B-8 beer bottle exhibit a stippled, textured surface. Around the shoulder of the bottle is embossed “NO DEPOSIT NO RETURN’ and “NOT TO BE REFILLED”. The base of the bottle exhibits the maker mark of the Armstrong Cork Co., Glass Division (see Figure 5-2). The mark consists of an “A” in a circle and was used between 1938 and 1969 (Toulouse 1971:24). The maker mark includes three sets of numbers located at the

Glass beer bottles; types B-4, B-7 and B-8; side view.



Glass beer bottles; types B-4, B-7 and B-8; bottom view.

Figure 5-2. Photographs of Beer Bottle Types B-4, B-7, and B-8.

left and right and bottom of the maker mark. The right side numbers represent the year of manufacture and allow the assignment of the year 1944 for the manufacture of this bottle.

Specialty Bottles and Jars

Type S-1 is an amber, cylindrical bottle with a threaded closure and black plastic cap (Figure 5-3). The plastic cap appears to have originally included an applicator such as a brush. The contents of the bottle remain uncertain but were most probably an applied fluid such as shoe polish or gun bluing. A single example of this type was recovered from the surface at Site 1719 (see Appendix B, Table B-9). The Type S-1 bottle is 10.5 cm in height and 4.2 cm in diameter.

The base of the Type S-1 bottle is stippled and carries the maker mark of the Owens Illinois Glass Company in use between 1929 and 1954 (Toulouse 1971:403). The trade name "Duraglas" is embossed on the heal of the bottle body near the base. The presence of the post 1940 "Duraglas" trade name and the 1929-1954 maker mark provides a date ranging between 1940 and 1954 for the manufacture of this bottle.

Type S-2 is an amber, cylindrical bottle with a threaded closure. This squat cylindrical form may have contained ink (see Figure 5-3). A single example of this bottle type was recovered from the surface of Site 1719 (see Appendix B, Table B-9). The bottle is 7.0 cm in height and 8.4 cm in diameter. The maker mark of the Anchor Hocking Glass Corp. appears on the bottle base. This mark has been in use since 1938 (Toulouse 1971:48). With no other diagnostic characteristics, this bottle can only be said to have been manufactured some time since 1938.

Type S-3 is a clear oval bottle with one flat side and a treaded closure. This calibrated bottle probably contained a medicinal liquid (Figure 5-4). One example was recovered from the surface of Site 1719 (see Appendix B, Table B-9). The bottle is 10.2 cm in height and 4.5 cm in diameter. On the flat panel side of the bottle the calibration "3ii" is embossed near the shoulder and the trade name "Duraglas" is embossed near the base. The bottle base carries the Owens Illinois Glass Company maker mark in use between 1929 and 1954 which together with the post 1940 "Duraglas" trade name provides a date ranging between 1940 and 1954 for the manufacture of this bottle (Toulouse 1971:403).

Type S-4 is a clear oval bottle with a threaded closure which probably contained cologne. One example was recovered from the surface in Site 1719 (see Appendix B, Table B-9). The bottle is 10.8 cm in height and the base is oval measuring 6.5 cm by 2.8 cm. This bottle exhibits distinct shoulders embossed with an arch design. A raised vertical panel is present on one side of the bottle (see Figure 5-4). The small neck and threaded closure accompany a restricted opening on the top of the closure which is designed to dispense a limited amount of fluid by shaking the bottle. No discernable maker mark was present on the bottle but the sophistication of the mold indicates post 1930 technologies.

Type S-5 is a clear oval bottle with a threaded closure. A single example was recovered from the surface of Site 1719 (see Appendix B, Table B-9). This bottle probably contained a viscous liquid such as hair tonic. The bottle is 12.8 cm in height the oval base measure 6.8 cm by 3.6 cm. The body of the bottle narrows from the base to the shoulder. Raised diagonal stripes are embossed on the heel and shoulders of the bottle (see Figure 5-4). The diagonal stripe resembles the traditional barber shop logo. No maker mark is present on the bottle however the mold technology suggests a post 1930 date of manufacture.

Type S-6 is a clear octagonal, wide-mouth jar with a threaded closure. One example of this type was recovered from the surface of Site 1719 (see Appendix B, Table B-9). This jar

Left: glass bottle type S-2; Right: glass bottle type S-1; side view.

Left: glass bottle type S-2; Right: glass bottle type S-1; bottom view.

Figure 5-3. Photographs of Specialty Bottle Types S-1 and S-2.

Glass bottles; types S-3, S-4 and S-5; side view.

Glass bottles; types S-3, S-4 and S-5; bottom view.

Figure 5-4. Photographs of Specialty Bottle Types S-3, S-4, and S-5.

probably contained a hair crème product. The jar is 6.5 cm in height and 7.0 cm in diameter. The octagonal body exhibits eight panels each contain an embossed letter which together spells the trade name “Barbasol.” The base of the bottle carries the embossed trade name “Barbasol” and an “A” in a circle, the maker mark of the Armstrong Cork Co., Glass Division (Toulouse 1971:24). This maker mark was in use between 1938 and 1969 and provides the potential date range for the manufacture of this jar (Toulouse 1971:24).

Type S-7 is a clear cylindrical jar with a threaded closure. This bottle probably contained a medicinal salve such as “Vaseline”. One example was recovered from the surface of Site 1719 (see Appendix B, Table B-9). The jar is 6.0 cm in height and 4.8 cm in diameter. On the base of the jar “Chesebrough New York” is embossed in a circle with the letters “MFG” in the center. Although no maker mark could be identified and correlated, a similar threaded jar with “Vaseline, Chesebrough New York” embossed on the body of the jar is illustrated in Fike (1987:184). A post 1930 date of manufacture is indicated for this jar.

Type S-8 is a white, cylindrical, wide-mouth jar with a threaded closure. One example was recovered at Site 7182 in Sinkhole K in the KS1 project area (see Appendix B, Table B-9). This jar probably contained a medicinal salve, similar to the Type S-7 bottle. The jar is 4.7 cm in height and 7.5 cm in diameter. The jar is made of white “milk” glass and exhibits a stippled texture on the body and base (Figure 5-5). The base of the jar carries the embossed number “6” but no discernable maker mark. Milk glass was used for medicines, cosmetics, toiletry, food and specialty items from the 1890s to the 1960s (Fike 1987:13). The mold characteristics suggest a post 1930 date of manufacture.

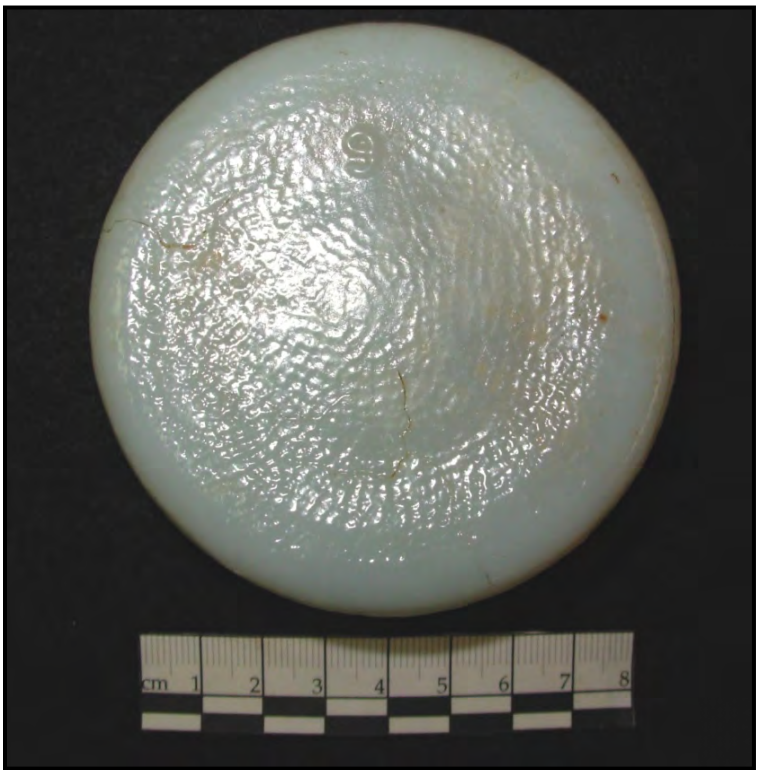
Type S-9 is a fragmentary example of the bottom half and base of a green, cylindrical, skirted bottle which contained Coca Cola. One example was recovered on the surface of Site 1719 (see Appendix B, Table B-9). A portion of the embossed “Coca Cola” label is present on the body of the bottle. “San Francisco Calif.” is embossed on the bottle base. A very faint Owens Illinois Glass Co., maker mark, in use between 1929 and 1954 (Toulouse 1971: 403), is located on the skirt of the bottle. The number “41” appears to the right of the maker mark indicating this bottle was manufactured in 1941.

Type S-10 is a clear oval bottle with a threaded closure. One example was collected from the surface of Site 7181, Feature B in KS2 (see Appendix B, Table B-9). This bottle probably contained a hair tonic product. The bottle is 13.0 cm in height and 5.0 cm by 3.0 cm across the base. The sides of the bottle exhibit an embossed arch design. The base of the bottle carries the Owens Illinois Glass Co., maker mark in use between 1929 and 1954 (Toulouse 1971: 403). The standardized mold technology indicates a post 1930 for the manufacture of this bottle.

Type S-11 is a clear, cylindrical wide-mouth bottle which contained milk or cream. A single example of this type was recovered from Site 7176, Feature B, Test Unit 1 in the KS2 project area (see Appendix B, Table B-9). The closure exhibits a countersunk interior ledge of the type designed for paper or cardboard cap (Figure 5-6). The bottle is 14.0 cm in height and 6.2 cm in diameter. The body of the bottle exhibits two embossed bands and the lettering “Property of Dairymen’s Association, Half Pint”. The letters “H D” are embossed on the base of the bottle. The bottle base also carries the Owens Illinois Glass Co., maker mark in use from 1929 through 1954 (Toulouse 1971: 403). To the right of the maker mark is the number “41” indicating that this bottle was manufacture in 1941.

Type S-12 is a clear, cylindrical bottle with a threaded closure. This bottle contained “Tooth Powder”. A single example was collected from the surface at Site 7177, Feature D in the KS 2 project area (see Appendix B, Table B-9). The bottle is 8.2 cm in height and 4.1 cm in diameter (Figure 5-7). On the base of the bottle “Dr. Lyon’s Tooth Powder is embossed in a

Milk glass jar; Feature K; type S-8; side view.



Milk glass jar; Feature K; type S-8; bottom view.

Figure 5-5. Photograph of a Glass Jar (Specialty Bottle S-8) from Site 7182.

Glass milk bottle; Feature B; S-11; side view.

Glass milk bottle; Feature B; S-11; bottom view.

Figure 5-6. Photographs of Specialty Bottle S-11 from Site 7176.

Glass tooth powder bottle; S-12; side view.

Glass tooth powder bottle; S-12; bottom view.

Figure 5-7. Photograph of Specialty Bottle S-12 from Site 7177.

circle. Inside the circle is the maker mark of the Armstrong Cork co., Glass Division, an “A” in a circle. This mark was in use between 1939 and 1969 (Toulouse 1971:24). The number “42” appears to the right of the maker mark providing a date of 1942 for the manufacture of this bottle. It can be seen in Figure 5-7 that the embossed base panel is off-center.

Window Glass

Three fragments of heavy, light green plate glass were recovered from the surface of Site 1719, Feature F (see Appendix B, Table B-9). The larger of the three fragments is 16.0 cm in length. The fragments are 3.0 mm in thickness. The precise application of this plate glass remains uncertain but may represent thick security widow glass or vehicle windshield glass.

Ceramic Artifacts

One ceramic artifact was recovered from surface collections at Site 7178, Feature B (see Table 5-3; see Table B-3 in Appendix B). This is an insulator that consists of a ceramic component and a large metal screw extending from the bottom of the object. The ceramic insulator measures 7.5 cm in length and 4.8 cm in diameter at the base. It has an oval-shaped hole in the center for stringing electrical cable. At the base of the insulator is a small panel with embossed lettering that reads: “PAT 4-16-29” (Figure 5-8). The metal screw attached to the bottom measures 5.8 cm in length and 0.9 cm in diameter. A similar insulator was observed screwed into a kiawe tree branch adjacent to Site 7178, Feature 5 bath house.

Metal Artifacts

A total of 132 metal artifacts were collected during surface collection and excavation. A variety of metal artifacts are represented including an assemblage of iron barrel hoops recovered at Site 7176, Feature A, Test Unit 1 in the KS2 project area. In KS1, a metal license plate was recovered in Site 7182, Feature F, Test Unit 1; two aluminum canteens were recovered at Site 7182, one in Feature C and one in Feature E; three complete tin cans were collected: two from the surface of Site 1719 and one from Site 7182, Feature J. A section of insulated wire, several wire nails and a wire staple are also present in the assemblage. The complete catalogue of metal artifacts by provenience is provided in Appendix B, Table B-8.

Barrel Hoops

An assemblage of fragmented iron barrel hoops of the type used to contain the staves of a wooden barrel were recovered at Site 7176, Feature A, Test Unit 1 in the KS2 project area (see Appendix B, Table B-8). The rusted hoop fragments are beveled to conform to the outside shape of the barrel. The ends of the hoop pieces are joined with iron rivets (Figure 5-9). Since the hoops are all fragmented, it is difficult to provide an accurate diameter. However, it is estimated that the diameter of the most intact hoop is 44.0 cm. The width of the hoop is 3.5 cm and it is 2.5 mm thick.

License Plate

A rusted metal license plate was recovered at Site 7182, Feature F, TU-1 in the KS1 project area (see Appendix B, Table B-8). The rectangular plate measures 32.5 cm in length and 9.5 cm in width. The plate is constructed of heavy gage, stamped iron with a raised border. Two rows of raised letters, “KANEOHE BAY, 411, 1942” are stamped on the face of the plate (see Figure 5-8).

Metal license plate from Site 7182 Feature F; front view.

Ceramic insulator from Site 7178 Feature B; front view.

Figure 5-8. Photographs of Artifacts from Site 7182 and 7178.

Metal barrel hoop from Feature A; top view

Metal barrel hoop from Feature A; side view

Figure 5-9. Photographs of Metal Barrel Hoops from Site 7176.

Canteens

Two aluminum canteens were collected from the surface at Site 7182 in KS1. One canteen was recovered from Feature C (see Appendix B, see Table B-4 and Table B-8). This canteen is oval with one depressed side, (kidney-shaped), designed to carry on a belt. The canteen is 18.8 cm in height and the base has a maximum diameter of 10.7 cm. The canteen has a threaded aluminum cap which is connected by an aluminum collar and chain (Figure 5-10). The canteen is constructed of two pieces which are joined together in a continuous, roughly soldered aluminum seam which continues from the closure, down the sides and across the bottom. The seam appears to have been hand soldered. Engraved near the base are the inscriptions "U.S., L.F. & C., 1918" defining the possible date of manufacture, or date when this type of canteen was first introduced.

A second aluminum canteen was recovered from Feature E at Site 7182 (see Appendix B, Table B-8; Table B-4). This canteen is also kidney-shaped and measures 18.5 cm in height and 10.3 cm across the base. The canteen has a threaded black plastic cap which was attached with an iron chain (see Figure 5-10). This canteen is formed of two pieces, a top and a bottom which are joined in a stamped seam which encircles the shoulder of the canteen. This canteen carries no identifying marks.

Tin Cans

A small rectangular can, with a rounded side and a threaded metal cap was recovered from the surface of Site 1719 (see Appendix B, Table B-8 and Table B-5). This rusted can measures 10.3 cm in height and 7.2 cm by 3.7 cm across the base (Figure 5-11; top photo). The contents of the can remain unclear but similar larger cans contained solvents or kerosene.

A squat cylindrical can was recovered from the surface of Site 1719 (see Appendix B, Table B-8). The can is 4.0 cm in height and 10.9 cm in diameter (see Figure 5-11). The can exhibits a compression lid similar to those generally associated with paint cans. The can may have contained paint or a viscous substance such as grease or shoe polish.

A cone top beer can was recovered from Site 7182, Feature J (see Appendix B, Table B-8). The can is 14.0 cm in height and 6.8 cm in diameter. The top of the can exhibits a short cone with a closure designed to accept a crown cap (see Figure 5-11). This is the earliest type of beer can, introduced around 1935 (Bush 1981:103).

Wire, Nails, Staple, Screen

Forty metal artifacts are present in the assemblage which exhibit no diagnostic or temporal attributes. These include a segment of insulated copper wire from Site 1719 (bag 167); several wire nails (bag 184, 189, 200), a wire staple (bag 197), and a fragment of wire screen (bag 104) (see Appendix B, Table B-8).

Miscellaneous Artifacts

Several artifacts fashioned from a variety of miscellaneous materials were recovered during surface collections and excavations. These are described below.

<u>Roofing Materials</u>

A total of 36 pieces of roofing material was collected from within Site 7182, Feature C. Two types of roofing material were present. Analysis shows that the materials are most similar to tar paper and asphalt shingles, a cheap and quick method of roofing. The tar paper does not exhibit anything extraordinary, but is in a fair state of preservation. The asphalt shingles are

Left: canteen from Feature E; right: canteen from Feature C; side view.

Left: canteen from Feature E; right: canteen from Feature C; bottom view.

Figure 5-10. Photographs of Metal Canteens from Site 7182.

Left: beer can; right: possible solvent container; side view.

Possible grease or shoe polish container; top view.

Figure 5-11. Photographs of Tin Cans from Sites 7182 and 1719.

friable and warped. One side exhibits black asphalt material, while the other has blue fiberglass adhesions, which indicates that as the exterior side. The pieces are approximately 4mm thick.

Metal Screen

Feature C within Site 7182 resulted in several diagnostic elements, including four small pieces of screen. The screen material is similar to screen and roofing material found in connection with the bath house at Site 7178. The bath house had remnants of screen adhering to a portion of the wood construction and appeared to have screened in a gap that was present between the roof and the walls of the bath house. The screen is friable metal, brown/oxidized in color. The pieces are approximately 1mm thick.

Fiberboard

Two fragments of a pressed wood material, similar to fiberboard, were found in Feature C. One side is smooth and black in color. The other side shows the fibers and is brown in color. The material is in fair state of preservation. The largest piece recovered measures 22.0 by 1.6 cm. There is no indication of its use from the pieces collected.

Wood Stick with Plastic

A single wooden dowel with a plastic collar was recovered from Feature C at Site 7182. The collar suggests that it was part of a larger implement. The remaining piece does not suggest what that implement may have been. The plastic is chipped and splintered at one end. There are ridges molded into the plastic and a bow tie-shaped design that encapsulates the nail that holds the plastic to the wood. A slit that measures 3.5 cm long is located on one side. The color is a faded red on the outside, to a darker red where the plastic and wood meet. The wood measures 35.0 cm in length, 3.0 cm in diameter, is in poor condition, and is disintegrating.

Boot Leather

Several pieces of a boot, possibly a WWII jump boot, were recovered on the surface of Site 1719, Feature F. The leather is in poor condition, extremely dry, curled and friable. A discernible number (8) is present on the portion of the sole that would designate the heel. Nails and a portion of the leather upper part of the shoe and tongue were recovered. The sole of the boot is black in color, while the pieces of upper appear to be a dark brown.

SUMMARY OF FAUNAL REMAINS RECOVERED IN 1995 TEST EXCAVATIONS

Faunal remains recovered during 1995 test excavations conducted by Beardsley (2001) included vertebrate and invertebrate faunal remains. Within the faunal assemblage, invertebrate faunal remains were the most common component (Beardsley 2001:V.25), followed by terrestrial vertebrates and marine vertebrates. The results of faunal remains for the six archaeological sites in KS1 (Sites 1717, 1719, 1719, 1720, and 1722) and KS2 (1721) are briefly summarized below.

Marine Invertebrates

Approximately 1.8 kilograms (kg) or 1,833.7 g, of invertebrate remains were recovered from 1995 test excavations in the six archaeological sites in KS1 and KS2. Table 5-4 summarizes the distribution of these invertebrate faunal remains by site, with combined feature totals.

Hawaiian marine mollusks were well represented in the invertebrate remains from features in these six sites. A total of 1,632 g of marine mollusks were recovered from the six

Table 5-4. Summary of Invertebrate Faunal Remains from 1995 Excavations.

		KS1					KS2	
	Site	**1717**	**1718**	**1719**	**1720**	**1722**	**1721**	**Total**
	Feature	**D,F**	**A-E**	**A-E**	**A,B**	**B,C,D,K,O**	**A,C,D**	
	Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**
Mollusks								
Gastropods								
Patellidae	*Cellana* spp.						7.8	**7.8**
Trochidae	*Trochus intextus*			1.0			0.9	**1.9**
Turbinidae	*Turbo sandwicensis*						22.8	**22.8**
Neritidae	*Nerita picea*	4.0	29.5	61.8	2.7	96.4	541.3	**735.6**
Littorinidae	*Littorina pintado*	0.8	0.8	1.2		1.5	9.9	**14.1**
Vermetidae				0.1				**0.1**
Cerithiidae						6.0		**6.0**
Strombidae	*Strombus maculatus*						3.0	**3.0**
Hipponicidae			0.1				0.6	**0.7**
Cypraeidae			6.4	11.9	1.0	0.3	33.3	**53.0**
Columbellidae				4.5			14.9	**19.4**
Condidae		1.8		22.6		27.9	25.6	**77.8**
Terebridae							6.9	**6.9**
Melampidae	*Melampus castaneus*						0.4	**0.4**
Non-marine		0.1	2.4	21.3			0.1	**23.9**
Unidentified			2.0				2.9	**4.9**
Total Gastropods		**6.6**	**41.1**	**124.4**	**3.7**	**132.0**	**670.3**	**978.2**
Bivalves								
Mytilidae			23.8					**23.8**
Mytilidae	*Brachidontes crebristriatus*	11.3	24.4	12.6		6.5	186.2	**240.9**
Pteriidae						3.9	0.7	**4.6**
Pteriidae	*Pinctada* spp.	0.3		1.9			40.1	**42.3**
Isognomonidae	*Isognomon californicum*		0.2			0.7	3.2	**4.0**
Tellinidae		18.7	52.8	20.3	4.8	29.3	211.3	**337.1**
Veneridae							1.1	**1.1**
Total		**30.2**	**101.1**	**34.8**	**4.8**	**40.4**	**442.5**	**653.8**
Total Mollusks		**36.9**	**142.2**	**159.2**	**8.5**	**172.4**	**1112.9**	**1632.0**
Other Invertebrates								
Echinoderms		2.2	59.7	14.6	4.1	10.3	45.2	**136.2**
Crustacea		2.4	0.7	8.9	2.7	6.0	19.7	**40.4**
Barnacle						0.3		**0.3**
Unidentified				3.0		0.7	21.1	**24.8**
Total Other Invertebrates		**4.6**	**60.5**	**26.5**	**6.8**	**17.2**	**86.0**	**201.6**
Total Invertebrates		**41.5**	**202.6**	**185.7**	**15.3**	**189.7**	**1198.9**	**1833.7**

sites. A total of 14 gastropod families and seven (7) bivalve families were identified (see Table 5-4) in these remains. According to Beardsley (2001: V-53), most of the mollusk families appear to have been part of the subsistence regimen, consumed as food. Some were used as raw material for tools (e.g., *Pinctada* spp. and *Isogonomon californicum* were used to make shell fishhooks).

In the gastropods, seven genera and six species were identified, including *Cellana* spp., *Trochus intextus*, *Turbo sandwicensis*, *Nerita picea*, *Littorina pintado*, *Strombus maculatus*, and *Melampus casteneous*. Of these, *Nerita picea* remains dominate the gastropod assemblages. Of the 978.2 g of gastropods, *Nerita picea* accounts for 75% of the gastropod total (735.6 g of 978.2 total), and 45% (735.6 of 1,632 g) of the mollusk total (see Table 5-4). In comparison, the next most abundant gastropods are the remains of Conidae and Cypraeidae, which account for 7.9% (77.8 g) and 5.4% (55.0 g), respectively, of the gastropod assemblage.

Nerita picea, the most commonly represented species in the invertebrate assemblage, were used as a food source, and usually required a pick to remove the meat. Often referred to as pipipi, N. picea were eaten raw or cooked (Titcomb 1978). Their shells were often strung in lei or bracelets (Buck 1957).

In the bivalves, two genera and three species were identified, including *Pinctada* spp., *Brachidontes crebristriatus*, and *Isognomon californicum*. Of these, the remains of Tellinidae dominates the bivalve assemblage. Of the 653.9 g of bivalves Tellindae remains account for 51.5% of this total, or 337.1 g. *Brachidontes crebristriatus* accounts for 36.8%, and *Pinctada* spp. for 6.5% of the bivalve assemblage.

Other invertebrates recovered include remains of sea urchins (Echinoderms), crab (crustaceans), and barnacles (see Table 5-4). Of the 201.6 g of other invertebrates, sea urchins dominate with 136.2 g, or 67.5% of the total.

Features of Site 1721 in KS1 yielded a majority of the marine invertebrate remains in the faunal assemblage (see Table 5-4). Of the 1,833.7 g of marine invertebrates, 65.4% (1,198.9 g) were recovered from feature excavations at Site 1721. This is true for gastropods, bivalves, and other invertebrates.

The identified invertebrates inhabit a variety of intertidal and inshore environments as well as subtidal reef platforms and marine benches. These environments were all accessible for local gathering by hand (Beardsley 2001:V-54).

Vertebrates

A total of 112.5 g, of vertebrate remains were recovered from 1995 test excavations in the six archaeological sites in KS1 and KS2. Table 5-5 summarizes the distribution of vertebrate faunal remains for the six sites from 1995 excavation by site, with combined feature totals. The vertebrate remains include bone remains of mammals and fish. Although sharks and rays are cartilaginous, they are also included in Table 5-5.

The late Dr. Alan C. Ziegler made all of the identifications, and PHRI staff performed further tabulations. Identified specimens represented cartilaginous and boney fishes, amphibians, reptiles, birds, and mammals. In the six sites in the KS1 and KS2 project areas, only cartilaginous and boney fishes, birds, and mammals were present. Table 5-6 presents a comparative summary of vertebrate taxa present in the 1995 and 2011 excavations.

None of the bone attributed to cartilaginous fishes was identified below zoological class. Of the 24 families of boney fishes identified, four families predominated in the faunal assemblages: Monocanthidae, Balistidae, Carangidae, and Acanthuridae. The identifiable amphibian remains were those of the Cane Toad (*Bufo marinus*). Reptilian remains included

small lizard bones and skeletal elements of an individual from the sea turtle family (Chelonidae), which could not be further identified.

Table 5-5. Distribution of Vertebrate Remains from 1995 Excavations.

	KS1					KS2	
Site	**1717**	**1718**	**1719**	**1720**	**1722**	**1721**	**Total**
Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**
Vertebrate Fauna							
Mammals							
Rattus exulans	2.0	14.5	0.2	1.3	0.2	0.2	**18.3**
Rattus norvegicus			0.1				**0.1**
Mus musculus	0.1	0.1					**0.2**
Sus scrofa				0.7		5.48	**6.19**
Indeterminate		0.1					**0.1**
Total Mammal	**2.0**	**14.7**	**0.2**	**2.1**	**0.2**	**5.7**	**24.9**
Sharks and Rays							
Chondrichthyes		0.2		0.1			**0.3**
Fish							
Muraenidae						0.1	**0.1**
Polynemidae						0.2	**0.2**
Mullidae						0.1	**0.1**
Cirrhitidae						0.7	**0.7**
Labridae						0.03	**0.03**
Scaridae						4.1	**4.1**
Acanthuridae	0.4					6.5	**6.9**
Balistifas	0.1			0.02		7.0	**7.1**
Monacanthidae	0.01		0.1	0.3	0.1	6.1	**6.5**
Diodontidae	0.1		0.1		0.8	4.1	**5.1**
Unidentified Fish	3.2	0.2	0.7	2.5	7.9	41.6	**56.1**
Total Fish	**3.8**	**0.4**	**0.9**	**2.9**	**8.7**	**70.5**	**87.2**
Total Vertebrate Remains	**5.8**	**15.2**	**1.1**	**5.1**	**9.0**	**76.2**	**112.5**

Table 5-6. Mammalian and Reptilian Bone Identifications.

Taxon	**Description of Taxon**	**1995**	**2011**
Cheloniidae	Family of Sea Turtles	X	
Rattus exulans	Pacific Rat	X	X
Rattus norvegicus	Norway Rat	X	
Rattus rattus	Roof Rat	X	
Mus musculus	House Mouse	X	
Herpestes auropunctatus	Mongoose	X	
Felis catus	Cat	X	
Canis familiaris	Dog	X	X
Sus scrofa	Pig	X	
Bos Taurus	Cow	X	X

A total of 24.9 g of mammal remains were recovered from the six sites during 1995 test excavations (see Table 5-5). Mammalian remains identified from the 1995 excavations included rat, mouse, mongoose, cat, dog, pig, and cow. In sites located in the KS1 and KS2 project area, only rat, mouse and pig were present (see Table 5-6). The assemblages also included mammalian remains from medium- and large-sized animals which could not be further identified. According to Ziegler's 1995 analysis, it is likely that many of the bones attributed to large mammals come from animals the size of a horse or cow (Beardsley 2001).

Of the rat and mouse bones, only one species – Pacific Rat or *Rattus exulans* – arrived in Hawai'i in pre-Contact times. The other rats (Norway Rat and Roof Rat) and the House Mouse probably all came to the islands in the early to mid-19th century by way of foreign shipping traffic (Atkinson 1977).

In the six sites in the KS1 and KS2 project areas, *R. exulans* yielded the most remains by weight in the mammal bone assemblage (see Table 5-5). Beardsley (2001: V.30) noted that rodent bones (rat and mouse) were nearly ubiquitous and were found in virtually every site in the project area, though not always in large amounts. None of the rodent bones were considered to be the remains of food items. Instead, they were considered to be elements of disturbance in historic and recent stratigraphic contexts.

Two of the non-murid taxa arrived in pre-Contact times with the Polynesian settlers of the Hawaiian Islands: Domestic Dog and Domestic Pig. Dog and pig remains were recovered from 11 of the pre-Contact sites excavated in 1995 and from two post-Contact sites (Beardsley 2001). Domestic cattle (*Bos taurus*) were introduced to Hawai'i in the early post-Contact era, in the late 18th century. Sugar planters seeking rodent control brought the Indian Mongoose (*Herpestes auropunctatus*) to Hawai'i in 1883 (Tomich 1986). In the six sites in the KS1 and KS2 project area, only pig bone was present. Pig bone recovered at Site 1720 in KS1 and Site 1721 in KS2 was considered to be the remains of food.

The remains sharks and rays were found at two sites, Site 1718 and 1720. These were limited to shark teeth. None of the bone attributed to cartilaginous fishes was identified below zoological class. Of the 24 families of boney fishes identified, four families predominated in the faunal assemblages: Monocanthidae, Balistidae, Carangidae, and Acanthuridae.

A total of 87.2 g of fish bone was recovered; all six sites yielded fish bone in 1995 excavations. In the six sites in the KS1 and KS2 project areas, only ten (10) families of fish were identified in the fish bone assemblage (see Table 5-5). No species identifications, however, could be determined. According to Ziegler, the predominant families of fish in the 1995 fish bone assemblage are members of common inshore reef-dwellers, "with at least the more common offshore bottom- and surface-frequenting groups apparently being almost completely absent, suggesting that deep-water long-line fishing and trolling from watercraft were seldom carried out here" (Beardsley 2001:V.26). Furthermore, the size of the fish and families represented suggest that most fishing was probably conducted from shore or in shallow near-shore waters. Both hooking and spearing, along with the surround-netting, were the most likely methods of capture (Beardsley 2001:V.26).

The bird remains from the 1995 excavations include many of the avian families identified in the previous studies of paleontological deposits at Kalaeloa (Olson and James 1982, 1991; Collins 1990). Table 5-7, below, lists the avian orders or families identified from faunal remains recovered in 1995 and 2011.

Table 5-7. Avian Bone Identifications Made in 1995 and 2011.

Avian Taxon	Description of Taxon	1995	2011
Procellariidae	Family of Petrels & Shearwaters	X	X
Hydrobatidae	Family of Storm Petrels	X	
Phaethonidae	Family of Tropicbirds	X	
Ardeidae	Family of Herons & Egrets	X	
Anatidae	Family of Geese & Ducks	X	
Accipitridae	Family of Hawks & Eagles		X
Phasianidae	Family of Francolins & Pheasants	X	
Rallidae	Family of Rails, Gallinules & Coots	X	
Charadriidae	Family of Plovers	X	
Scolopacidae	Family of Sandpipers & Waders	X	
Columbidae	Family of Doves	X	
Strigidae	Family of Typical Owls	X	X
Passeriformes	Order of Song & Perching Birds	X	X
Meliphagidae	Family of Honeyeaters	X	
Corvidae	Crows	X	
Sturnidae	Family of Starlings & Mynas	X	
Fringillidae	Family of Finches	X	

Most of the avifaunal remains discussed in Beardsley's (2001) overview of the faunal analyses appear to be paleontological in origin, and pre-date human occupation of the Kalaeloa region. Exceptions are the following:

- Red Junglefowl (*Gallus gallus*), brought to Hawai'i by Polynesian settlers (Ziegler 2002)
- Spotted Dove (*Streptopelia chinensis*), introduced in the 19th century (Schwartz and Schwartz 1951)
- Zebra Dove (*Geopilia striata*), introduced in 1922 (Pratt et al. 1987)
- Common Myna (*Acridotheres tristis*), brought to Hawai'i in 1865 as a form of "pest control" (Ziegler 2002)

SUMMARY OF FAUNAL REMAINS RECOVERED IN 2011 TEST EXCAVATIONS

In the Hawaiian food economy, there was a great dependence upon marine resources, including marine and fresh/brackish water mollusks to supplement poi, the starchy mainstay of the Hawaiian diet (Titcomb 1979). It is not surprising, therefore, that mollusks are present in moderately large quantities in the recovered faunal assemblage at sites excavated in 2011.

Marine Invertebrates

Approximately 872.5 g of invertebrate remains were recovered from 2011 test excavations in the seven archaeological sites in KS1 and KS2. Table 5-8 summarizes the distribution of these invertebrate remains by site, with combined feature totals. Tables C-1 through C-11 in Appendix C provide the distribution, by site and feature, of marine faunal remains recovered during 2011 excavations.

Hawaiian marine mollusks were well represented in the invertebrate remains from features in these seven sites. A total of 860.4 g of marine mollusks were recovered from the six sites. A total of nine (9) gastropod families and seven (7) bivalve families were identified (see gastropod total (562.0 g of 650.7 g), and 65.3% (562.0 g of 860.4 g) of the mollusk total (see

Table 5-8. Summary of Invertebrate Faunal Remains from 2011 Excavations.

		KS1						KS2	
	Site	**1717**	**1718**	**7182**	**7184**	**7185**	**7186**	**7176**	**Total**
	Combined Features	**E, D, H**	**J, H, K**	**C, I**	**A**	**D**	**A, B**	**A,B**	
	Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
Mollusks									
Gastropods									
Trochidae	*Trochus* sp.		0.2						**0.2**
Turbinidae	*Turbo* sp.		0.6						**0.6**
Neritidae	*Nerita picea*	109.5	422.3	16.3			0.1	13.8	**562**
Neritidae	*Nerita polita*		0.3	26.0					**26.3**
Littorinidae	*Littorina pintado*		1.2						**1.2**
Strombidae	*Strombus* sp.		0.3						**0.3**
Hipponicidae	*Hipponix* spp.		0.2						**0.2**
Cypraeidae	*Cypraea* spp.	1.7	1.3					0.4	**3.4**
Cypraeidae	*Cypraea caputserpentis*		0.2	0.2					**0.4**
Muricidae	*Drupa* sp.		23.3						**23.3**
Condidae	*Conus* sp.	0.6	2.7	9.4		11.6			**24.3**
Condidae	*Conus pennaceus*	6.9	0.4						**7.3**
Unidentified gastropods		0.5	0.7						**1.2**
Total Gastropods		**119.2**	**453.7**	**51.9**	**0.0**	**11.6**	**0.1**	**14.2**	**650.7**
Bivalves									
Mytilidae	*Brachidontas crebristriatus*	1.0	119.2	1.1	0.3			0.3	**121.9**
Isognomonidae	*Isognomon* sp.	0.5	1.6	0.4			1.1		**3.6**
Tellinidae	*Tellina palatam*	4.6	70.4	7.9				1.2	**84.1**
Lucinidae	*Ctena bella*			0.2					**0.2**
Unidentified bivalves			0.1						**0.1**
Total Bivalves		**6.1**	**191.3**	**9.4**	**0.3**	**0.0**	**1.1**	**1.5**	**209.7**
Total Mollusks		**125.3**	**645.0**	**61.3**	**0.3**	**11.6**	**1.2**	**15.7**	**860.4**
Other Invertebrates									
Echinoderms		1.0	1.7	1.1					**3.8**
Crustacea			0.8	7.5					**8.3**
Total Other Invertebrates		**1.0**	**2.5**	**8.6**	**0.0**	**0.0**	**0.0**	**0.0**	**12.1**
Total Invertebrates		**126.3**	**647.5**	**69.9**	**0.3**	**11.6**	**1.2**	**15.7**	**872.5**

Table 5-8) in these remains. These families are all represented in invertebrate faunal remains from habitation features excavated by Beardsley (2001: V-53) in 1995. Like the marine mollusk families identified in the 1995 faunal assemblage, it is likely that the mollusk families identified in the 2011 excavations are part of the subsistence regimen, and were consumed as food. *Isogonomon californicum* was probably consumed as food and used to make shell fishhooks.

In the gastropods, nine genera five species were identified, including *Trochus* spp., *Turbo* spp., *Nerita picea*, *Nerita polita*, *Littorina pintado*, *Strombus* spp., *Hipponix* spp., *Cypraea* spp., *Cypraea caputserpentis*, *Drupa* spp., *Conus* spp., and *Conus pennaceus*. Of these, *Nerita picea* remains dominate the gastropod assemblage. *Nerita picea* accounts for 86.3% of the

Table 5-8). In comparison, the next most abundant gastropod remains are represented by *Conus* spp., *Drupa* spp., and *Nerita polita*, which account for 3.8% (24.3 g), 3.6% (23.3 g), and 4.1% (26.3 g), respectively, of the gastropod assemblage.

Nerita picea, which was the most commonly represented species in the 1995 invertebrate assemblage, is also the most common marine mollusk species in the 2011 invertebrate assemblage.

In the bivalves, four genera and three species were identified, including *Brachidontes crebristriatus*, *Isognomon* spp., *Tellina palatum*, and *Ctena bella*. Of these, the remains of *Brachidontes crebristriatus* dominates the bivalve assemblage. Of the 208.2 g of bivalves *Brachidontes crebristriatus* remains account for 58.4% of this total, or 121.6 g. *Tellina palatum* accounts for 39.8% of the bivalve assemblage.

Other invertebrates recovered include remains of sea urchin (Echinoderms) and crab remains (see Table 5-8). Of the 12.1 g of other invertebrates, crab remains are more abundant (8.3 g), with 68.5% of this category.

Features J and K of Site 1718 in KS1 yielded a majority of the marine invertebrate remains in the invertebrate faunal assemblage from 2001 excavations (see Table 5-8; see Tables C-3 and C-4 in Appendix C). Of the 856.8 g of marine invertebrates, 75.6% (647.5 g) were recovered from feature excavations at Site 1718. Feature J accounted for 94.9% (614.3 g) of the invertebrate remains recovered from Site 1718.

Vertebrates

A total of 243.7 g of vertebrate remains were recovered from 2011 test excavations in six archaeological sites in KS1 and KS2 and one non-site locale (Boring Locale 1) in KS2. Table 5-9 summarizes the distribution of vertebrate faunal remains from 2011 excavation by site, with combined feature totals. Vertebrate remains were identified and analyzed by Dr. Sara Collins, who identified the remains to the lowest possible taxonomic level. Tables C-1 through C-11 in Appendix C provide the distribution, by site and feature, of faunal remains recovered during 2011 excavations.

Table 5-9. Distribution of Vertebrate Remains from 2011 Excavations.

	KS1					KS2		
Site	**1718**	**7182**	**7184**	**7185**	**7186**	**7176**	**Boring Locale 1**	**Total**
Combined Features	**J, H, K**	**C, I**	**A**	**D**	**A, B**	**A,B**		
Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**G**	**g**
Mammals								
Rattus exulans	0.1	0.5						**0.6**
Rattus spp.	1.3	0.1	0.2	0.8	0.1	0.2	0.1	**2.8**
Bos taurus					0.4			**0.4**
Canis familiaris							209.2	**209.2**
Small mammal	0.3	0.4	0.2					**0.9**
Medium mammal	2.6	0.3			0.3			**3.2**
Unidentified mammal	0.1	0.2	0.1		0.1			**0.5**
Total Mammal	**4.4**	**1.5**	**0.5**	**0.8**	**0.9**	**0.2**	**209.2**	**217.5**

	KS1					KS2		
Site	**1718**	**7182**	**7184**	**7185**	**7186**	**7176**	**Boring Locale 1**	**Total**
Combined Features	**J, H, K**	**C, I**	**A**	**D**	**A, B**	**A,B**		
Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**G**	**g**
Fish								
Pervagor spp.	2.2	0.2						**2.4**
Unidentified Fish	6.2	1.1	0.1					**7.4**
Total Fish	**8.4**	**1.3**	**0.1**	**0.0**	**0.0**	**0.0**		**9.8**
Bird								
Pterodroma sandwichensis		3.5						**3.5**
Puffinus pacificus		1.3						**1.3**
Strigiform cf. *Gallistrix* spp.		0.3						**0.3**
Medium Procellariid		2.1						**2.1**
Medium Aves		3.3						**3.3**
Small Passeriform		0.1						**0.1**
Falconiform cf. Accipitridae		0.3						**0.3**
Pterodroma cf. *jugabilis*		0.1						**0.1**
UI bird bone	0.2	4.9		0.2		0.1		**5.4**
Total Bird	**0.2**	**15.9**	**0.0**	**0.2**	**0.0**	**0.1**		**16.4**
Total Vertebrates	**13.0**	**18.7**	**0.6**	**1.0**	**0.9**	**0.3**	**209.2**	**243.76**

The following categories come from Ziegler (1993), and were used to describe the identifications made.

- **Medium Aves**: bone from a bird ranging in size from a crow or medium-sized petrel to a chicken but cannot be further identified.
- **Medium Procellariid**: Bone that comes from an individual of medium-sized species in this Family (Shearwater and Petrel Family), including *Pterodroma sandwichensis* (Hawaiian Petrel or *'ua'u*), *Puffinus pacificus* (Wedge-tailed Shearwater or *'ua'u kani*), and *Puffinus auricularis* (Newell's Shearwater or *'a'o*).
- ***Pterodroma sandwichensis***: bone that comes from an individual of this endemic species
- ***Puffinus pacificus***: bone that comes from an individual of this indigenous species.
- ***Pterodroma* cf. *jugabilis***: bone that comes from an individual of this extinct, endemic species
- **Falconiform cf. Accipitridae:** bone that comes from an individual in this family of raptors but cannot be identified further.
- ***Strigidae* cf. *Gallistrix* spp**: bone that comes from an individual in this genus of owls but cannot be identified further.
- **Small Passeriform**: bone that comes from a bird in the Order of Song and Perching Birds but cannot be identified further.

- **Medium Mammal**: bone that comes from a mammal the size of a dog or small pig but cannot be identified further.
- ***Rattus* spp.**: bone that comes from an individual in this genus of rats, including *Rattus exulans* (Pacific Rat), *Rattus rattus* (Roof Rat), and *Rattus norvegicus* (Norway Rat).
- ***Rattus exulans***: bone that comes from an individual in this prehistorically introduced species.
- ***Canis familiaris***: bone that comes from an individual of this prehistorically introduced species
- **Cf. *Bos taurus*** (Domestic Cattle): bone that comes from an individual of this introduced species.

As Tables 5-5, 5-6, and 5-9 above, make clear, the 2011 excavations produced a greatly diminished species list, compared with the faunal identifications made from the 1995 assemblages. The mammalian identifications, in particular, provide little information. *Rattus exulans* arrived in Hawai‘i in pre-Contact times, but it is unclear whether or not the Polynesian settlers brought the rat along deliberately or if the rodent was a stowaway (Tomich 1986). The Pacific Rat prefers agricultural or open lands although it will live near human settlements (Tomich 1986). The Pacific Rat’s presence in archaeological deposits, including those excavated in the subject project area, does not provide any chronological information. The faunal remains attributed to *Rattus* spp. were skeletal elements such as caudal vertebrae that lacked any further diagnostic features. The bones identified as Domestic Dog were found at Boring Location 1 and are the remains of a modern dog burial; these faunal remains are discussed in Section 4 of this report. The cow is represented by a single tooth fragment. While it may be associated with prior ranching or farming activities in the area, little can be said about it.

A total of 9.8 g of fish bone was recovered during the 2011 excavations, representing 4.0% of the vertebrate faunal assemblage. Unidentified fish bone dominates the fish remains, with 7.4 g, or 75.5% of the fish bone assemblage. This is due to the absence of diagnostic pieces (e.g., mouth and cranial parts) in the fish bone assemblage. *Pervagor* spp., a member of the file fish family (Monocanthidae) is represented by 2.4 g or 24.5% of the fish bone assemblage. *Pervagor* spp. was identified by the diagnostic “spines” of this fish. File fish inhabit shallow waters along the coastline on both sides of the reef. They have two dorsal fins, the first of which is represented by a large dorsal spine (Tinker 1991:479).

Fish bone remains were recovered from three sites, including Sites 1718, 7182, and 7184 (see Table 5-9; see Tables C-3 through C-7 in Appendix C). Of these three sites, Site 1718 yielded 8.4 g of fish bone, representing 85.7% of the fish bone assemblage. Of the 8.4 g, 6.2 g includes unidentified fishbone and 2.2 g of *Pervagor* spp.

A total of 16.4 g of bird bone remains was recovered during the 2011 excavations, representing 6.7% of the vertebrate faunal assemblage. Although the avian remains from the 2011 excavations are similarly small in number compared with those identified in 1995, there are several identifications of interest. Bones from several extinct or extirpated bird taxa were identified in the 2011 assemblages. Extirpation is defined as local extinction; while a species may be pushed into extinction at one locale within its territory, it thrives at other locales. Examples of extirpated species include *Pterodroma sandwichensis* and *Puffinus pacificus* which are locally extinct at Kalaeloa but maintain breeding populations elsewhere in the Hawaiian Islands.

The bones of *P. sandwichensis* identified in this project did not show evidence of alteration by humans (e.g., charring or cutting), but the Hawaiian Petrel has been found in some abundance in midden deposits elsewhere at Kalaeloa (Collins 1990). The specimens identified as *P. sandwichensis* and *P. pacificus* in the current study were too few in number to generalize about the populations they may represent. Earlier studies, including Beardsley (2001) and Collins (1990), recorded fairly large numbers of these species, including juveniles, which strongly suggested the former presence of breeding populations at Kalaeloa. The third Procellariid to be identified in the 2011 assemblages is the extinct *Pterodroma jugabilis*, first described by Olson and James (1991). *P. jugabilis* was a petrel between the size of a larger Bonin Petrel (*Pterodroma hypoleuca*) and the smaller Bulwer's Petrel (*Bulweria bulwerii*) found in some abundance in paleontological deposits at Kalaeloa (Collins 1990). While there was no evidence from the Kalaeloa sites—including the current project—that humans preyed upon *P. jugabilis*, Olson and James (1991) state that its bones were found in archaeological deposits on Hawai'i Island at Kīholo.

Two other identifications of extinct birds merit some comment. A mandibular portion is attributed to a member of the Accipitridae Family (Hawks and Eagles). There is one living Accipiter in Hawai'i – the Hawaiian Hawk or 'Io (*Buteo solitarius*) – but this specimen probably belongs to one of the two extinct genera in this family: the *Haliaeetus* spp. of eagle; the Circus spp. of hawk. There was insufficient reference material to make a further refinement of the identification. Two pedal phalanges were identified as coming from an extinct genus of owl (*Gallistrix* spp.) in the Family Strigidae. Currently, the only Strigid in Hawai'i is the *Pueo* or Short-eared Owl (*Asio flammeus sandwichensis*). Bone identified as that of a *Pueo* has been documented in Beardsley (2001) and Collins (1990) but in the current study, the skeletal elements more closely resemble those of the genus *Gallistrix*. Olson and James (1991) have described several new species of *Gallistrix* (all of them now extinct) but *G. orion* is the only one documented in O'ahu localities.

Unidentified bird bone dominates the bird bone remains, with 5.4 g or 32.9% of the bird bone assemblage. *Pterodroma phaeopygia* and Medium Aves follow with 3.5 g and 3.3 g (21% and 20.1%), respectively. Bird bone was recovered in four sites, including Sites 1718, 7182, 7185, and 7186 in KS1 (see Table 5-9; see Tables C-3 through C-6 and Tables C-8 and C-9 in Appendix C). Site 1718 is a habitation site, and the remaining four sites are sinkholes. Site 7182, Features C and I, two of a cluster of nine (9) sinkholes in KS1, yielded the majority of the bird bone with approximately 97% (15.9 g of the 16.4 g) of the bird bone assemblage (see Tables C-5 and C-6 in Appendix C). Of these sinkholes, Feature I yielded 14.1 g of bird bone, or 85.6% of the bird bone assemblage. Feature C yielded 1.8 g, or 11% of the assemblage.

SUMMARY OF FLORAL ANALYSES FROM 1995 TEST EXCAVATIONS

Beardsley's 1995 floral analysis program was comprehensive and included macrobotanical analyses, as well as pollen and phytolith studies. Pollen, phytolith, and macrobotanical samples were submitted to Dr. Linda Cummings at PaleoResearch Laboratories in Golden, Colorado (Beardsley 2001:V.58) for identification and analyses.

The 50 samples submitted to PaleoResearch Laboratories were derived from layers containing cultural materials as well as paleontological remains. The PaleoResearch analyses are found in Beardsley's Appendix D (2001), and are briefly summarized here.

A variety of plants were identified from pollen, phytolith, and macrobotanical remains. Within the pollen record, Beardsley noted that there appears to be little difference between her study areas, as well as between the various feature types (Beardsley 2001:V.58). She explained that when differences were noted, they seem to relate more to depth of the samples

and to location across the landscape of Kalaeloa. Larger quantities of *Antidesma* pollen were present in lower layers, suggesting the presence of trees in the general vicinity of habitation sites, while upper layers were dominated by Cheno-am pollens, suggesting a vegetation change from a landscape dominated by trees to one dominated by shrubs.

The pollen results from the 1995 excavations and samples, according to Beardsley indicated that:

> …several tree species were present in the islands prehistorically. These include a species of Anacardiaceae (mango family), *Antisma* (hame), an endemic tree which bears edible fruit and has a hard wood that was used by Hawaiians, a species of Araliaceae (Ginger family), *Morinda* (noni) which was used medicinally by Hawaiians, *Myrsine* (‘olike), *Pritchardia* palms, and *Rauwolfia* (hao), also used medicinally.
>
> Identified shrubs that may have been present prehistorically include *Canthium* (alahe‘e), which has a hard wood used for many items by the Hawaiians, *Dodonaea* (a‘ala‘i), a species of *Euphorbia*, *Erythrina* (wiliwili), used for the outriggers of Hawaiian canoes, *Sida* (‘ilima), from which flower lei were made, *Scaevola* (naupaka), a species of Solanaceae (Nightshade family), and *Waltheria* (‘uhaloa), used medicinally.
>
> Identified herbs which may have been present prehistorically include Apiaceae (Snakerooot), *Artemisia* (wormwood; hinahina), members of the sunflower family, *Boerhavia* (alena), cf. *Charpentaria* (papala), *Heliotropium* (seaside heliotrope), and *Sicyos* (‘anunu). Grasses present include Cyperaceae (sedge family) and Poaceae (grass family). In addition, a member of the shrub Fabaceae (pea family) and *Chenopodium* (goosefoot), and the herbs *Amaranthus* (pigweed), Argemone (prickly poppy), and *Portulaca* (purslane) were identified from the macrobotanical remains (Beardsley 2001:V.60).

Table 5-10 below is derived from Beardsley’s (2001) Table E-2, and presents the identifications from charred wood (macrobotanical) remains collected in 1995 from archaeological sites in the KS1 and KS2 project areas. According to Beardsley (2001: V63), 26 taxa were identified, including 16 native species, four Polynesian introductions, five exotic species, and one palm that could not be identified to the species level (see Table 5-10). Table 5-11 presents the taxa identified in wood charcoal samples from the 1995 excavations.

Table 5-10. Summary of Wood Charcoal Taxa from 1995 Excavations.

Site	Feature	Unit	Layer/ Level	Depth, cmbd	Taxa	Part	Count	Weight (g)
1717	F	53	III/1-2	6-36	cf. *Rhizophora mangle*	Wood	2	0.42
					cf. *Xylosma hawaiiense*	Wood	2	0.13
					Chamaesyce spp.	Wood	8	0.93
					Chenopodium oahuense	Wood	6	1.00
					Dodonaea viscosa	Wood	5	0.25
1718	A	39	III/1	24-52	*Chenopodium oahuense*	Wood	8	0.52
1718	A	39	HF-6	19-29	*Scaevola* cf. *corriacea*	Wood	1	0.05
					cf. *Pittosporum* spp.	Wood	2	0.15
					Chamaesyce spp.	Wood	5	0.22
					Chenopodium oahuense	Wood	112	4.31
					cf. *Colubrina oppositifolia*	Wood	3	0.16

Site	Feature	Unit	Layer/ Level	Depth, cmbd	Taxa	Part	Count	Weight (g)
1719	A	29	HF-4			Bark	1	0.01
					Acacia koaia	Wood	10	0.21
					Chamaesyce spp.	Wood	7	0.13
					Chenopodium oahuense	Wood	15	0.15
					Dodonaea viscosa	Wood	2	0.01
					Myoporum sandwicense	Wood	2	0.01
1719	B	33	HF-5	15-19	*Chamaesyce* spp.	Wood	5	0.13
					Chenopodium oahuense	Wood	7	0.23
					Dodonaea viscosa	Wood	1	0.05
					cf. *Sida fallax*	Wood	22	1.6
1721	A	44	I/1-3	0-36	*Syzygium* cf. *cumini*	Wood	1	0.02
					Acacia koaia	Wood	3	0.36
					cf. *Sida fallax*	Wood	2	1.06
					cf. *Colubrina oppositifolia*	Wood	2	0.83
					Sesbania tomentosa	Wood	2	0.05
					Unknown 1	Wood	1	0.02
					Unknown 2	Wood	1	0.06
					Unknown 3	Wood	3	0.09
					Unknown 5	Wood	2	0.09
						Bark	4	0.18
						Parenchyma	4	0.23
					Arecaceae	Wood	13	0.13
					Chamaesyce spp.	Wood	22	1.36
					Chenopodium oahuense	Wood	32	3.78
					Lagenaria siceraria	Fruit rind	1	0.26
					Santalum spp.	Wood	6	0.38
1721	A	44	HF-7	20-28	cf. *Canthium odoratum*	Wood	1	0.01
					Unknown 5	Wood	1	0.07
						Bark	5	0.15
					Arecaceae	Wood	1	0.01
					Chamaesyce spp.	Wood	5	0.15
					Chenopodium oahuense	Wood	25	0.35
					cf. *Dodonaea viscosa*	Wood	2	0.02
					Santalum spp.	Wood	2	0.03
					Syzygium cf. *cumini*	Wood	5	0.06
1722	B	46	HF-9	14-23		Parenchyma	2	0.01
					Chamaesyce spp.	Wood	16	0.65
					Myoporum sandwicense	Wood	1	0.01

According to Beardsley (2001:V.63), there is little change in the composition and diversity over the time represented by the samples, which suggests a stable plant community with the continued use of native species as well as a few introduced species.

Table 5-11. Taxa Identified in Wood Charcoal Samples from 1995 Excavations.

Family	Scientific Name	Common/ Hawaiian Name	Origin	Habit
Arecaceae		Palm		Tree
Chenopodiaceae	*Chenopodium oahuense*	*Aheahea*	Endemic	Shrub
Cucrubitaceae	*Lagenaria siceraria*	*Ipu*	Polynesian introduction	Vine
Euphorbiaceae	*Chamaesyce* spp.	*Akoko*	Endemic	Shrub
Fabaceae	*Acacia koaia*	*Koaia, koaie*	Endemic	Tree
	Sesbania tomentosa	*Ohai*	Endemic	Shrub
Flacourtiaceae	*Xylosma hawaiiense*	*Maua*	Endemic	Tree
Goodeniaceae	*Scaevola corriacea*	Dwarf *naupaka*	Endemic	Shrub
Malvaceae	*Sida fallax*	*Ilima*	Indigenous	Shrub
Myoporaceae	*Myoporum sandwicense*	*Naio*	Indigenous	Tree
Myrtaceae	*Syzygium cumini*	Java plum	Exotic	Tree
Pittosporaceae	*Pittosporum* sp.	*Hoawa*	Endemic	Tree
Rhamnaceae	*Colubrina oppositifolia*	*Kauila*	Endemic	Tree
Rhizophoraceae	*Rhizophora mangle*	American or red mangrove	Exotic	Shrub-tree
Rubiaceae	*Canthium odoratum*	*Alahee*	Indigenous	Shrub-tree
Santalaceae	*Santalum* sp.	*Iliahi*	Endemic	Shrub-tree
Sapindaceae	*Dodonaea viscosa*	*Aalii*	Indigenous	Shrub-tree

SUMMARY OF FLORAL REMAINS FROM 2011 EXCAVATIONS

Because Beardsley had already conducted numerous wood charcoal identifications (see Table 5-10 and 5-11), only wood charcoal to be submitted for radiocarbon dating was submitted for wood charcoal identifications. These are discussed in Section 6 Specialized Analyses. A total of 62.2 g of floral remains was recovered from 2011 excavations in the KS1 and KS2 project areas. The types of floral remains identified include wood charcoal and *kukui* nut shell fragments. Table 5-12 below presents the distribution of the 2011 floral remains.

The floral remains are dominated by wood charcoal fragments, with 61.9 g or 99.5% of the floral assemblage. Wood charcoal was recovered from 8 features in six sites in the KS1 and KS2 project areas (see Table 5-12).

A total of 0.3 g of fragmented shell remains of *kukui* (*Aleurites moluccana*) were recovered from two sites, including Sites 1717 (Feature G) and 1718 (Feature J). *Kukui* had many uses in traditional Hawaiian culture (Abbott 1992), including but not limited to lamp oil, dyes (for kappa and tattooing), food preparation, and medicinal purposes.

Table 5-12. Distribution of Floral Remains from 2011 Excavations.

	KS1							KS2	
Site	**1717**	**1717**	**1718**	**1718**	**7182**	**7185**	**7186**	**7176**	**Total**
Feature	**E**	**G**	**J**	**K**	**I**	**D**	**A**	**D**	
Weight in grams (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
Wood charcoal	2.4	0.4	11.8	0.9	19.3	7.3	16.2	3.6	**61.9**
Kukui shell fragments (charred)		0.1	0.2						**0.3**
Total Floral Remains	**2.4**	**0.5**	**12.0**	**0.9**	**19.3**	**7.3**	**16.2**	**3.6**	**62.2**

SECTION 6 MACROBOTANICAL SCREENING AND RADIOCARBON DATING

Macrobotanical charcoal screening for endemic and Polynesian-introduced, short-lived floral species recovered from excavations was undertaken to provide samples with the narrowest possible temporal range for radiocarbon dating. Based on the results of the macrobotanical screening, charcoal samples were submitted for radiocarbon dating to augment the dating program detailed in Beardsley (2001:V.60). In addition to using macrobotanical screening to aid in radiocarbon dating, the results can also be informative in understanding, albeit qualitatively, environmental and cultural issues relating to traditional or historical use of flora.

Material from three features (Site 1718/Feature J, Site 7185/Feature D, and Site 7186/Feature A) was selected for analysis. Feature J of Site 1718 is a small oval enclosure from which a dense collection of traditional Hawaiian faunal, floral, and artifactual material was recovered, while Features D of Site 7185 and Feature A of Site 7186 are limestone sinkholes with sparse artifact concentrations.

MACROBOTANICAL SCREENING RESULTS

Four charcoal samples were submitted to Gail M. Murakami (International Archaeological Research Institute, Inc.; see Appendix D) for taxa identification to aid in selecting samples for radiocarbon dating by Beta Analytic, Inc. The results are summarized in Table 6-1. Descriptions of the taxa identified from the charcoal samples are presented below.

Table 6-1. Taxa Identification Results of Charcoal Samples.

Sample/ Bag No.	Site/Fe.	Unit	WIDL No.	Taxa	Common/Hawaiian Name	Status/Habit	Part	Count	Weight (g)
1/149	1718/J	TU-1 (II/1)	1112-1	*Aleurites moluccana*	*Kukui*, candlenut	Polynesian Introduction/Tree	Nutshell	8	0.23
			1112-2	*Chenopodium oahuense*	*ʻĀheahea*, *ʻāweoweo*		Wood	3	0.08
			1112-3	Not identified			Bark	1	0.02
2/56	7185/D	TU-1 (I/2)	1112-4	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	15	2.86
3/120	7186/A	TU-1 (II/1)	1112-5	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	8	0.14
4/122	7186/A	TU-1 (II/1)	1112-6	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	20	1.54

Taxa Notes

Aleurites moluccana (L.) Willd. (*Kukui*)

Once cultivated, this Polynesian introduction has escaped into the native forest, where the pale foliage of the 10 to 20 m trees (Wagner et al. 1990:598) can be seen in abundance in moist gulches and valleys. Dyes were once extracted from the bark and roots (Buck 1957:187), the oily kernel was burned for light (Buck 1957:107) or eaten as a relish after baking (Buck 1957:48), and net floats and dugout canoes were made from the soft wood (Buck 1957:297).

Chamaecyse spp. (*ʻAkoko*)

The distribution of the 15 endemic shrubs and small trees in this genus range from coastal environments to upper forest zones on the main Hawaiian Islands. Nine of these native species are found on Oʻahu (Wagner et al. 1990:602-617; Rock 1974:243-262). *ʻAkoko* was

once valued for firewood by the Hawaiians (Hillebrand 1981:396). The milky sap was once considered a possible source for rubber (Rock 1974:261).

Chenopodium oahuense (Meyen) Aellen (*'Āheahea, 'āweoweo*)

This endemic species is usually a shrub in the coastal lowlands but may become arborescent at higher elevations (Hillebrand 1981:380). Its known distribution in the main Hawaiian Islands includes coastal, dry forest, and subalpine shrubland at 0 to 2,520 meters elevation (Wagner et al. 1990:538). The soft wood is not known to have been used by the ancient Hawaiians but the leaves were cooked and eaten as greens (Hillebrand 1981:380; Malo 1951:23).

DISCUSSION

The four samples submitted for macrobotanical screening are consistent with, but less species-diverse than samples collected by Beardsley (2001; see Section 5) from other sites within the APE. The presence of *Aleurites moluccana* (*kukui*) in Feature J of Site 1718 is unique within the samples collected from the current APE, and only occurs at two sites within Beardsley's larger NASBARPT dataset. It is likely that the local environment did not support *kukui* stands during the pre-Contact period, suggesting that the identified sample was introduced for traditional use.

The remainder of the species identified within the current dataset are comparable to those submitted for macrobotanical analysis by Beardsley and represent common taxa within the pre-Contact 'Ewa landscape; their inclusion within archaeological contexts may indicate traditional use or the incidental intrusion of the material into the archaeological record.

RADIOCARBON DATING RESULTS

Three macrobotanical samples were submitted to Beta Analytic, Inc. for radiocarbon age determination (see Appendix E). The dataset included charcoal collected as part of the testing program selected for dating based on the criteria noted above. Samples were prepared following standard procedures for pretreatment. All three samples were submitted for Accelerator Mass Spectrometry (AMS) dating due to low sample weights. All samples (including those submitted by Beardsley [2001]) were calibrated using OxCal (version 4.1.7) software (Table 6-2), following the probability method as discussed in Telford (Telford et al. 2004).

Beardsley (2001:V.61) noted that the 34 samples submitted for dating from the NASBARPT project "…did little to clarify the regional cultural historic sequence, or to refine a local chronology." Likewise, the three additional dates derived from the current study do not contribute significantly to clarify specific issues of the regional culture history. However, the calibration or recalibration of the dates using the "probability" method does add additional clarification for the likely radiocarbon age of each sample.

Of the 12 dates reported in Table 6-2, only two (Beta No. 85056 and 85055) have a high or reasonably high likelihood of dating to before the mid 17th century. A third sample (Beta No. 85058) has about a 13 percent probability of dating to before the 17th century, but an approximately 83 percent chance of dating to after the 17th century. The remainder of the dates place sites in the APE during the late pre-Contact period or even early post-Contact period. Figure 6-1 aggregates the probability distribution of 11 radiocarbon dates from the APE (Beta No. 85057 was omitted) showing that approximately 75 percent of the dates fall between AD 1650 and AD 1870 and that the median radiocarbon age is AD 1770, confirming that the sites within the APE date to the late pre-Contact period.

Table 6-2. Radiocarbon Dates from Sites within the APE.

Beta No.[a]	Site/Fe.	Provenience	Material	Measured Radiocarbon Age (BP)[b]	13C/12C Ratio[c]	Conventional Radiocarbon Age (BP)	Calibrated Age (AD)[d,e]
85056	**1717/F**	**EU-53 (III/1-2)**	**Charred material**			**350 ± 70**	**1432-1664 (95.4%)**
85053	**1718/A**	**EU-39 (II;HF-6)**	**Charred material**			**150 ± 70**	**1656-1953 (95.4%)**
85052	**1718/A**	**EU-39 (III-1)**	**Charred material**			**140 ± 60**	**1665-1785 (41.8%)** **1793-1952 (53.6%)**
302261	1718/J	TU-1 (II/1)	Charred material	30 ± 30	-10.9 o/oo	260 ± 30	1520-1593 (27.8%) 1619-1670 (52.8%) 1780-1800 (12.6%) 1943-1954 (2.2%)
85051	**1719/B**	**EU-33 (HF-5)**	**Charred material**			**80 ± 60**	**1675-1778 (33.4%)** **1799-1942 (62.0%)**
85054	**1721/A**	**EU-44 (I/1-3)**	**Charred material**			**170 ± 90**	**1521-1591 (5.7%)** **1621-1955 (89.7%)**
85055	**1721/A**	**EU-44 (II/1-3)**	**Charred material**			**250 ± 60**	**1468-1695 (62.8%)** **1726-1814 (23.4%)** **1853-1868 (0.9%)** **1918-1955 (8.0%)**
85057	**1722/B**	**EU-46 (HF-8)**	**Organic sediment**			**100.1 ± 0.7% Modern**	**Post 1950**
85058	**1722/B**	**EU-46 (HF-9)**	**Charred material**			**190 ± 100**	**1495-1602 (12.6%)** **1616-1955 (82.8%)**
85113	**1722/C-D**	**EU-47 (II-1)**	**Charred material**			**150 ± 50**	**1665-1786 (44.9%)** **1792-1894 (33.9%)** **1905-1952 (16.6%)**
302262	7185/D		Charred material	100.7 ± 0.4 pMC	-11.0 o/oo	170 ± 30	1659-1699 (17.6%) 1722-1818 (50.7%) 1833-1880 (8.2%) 1916-1954 (18.9%)
302263	7186/A		Charred material	60 ± 30	-22.6 o/oo	100 ± 30	1682-1736 (27.2%) 1805-1935 (68.2%)

[a] Bolded entries are from Beardsley (2001)
[b] Beardsley (2001) does not provide Measured Radiocarbon Age data
[c] Beardsley (2001) does not provide 13C/12C ratio data.
[d] Calibrated ages were determined at the 2-sigma level using OxCal 4.1.7, calibration curve IntCal-09 (Reimer et al. 2009)
[e] Data from Beardsley (2001) was recalibrated using OxCal 4.1.7.

SECTION 7 INTERPRETATION AND CONCLUSIONS

Archaeological survey within the APE documented four previously recorded archaeological sites (Sites 1717, 1718, 1719, and 1721) as well as 12 previously undocumented sites (Sites 7176-7182 and Sites 7184-7188). Thirteen previously recorded sites (Sites 1720, 1722, 4554-4556, 4558-4562, and 4565-4567) were not relocated and are presumed destroyed by bulldozing or grubbing since the mid 1990s when the most recent archaeological survey was conducted (Beardsley 2001). Two previously recorded sites (Sites 1727 and 4553) adjacent to but outside the APE were revisited but no additional work was undertaken. One site (Site 4552), also adjacent to but outside the APE, is presumed extant due to a lack of disturbance in the area, but was not relocated.

To facilitate interpretations, significance evaluations, and recommendations, data from Beardsley (2001) was incorporated into site descriptions for Sites 1717, 1718, 1719, and 1721. Likewise, site descriptions for Sites 1720 and 1722, both destroyed, come primarily from Beardsley (2001), with additional information from Haun (1991). Although NRHP significance evaluations and recommendations are no longer pertinent to the destroyed resources, the previously recorded data from these sites contribute to the overall archaeology within the APE.

CHRONOLOGY

Regarding chronology within her NASBARPT APE, Beardsley (2001: VI.3) concludes that:

> Little can be said about the specific distribution of sites and site types by date: our chronology of site types is neither refined nor developed sufficiently to link time with place or style. At best, models formed in advance of this project change little; the added information generated by current project work simply confirms and supplies more hard and firm evidence for occupation of the project area by AD 1200. What people were doing, where they were living and how they managed the landscape are only broadly recognized in the archaeological record.

Figure 7-1, the probability distribution of radiocarbon dates based on several scenarios, appears to confirm Beardsley's claim that occupation of her APE may have begun around or prior to AD 1200. However, 75 percent of the probability distribution for Beardsley's 19 radiocarbon dates is between AD 1425 and AD 1900, with a median date of AD 1700. In Figure 7-1, Beardsley's (2001) data also show a slight bimodal distribution of dates with one crest at approximately AD 1450 and another, much larger, crest at around AD 1700.

Using only the radiocarbon dates from the current APE (see Section 6, Table 6-2) indicates a more restricted and slightly more recent occupation of the project area, with 75 percent of the probability distribution falling between AD 1650 and AD 1875, with a median of AD 1775. While the radiocarbon dating program associated with the current study, like Beardsley's, does not alter existing models, it does suggest a slightly later occupation of the current study than the overall NASBARPT study area of Beardsley (2001; see also Tuggle 1997b).

SUBSISTENCE PATTERNS

Excavations during the current study added little to Beardsley's (2001) discussion of subsistence patterns beyond confirming the ubiquity of sparse concentrations of marine shell in archaeological deposits on the 'Ewa Plain. Excavations at previously recorded and newly recorded pre-Contact sites recovered quantities of fauna and artifacts suggesting predominantly

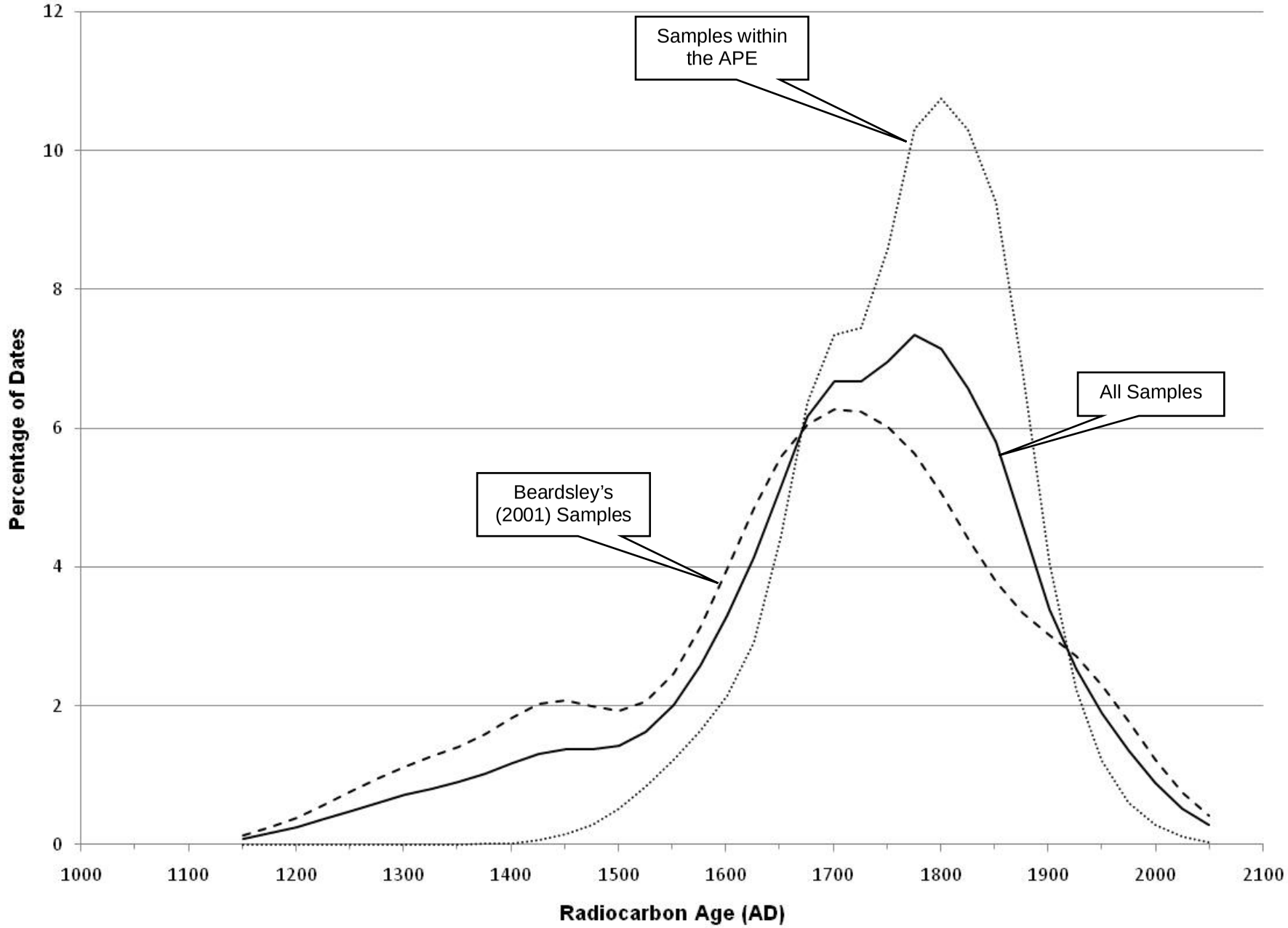


Figure 7-1. Probability Distribution Graph of Radiocarbon Dates for All Samples collected by Beardsley (2001) and the Current Project, All Samples within the APE, and Beardsley's Samples Only.

temporary or expedient use (see Section 5). However, material recovered from Site 1718, Feature J (a small circular oval enclosure newly recorded during the current study) produced concentrations of artifacts and midden possibly indicative of more long-term or intensive use of the site. Excavations within features designated as agricultural recovered few artifacts and sparse faunal material; however, charcoal flecking noted at most features is possibly indicative of human-induced fires, or mulching, related to agricultural use.

As indicated in the faunal section of Section 5 and the macrobotanical section of Section 6, the overall pattern within the dataset generated during the current study is similar but less species-diverse than the dataset generated by Beardsley (2001) within the same area. However, the discrepancy in species diversity between the 1995 and 2011 work appears to focus on two features: Feature A of Site 1721, and Feature J of Site 1718. While these two features are similar in morphology to other sinkholes and above-ground structures, the higher concentration of traditional artifacts, along with the high concentration of midden, suggests either a longer duration of use or a more intensive short-term use than at similar sites. Future work at these sites should focus on understanding the depositional history of these features in order to clarify the chronology.

SINKHOLES

As noted by Beardsley (2001) and other researchers (see Tuggle and Tomonari-Tuggle 1997b), sinkhole features are ubiquitous on the ‘Ewa Plain. These features have been documented to have multiple traditional functions including habitation, human burial, agriculture, and resource exploitation. Four new sinkhole sites (Sites 7182, 7184, 7185, 7186) were recorded as part of the current study. As has been shown within the current APE, both short-term and long-term habitation of sinkholes is indicated, as is human burial and agriculture. This pattern is not unique to the APE, however, and is exhibited throughout the ‘Ewa Plain and into Waianae District.

While the use of sinkholes is present within the APE, the materials recovered from these features are not remarkable other than the dense concentrations of traditional artifacts and midden recovered from Feature A of Site 1721. The remaining sinkhole features within the APE contain sparse midden accumulations that in several cases have been mixed with historic or modern rubbish. Based on the surface artifacts recovered from Site 1727 by Haun (1991), it is likely that this sinkhole (located just outside the project area (see Figure 4-2) will yield diverse faunal and artifact assemblages as Site 1721, Feature A.

In addition, the current survey recovered charcoal and faunal remains from excavations at two sinkholes: the modified sinkhole (Feature A) at Site 7186 and the largest sinkhole (Feature D) at Site 7185. These cultural materials strongly suggest that these two sinkholes were used for agriculture. Sinkholes used for agriculture have been found elsewhere on the ‘Ewa Plain (e.g., the Deep Draft Harbor; Davis 1995), and into the Waianae area.

MILITARY USE

The military use of NASBARPT has been well documented (Tuggle and Tomonari-Tuggle 1994, 1997b). The current APE appeared to have been developed less intensively than other parts of the base and only remnants of military activity remain. The current investigation represents the first archaeological survey that has documented foundations of buildings and infrastructure presumed to be associated with military buildings built just before or shortly after December 1941.

In the KS1 project area, Site 7178 (see Figure 4-22), a possible military encampment complete with a sentry post structure (Feature D), a bath house, (Feature F), and an associated refuse dump (Site 7182), was identified. Beer bottles and specialty bottles recovered from surface collections at Site 7178 date to the early to mid-1940s (see Section 5 beer bottle types). Site 7179 was also identified as a military structure, based on the platform's architecture and on communications wire present. The central hole in the platform may have supported a pole with a loud speaker, or a standard with a flag.

In Site 7182, a sinkhole cluster located about 25.0 to 30.0 m south of the Site 7178 military encampment, the extent of beer bottles and metal artifacts suggest that military personnel were using a number of the sinkholes to dump refuse. What was thought to be a license plate is likely a pass and ID plate provided to civilian workers (see Figure 5-8). Based on information from John Bennett, it appears that these plates were used to identify civilian cars registered to Navy bases on O'ahu, a predecessor of today's military decals affixed to civilian cars (Wood 1992: 20).

In KS2 Site 7177, which includes seven dispersed concrete foundations in KS2, likely represents infrastructure facilities. According to John Bennett, at Site 7177, Feature A (concrete foundation) of Site 7177 (see Figure 4-55), a large concrete foundation, one of the pieces of graffiti, "1st Sgt. Btry D 870" may refer to Battery D, 870th Anti Aircraft Artillery (A.A.A.) Automatic Weapons Battalion, a battalion (Semimobile) that was made up of African-American soldiers stationed at Barbers Point on December 12, 1943 until moving to Fort Lawton, Washington on June 15, 1946 (Stanton, 1964: 509).

While it is not known what Site 7177, Features C and D are. It may be that Feature C is an oil/water separator. However, it also resembles a structure associated with sewer outfalls (see Appendix F: Sewer Outfall Structures; pg.3).

SECTION 8 SITE SIGNIFICANCE EVALUATIONS AND RECOMMENDATIONS

SIGNIFICANCE EVALUATIONS

Evaluating the significance of archaeological sites or historic properties is a requirement for state-regulated projects under HAR Chapter 6E-8 and its implementing regulation (Chapter §13-275-6). The purpose of the AIS was to determine if archaeological resources that are on, or potentially eligible for, the NRHP or HRHP were located in the project APE. Resources were assessed against the NRHP criteria (36 CFR 60.4) to determine their potential for eligibility. These criteria require that the quality of significance in American history, architecture, culture, and archaeology should be present in buildings, structures, objects, sites, or districts that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that the buildings, structures, objects, sites, or districts:

- A. are associated with events that have made a significant contribution to the broad patterns of our history;
- B. are associated with the lives of persons significant in our past;
- C. embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. have yielded, or may be likely to yield, information important in prehistory or history.

In addition, one other criterion (e) has been added to the HRHP evaluation:

> Have an important value to the native Hawaiian people or other another ethnic group with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity (Chapter §13-275-6).

Typically, criterion (e) is invoked in Hawai'i when human burials are present in archaeological contexts. However, the criterion has also been used when other resources such as Traditional Cultural Properties (TCP) are being evaluated.

The site significance evaluations for the 16 sites documented during the 2011 archaeological inventory survey are presented in Table 8-1. Twelve sites are recommended as not eligible (NE) for the NRHP or HRHP. These sites have been described, mapped, and in most cases excavated to a level that it is unlikely that additional important data remain. Furthermore, most of the extant archaeological resources in the APE have been disturbed by recent land alteration. Any effects that may occur during the proposed development have been mitigated.

Four sites (Sites 1718, 1719, and 7185 in KS1 and Site 1721 in KS2) are recommended significant under Criterion D. In addition, Site 1721 is also recommended as significant under Criterion e of the HRHP because isolated, disarticulated human burials skeletal remains were found in the Feature A modified sinkhole. These remains were returned to the Navy under the authority of NAGPRA.

Some features of Sites 1718, 1719, and 7185 no longer contribute to their site's significance either because of data collection, disturbance, or both (see Section 4). However, Features A and J in Site 1718, Features A, B, and C in Site 1719, and Feature D in Site 7185

Table 8-1. NRHP Significance Evaluations and Recommendations for Archaeological Sites in KS1 and KS2.

SIHP Site 50-80-12-	Description	NRHP Significance Recommendation*	Additional Work Recommendation
KS1			
1717	Pre-Contact temporary habitation and agricultural complex: 18 features, site area disturbed.	NE	None
7179	Mound/military industrial use; 1 feature, site area disturbed.	NE	None
1718	Pre-Contact temporary habitation and agricultural complex; 12 features, site area disturbed; 10 features no longer contribute to site significance.	D	Preservation of Features A and J
1719	Pre-Contact temporary habitation and agricultural complex; 6 features, site area disturbed; 3 features no longer contribute to site significance.	D	Preservation of Features A, B, and C
7178	Military/industrial feature complex; 6 features, site area disturbed.	D	None
7182	Sinkhole complex; pre-Contact temporary habitation and post-Contact rubbish dump (Military): 11 features, site area disturbed.	NE	None
7184	Sinkhole, pre-Contact agriculture: 1 feature, site area disturbed	NE	None
7185	Sinkhole complex, pre-Contact agriculture: 5 features.	D	Preservation of Feature D
7186	Sinkhole complex, pre-Contact agriculture: 2 features, site area disturbed.	NE	None
7187	Feature Complex, transportation/industrial/agricultural: 3 features, site area disturbed.	NE	None
7188	Concrete vault, industrial/drywell: 1 feature, associated infrastructure destroyed	NE	None
KS2			
1721	Pre-Contact temporary habitation and agricultural complex ; possible human burial.	D HRHP: D, E	Preservation of site
7176	Feature Complex, military: 2 features, site area disturbed	NE	None
7177	Military feature complex: 7 features, dispersed, site area disturbed.	NE	None
7181	Historic/Military artifact scatter/refuse dump: 2 features, site area disturbed	NE	None
7180	Concrete vault/portable machine-gun pillbox: 1 features, removed from context	NE	None
* NE = recommended not eligible; D = recommended eligible under Criterion D			

still have the potential to contribute information important to the history or prehistory of Hawai‘i and are being recommended for preservation. All features within Site 1721 are recommended for preservation.

RECOMMENDATIONS

Recommendations for further archaeological work on KS1 and KS2 project areas include the following:

1. Preparation of an Archaeological Monitoring Plan (AMP)
2. Archaeological monitoring during grading and grubbing operations in KS1 and KS2
3. Preparation of a Historic Preservation Plan (HPP) for selected sites and features to be preserved.

Preparation of an AMP is recommended because there are sites scheduled to be preserved and they will require protection during grading and grubbing operations. The AMP should specify the following:

- The locations and descriptions of sites to be preserved in the KS1 and KS2 project;
- The protection measures to be taken for the preserved sites in the KS1 and KS2 project areas during construction;
- The need for archaeological monitors to ensure their protection type during grubbing and grading operations.

The AMP should specify that archaeological monitoring will be conducted during ground-disturbing operations including installation of silt fences, all grading and grubbing operations, and sub-grade excavations that extend beyond 2.0 to 3.0 feet in depth (including construction excavations that extend into the limestone bedrock). It is important to have a monitor on site for excavations into the limestone bedrock in case a sinkhole is opened that contains cultural materials and features, including human burials.

An HPP should be prepared to ensure long-term protection of sites and features recommended for preservation. The HPP should identify the sites and features to be preserved, define buffer zones, and provide short-term and long-term preservation strategies. Short-term protective measures should be implemented prior to the start of construction and will primarily entail installation of orange plastic fencing along boundaries of the project areas and around sites and features to be preserved. Short-term protective measures should also include having an archaeological monitoring on site during construction. Fencing should also be installed around sites that are just outside the KS1 and KS2 project areas (e.g., Sites 1727 and 4552 (see Figure 1-2). Long-term protective measures should include recommended methods of hand-clearing of vegetation in the site preserves, and some type of permanent fence (e.g., chain link fencing) or low vegetation barrier to be installed around the site. The HPP may also include recommendations for partnering with community stakeholder groups and educational opportunities associated with the preserved sites.

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APPENDIX A

Selected Plan View Maps and Profiles from Beardsley (2001)

Appendix A Figure List

Figure A-1. Site 1717, Plan View.

Figure A-2. Site 1717, Feature F, EU-53 Profile.

Figure A-3. Site 1718, Plan View (from Haun and Kelly, 1985).

Figure A-4. Site 1718, Feature A.

Figure A-5. Site 1719, Plan View (From Haun and Kelly, 1985).

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Figure A-9. Site 1721, Feature A, EU-44 Profile.

Figure A-10. Site 1721, Features A-D and Features E-H, with Inset of Feature A Interior.

Figure A-11. Site 1722, Features C, D, E, K, and P.

Figure A-12. Site 1722, Features B and L.

Figure A-13. Site 1722, Feature M.

Figure A-14. Site 1722, Feature O.

Figure A-15. Site 1722, Feature R.

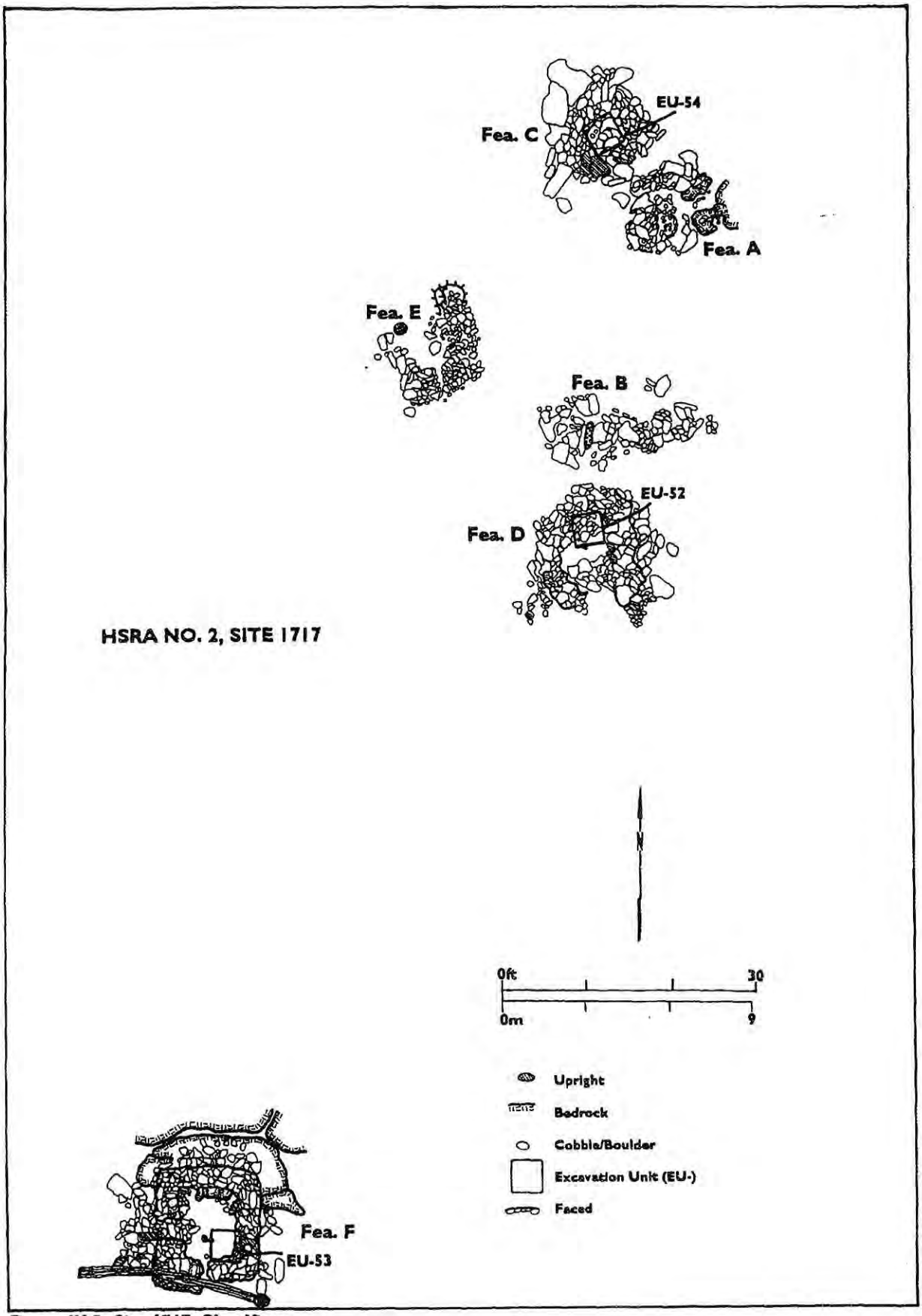


Figure IV-2. Site 1717, Plan View

Figure A-1. From Beardsley (2001).

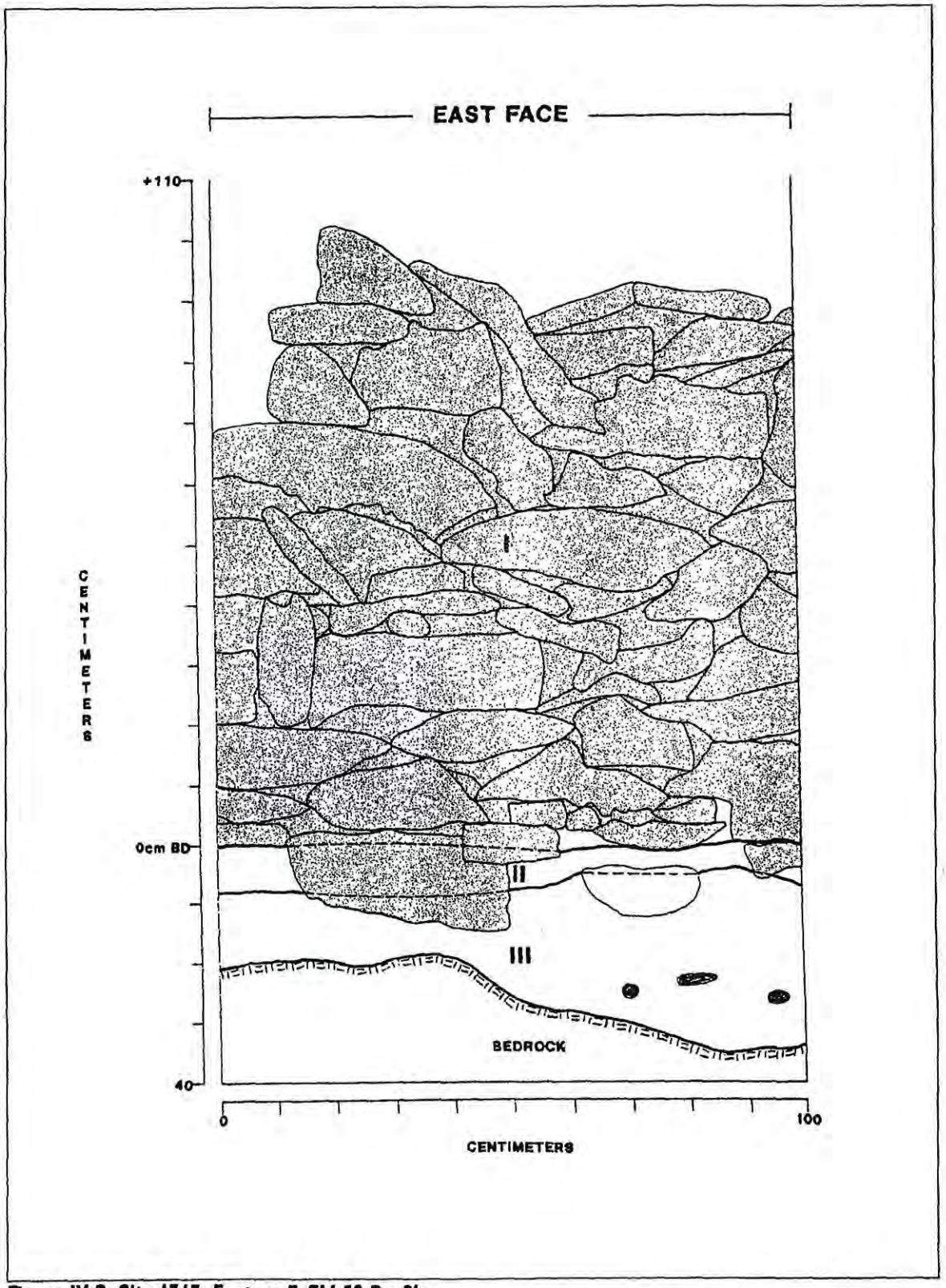


Figure IV-3. Site 1717, Feature F, EU-53 Profile

Figure A-2. From Beardsley (2001).

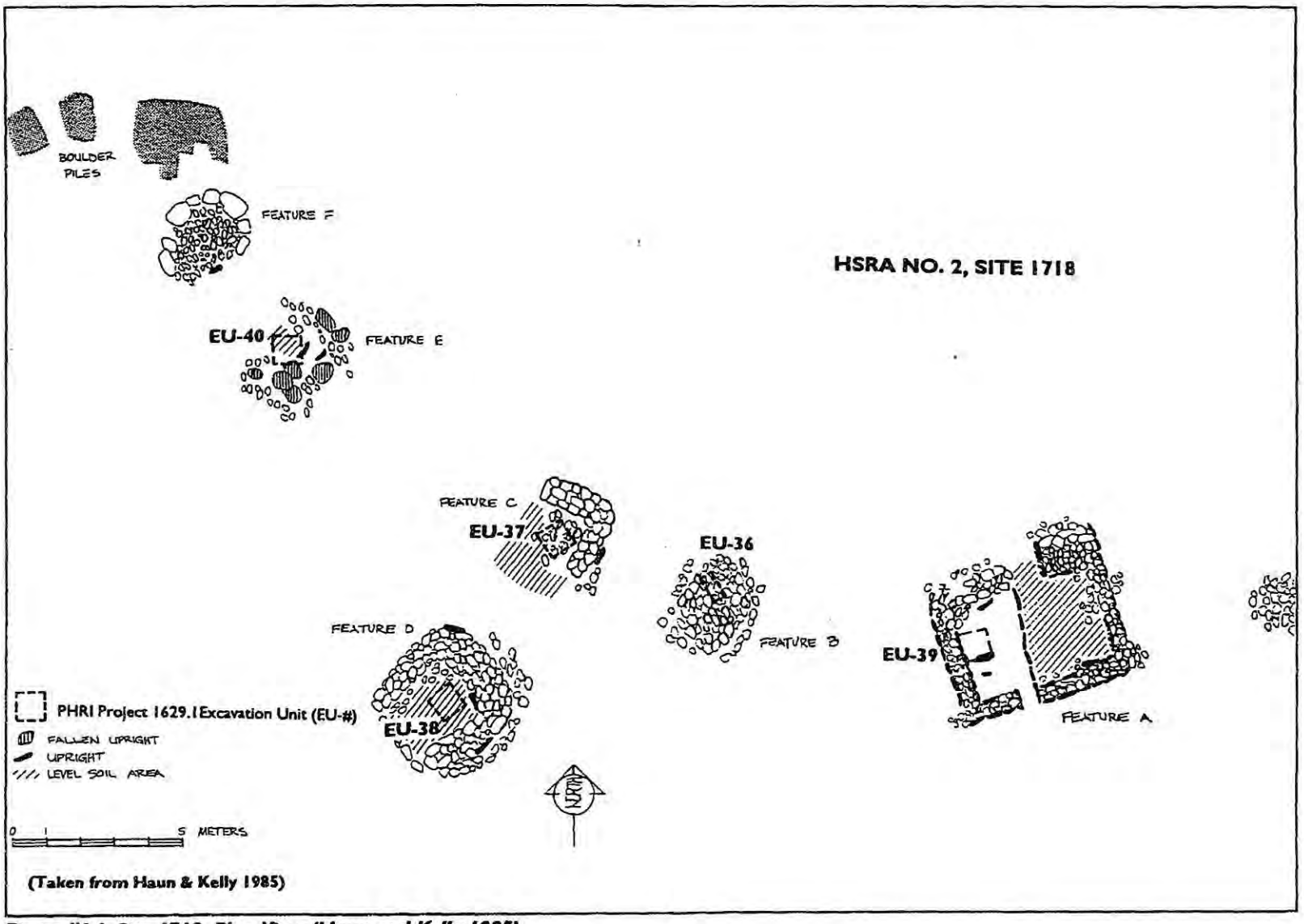


Figure IV-4. Site 1718, Plan View (Haun and Kelly 1985)

Figure A-3. From Beardsley (2001).

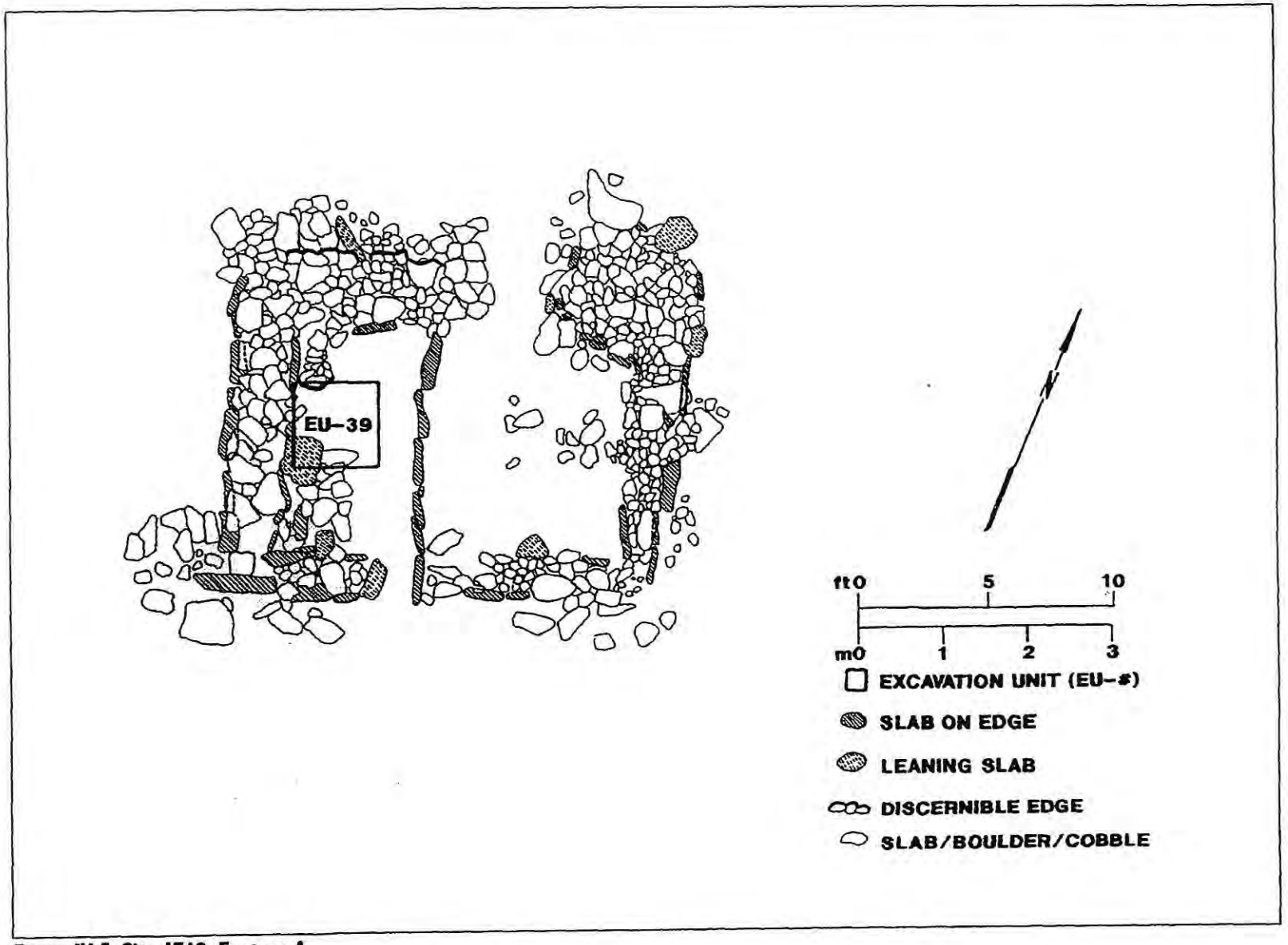


Figure IV-5. Site 1718, Feature A

Figure A-4. From Beardsley (2001).

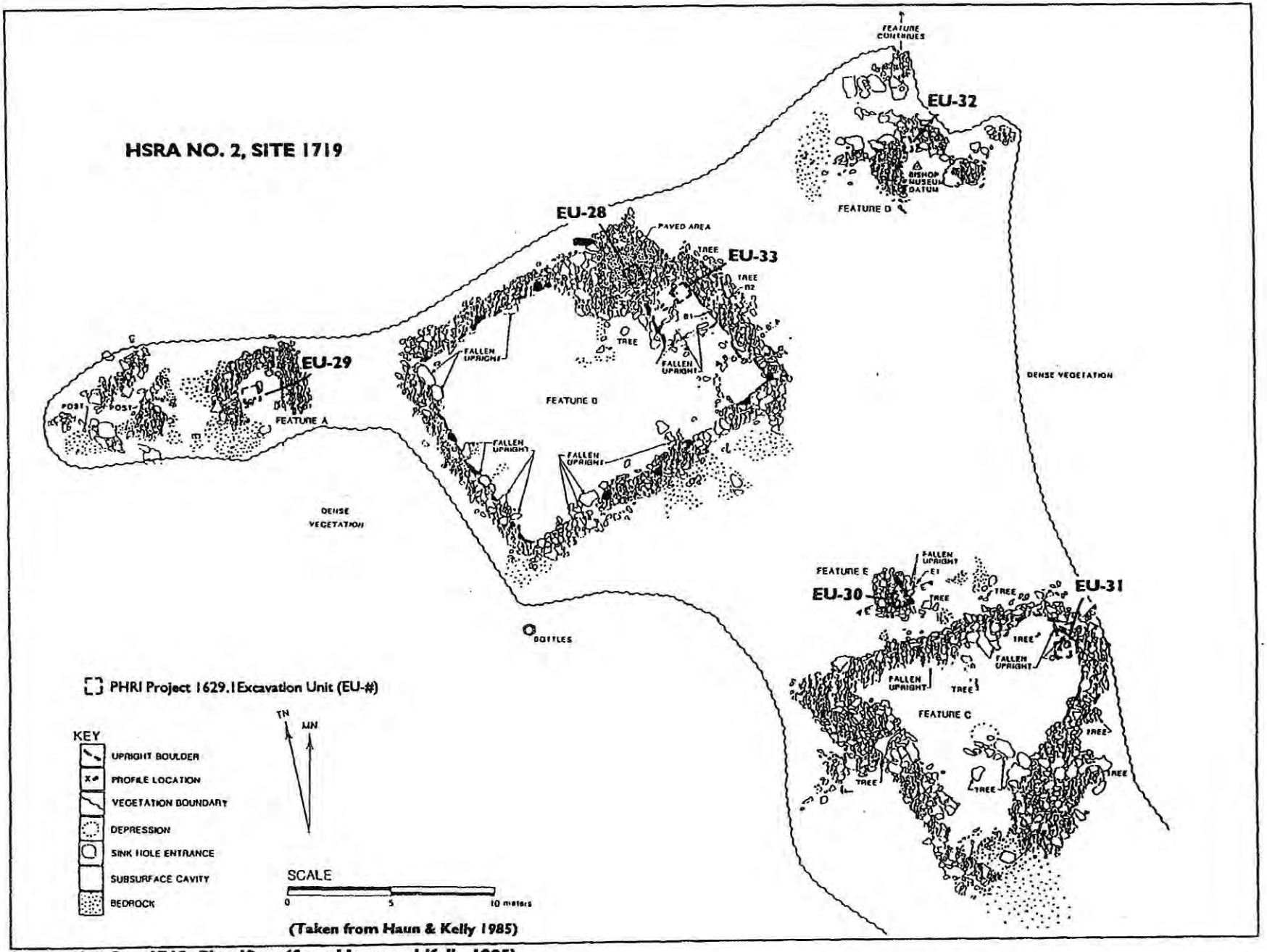


Figure IV-6. Site 1719, Plan View (from Haun and Kelly 1985)

Figure A-5. From Beardsley (2001).

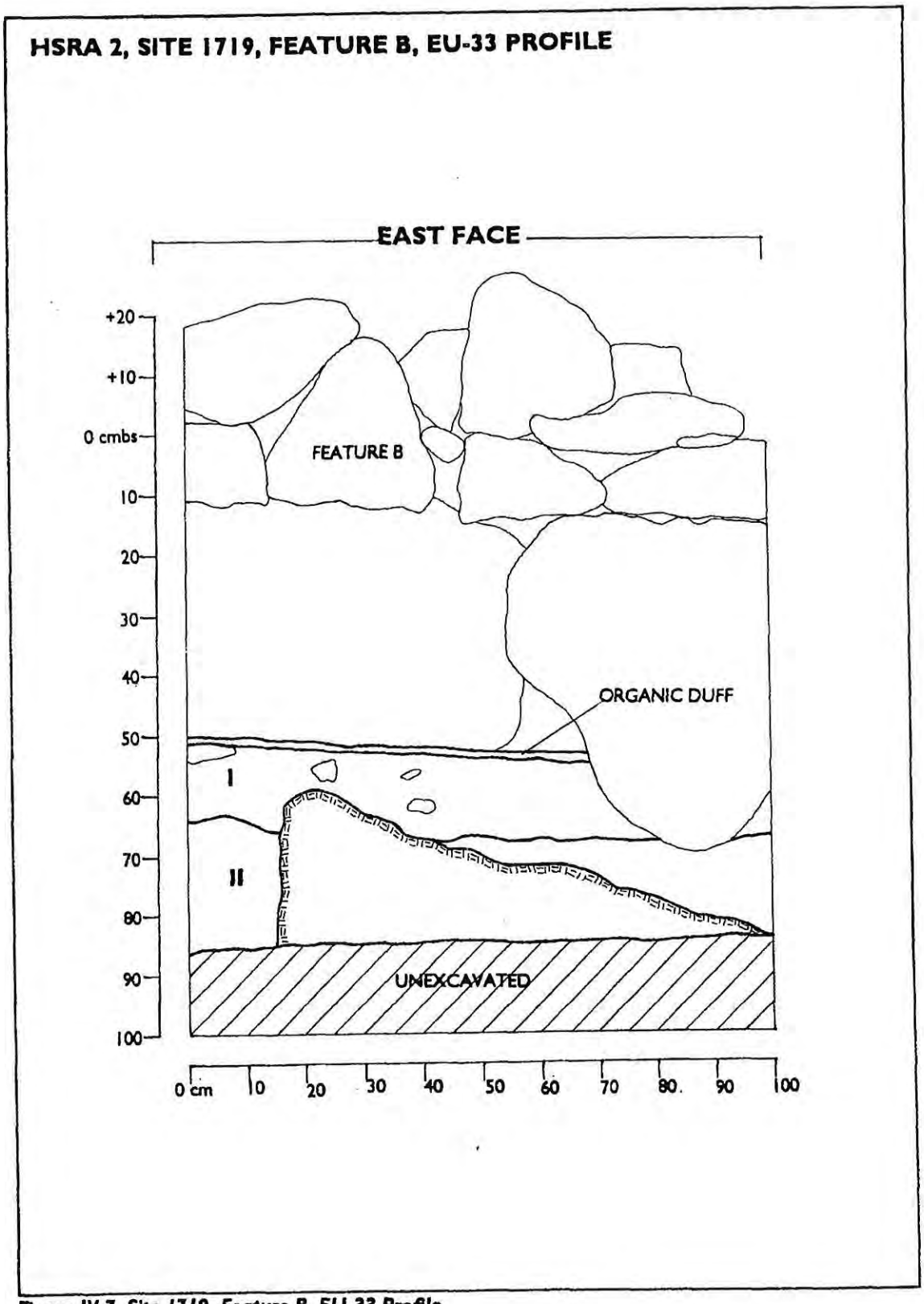


Figure IV-7. Site 1719, Feature B, EU-33 Profile

Figure A-6. From Beardsley (2001).

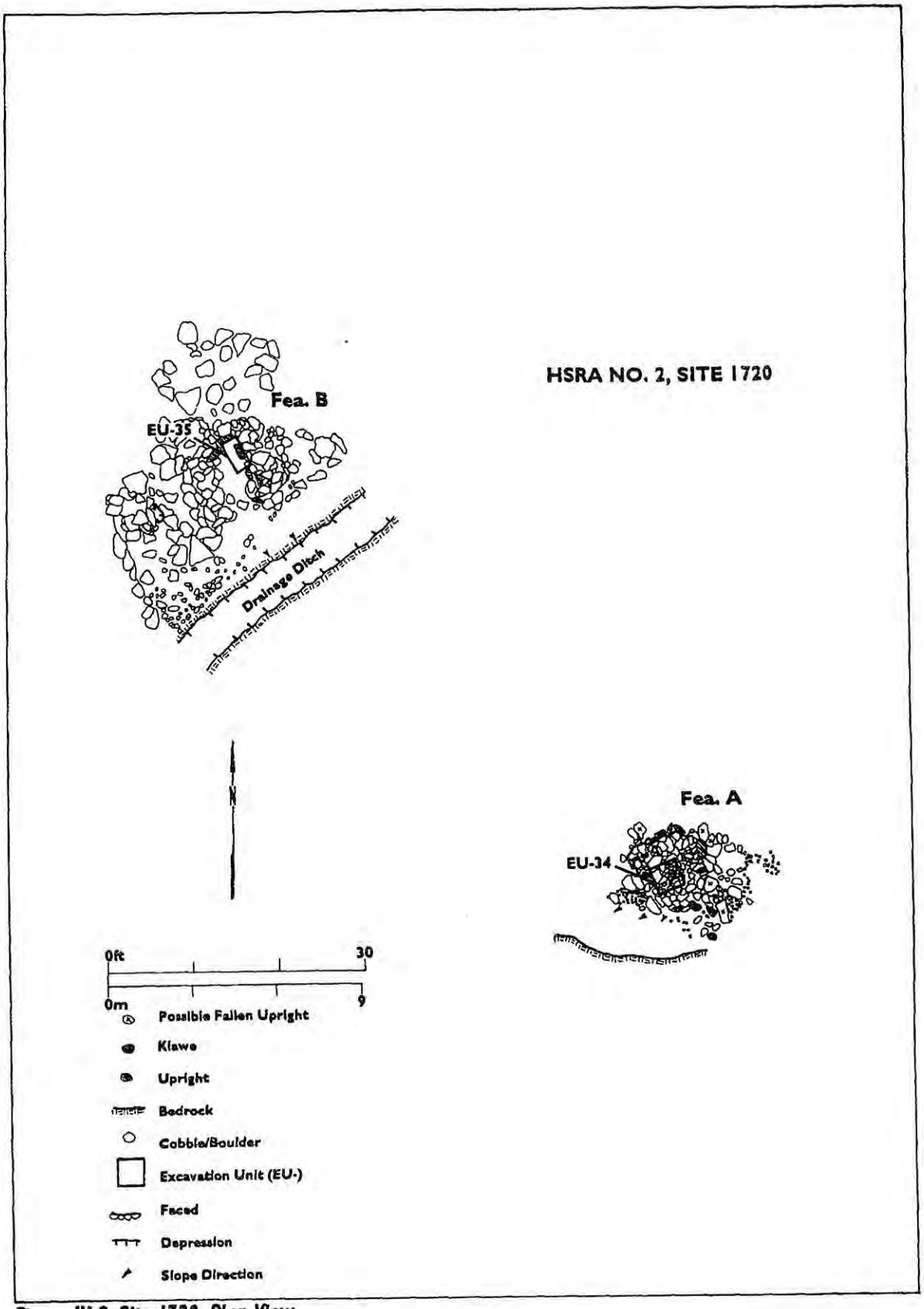


Figure IV-8. Site 1720, Plan View

Figure A-7. From Beardsley (2001).

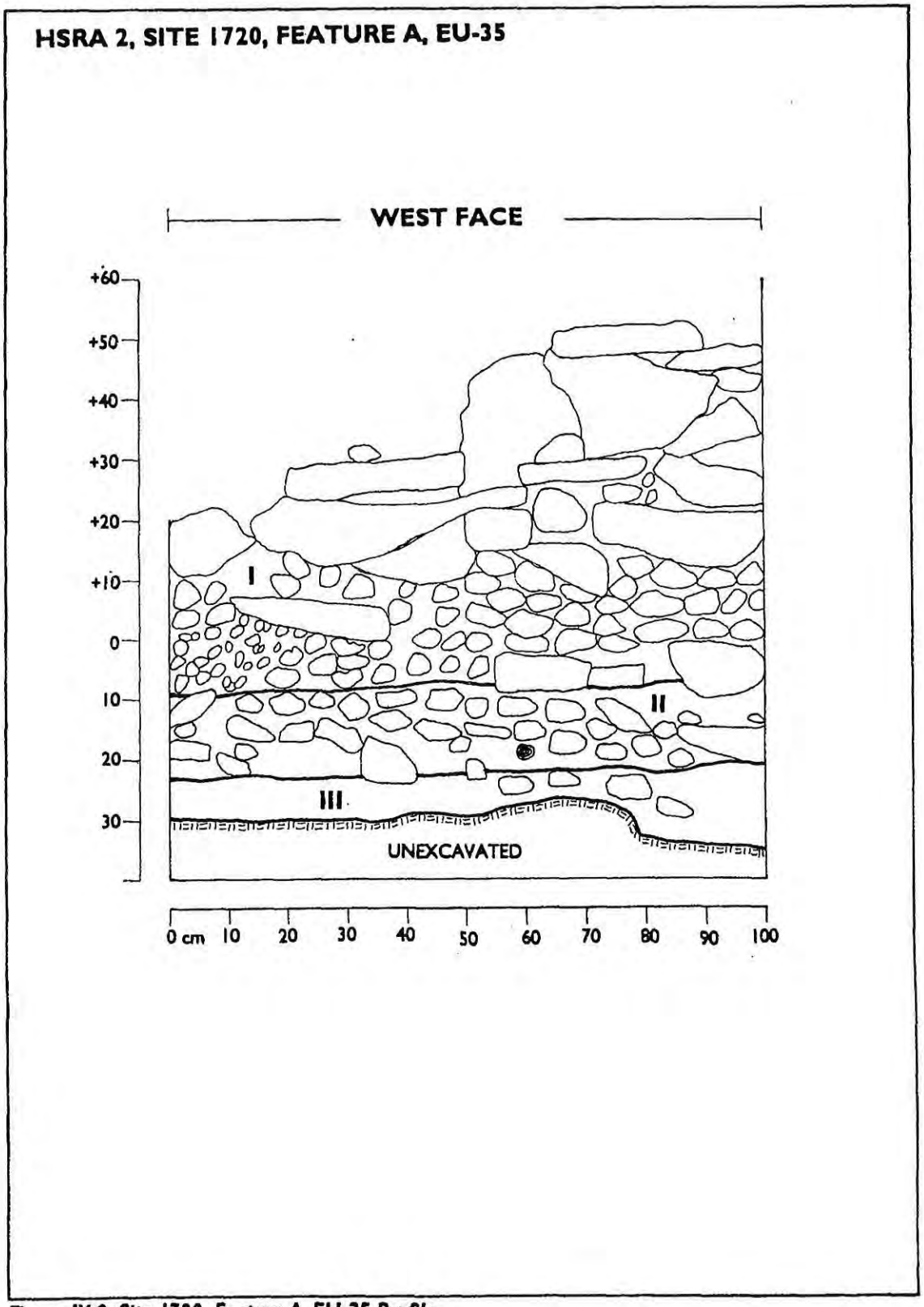


Figure IV-9. Site 1720, Feature A, EU-35 Profile

Figure A-8. From Beardsley (2001).

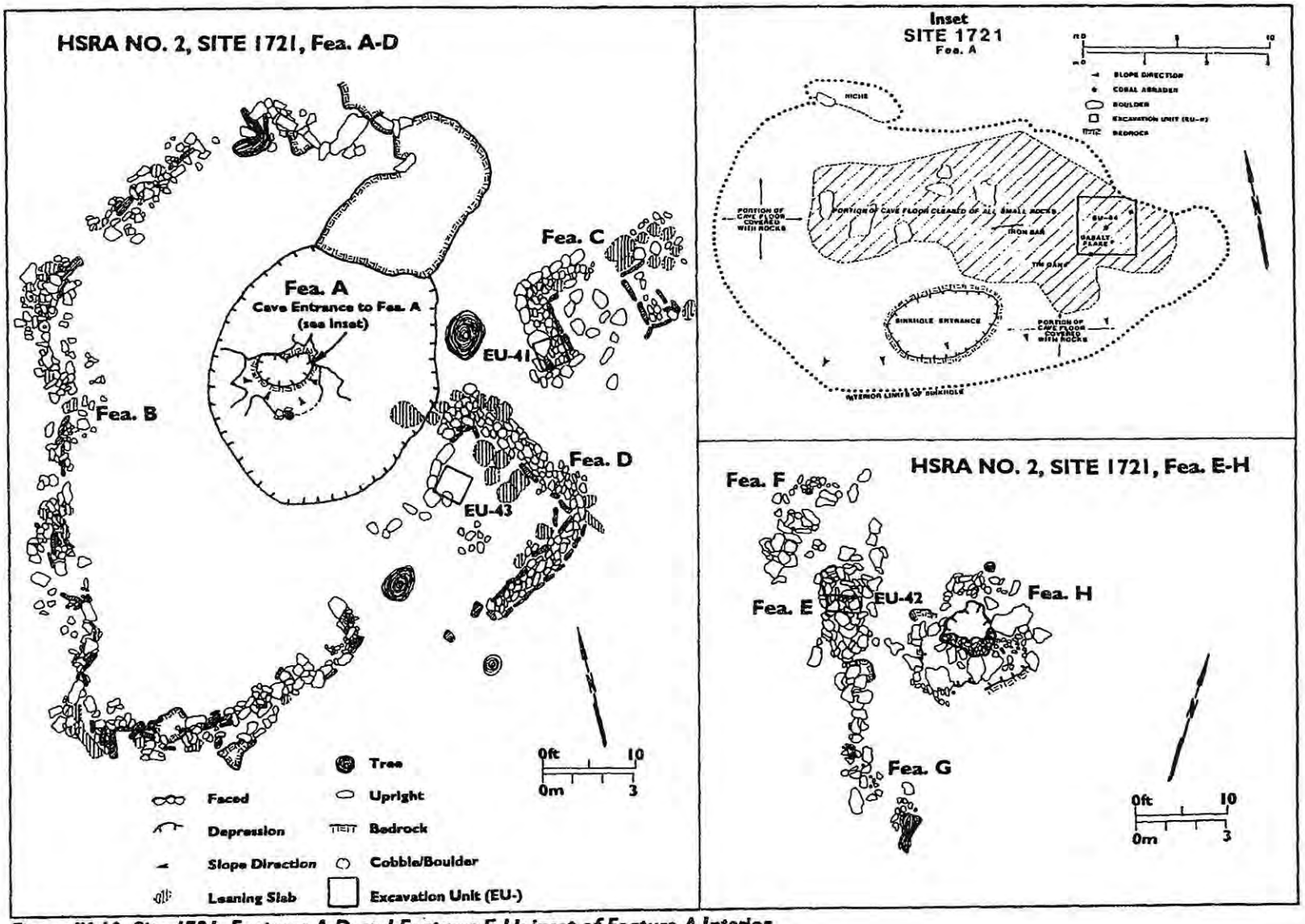


Figure IV-10. Site 1721, Features A-D and Features E-H; inset of Feature A Interior

Figure A-9. From Beardsley (2001).

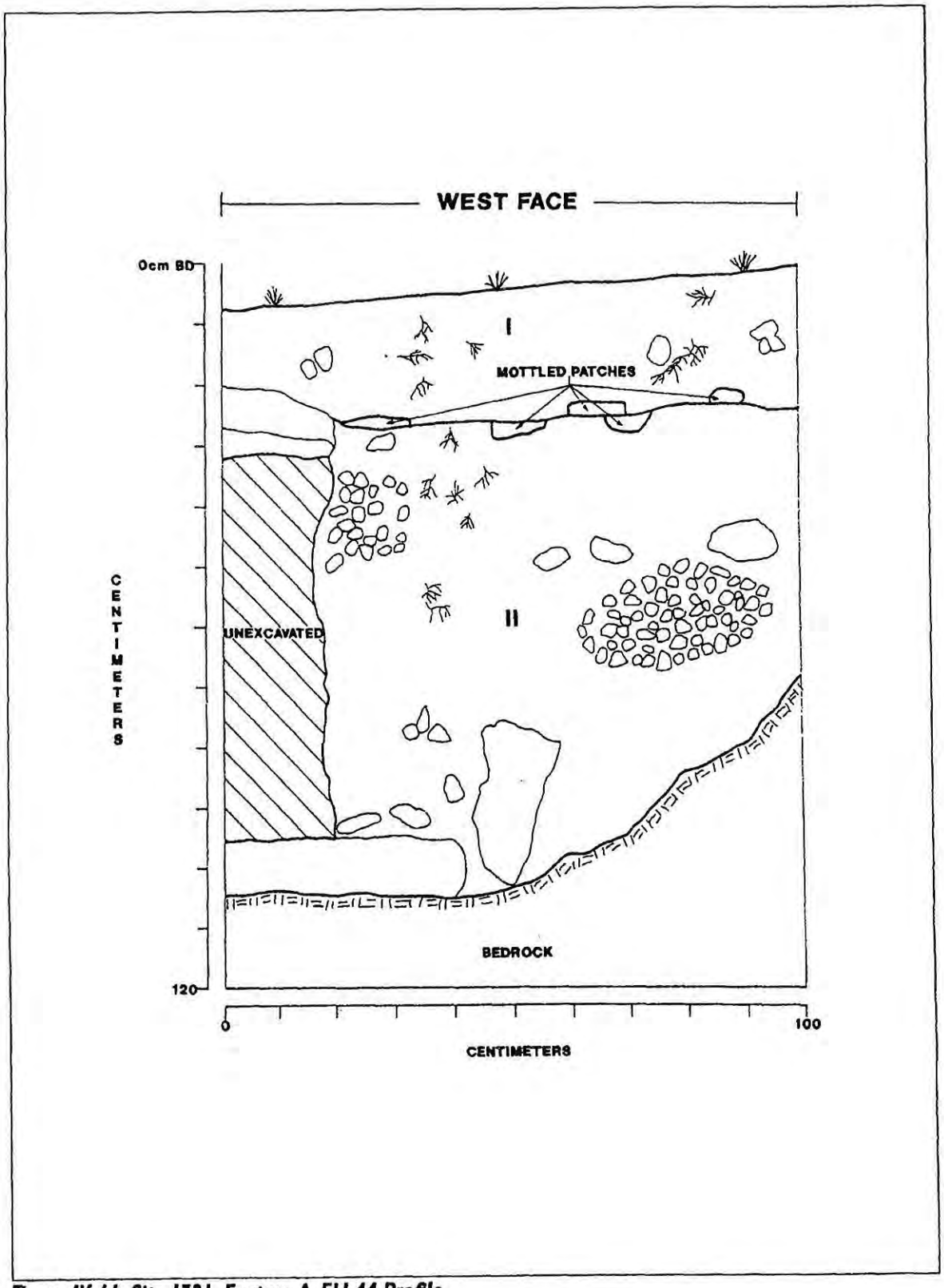


Figure IV-11. Site 1721, Feature A, EU-44 Profile

Figure A-10. From Beardsley (2001).

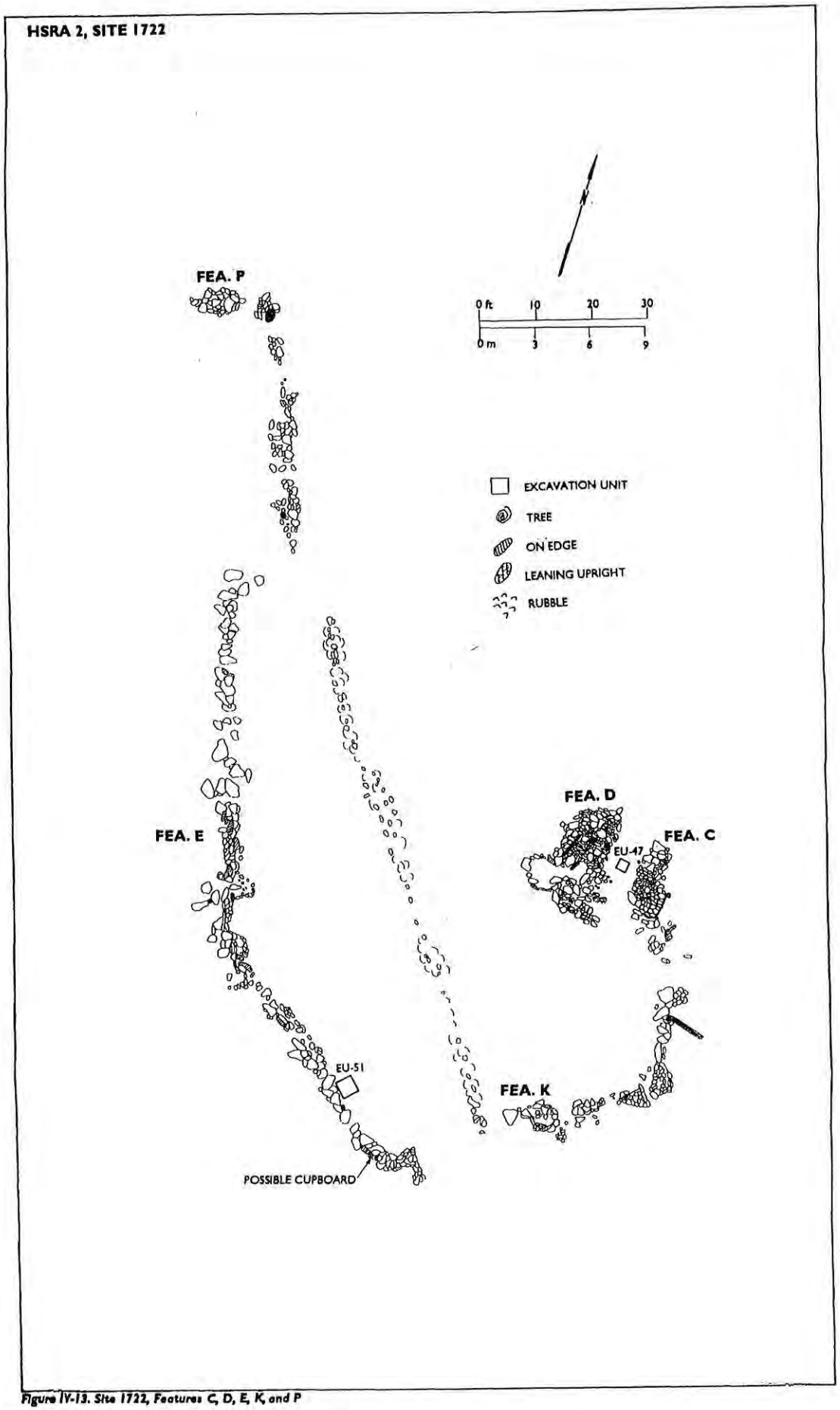


Figure IV-13. Site 1722, Features C, D, E, K, and P

Figure A-11. From Beardsley (2001).

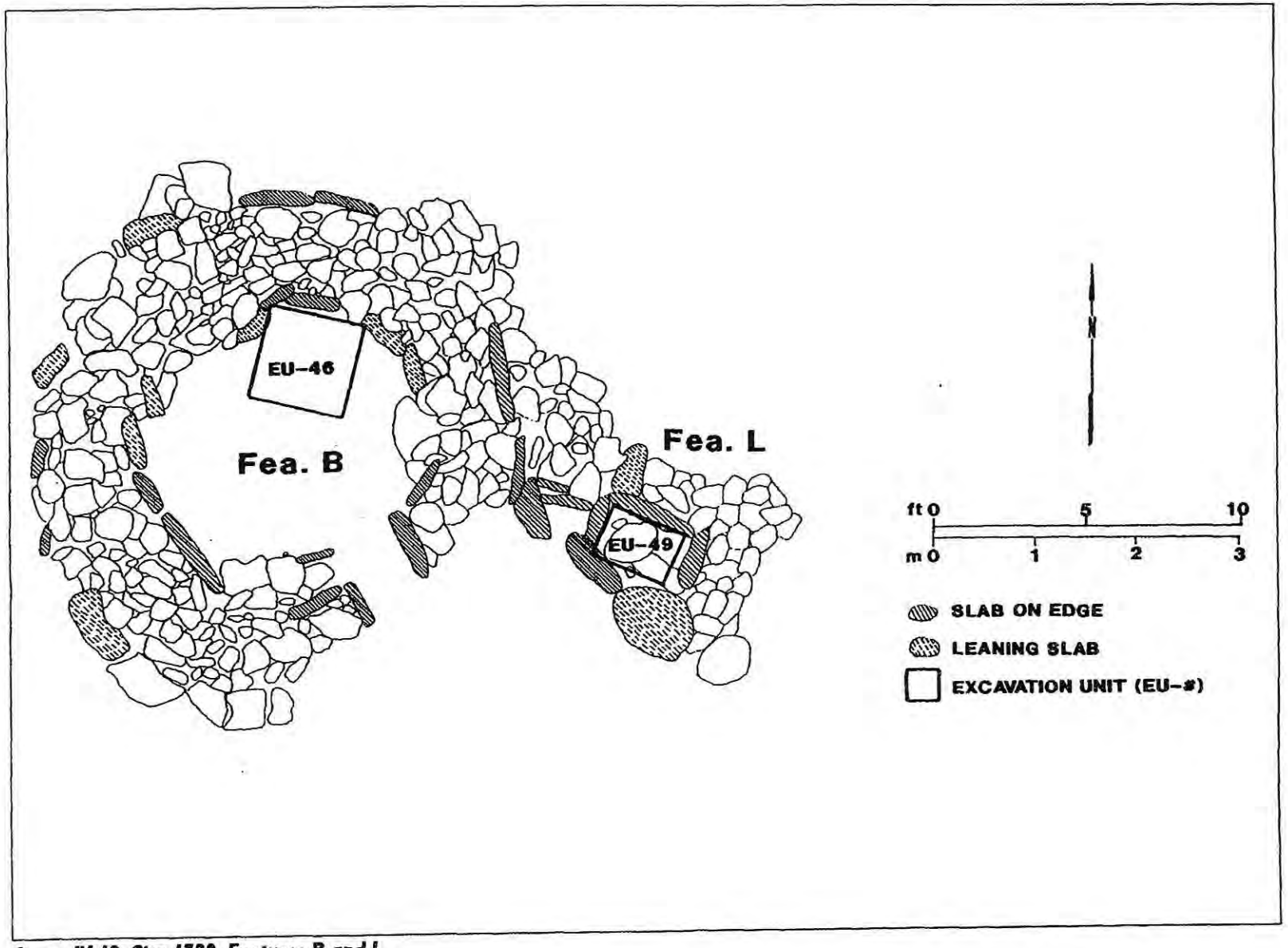


Figure IV-12. Site 1722, Features B and L

Figure A-12. From Beardsley (2001).

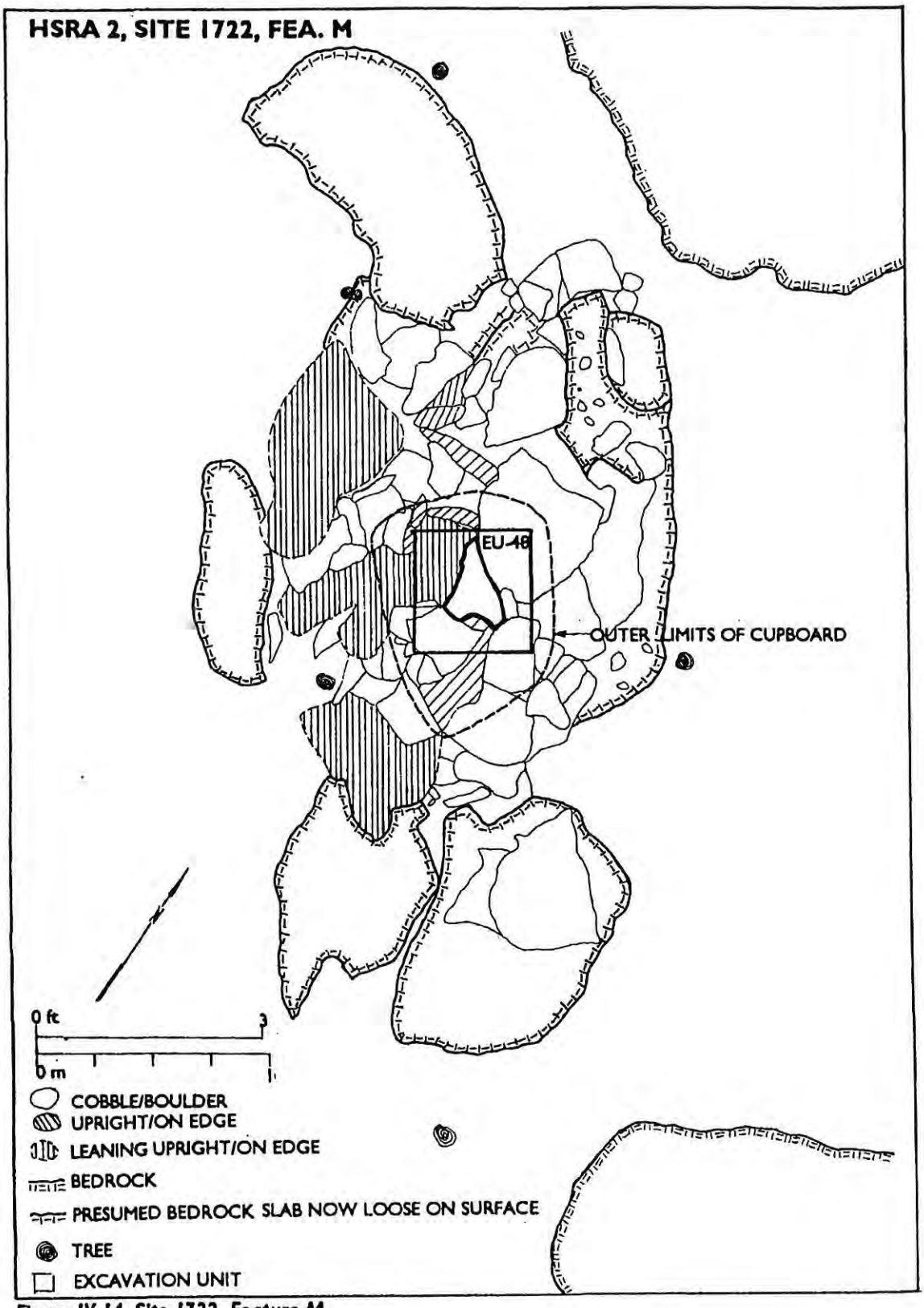


Figure IV-14. Site 1722, Feature M

Figure A-13. From Beardsley (2001).

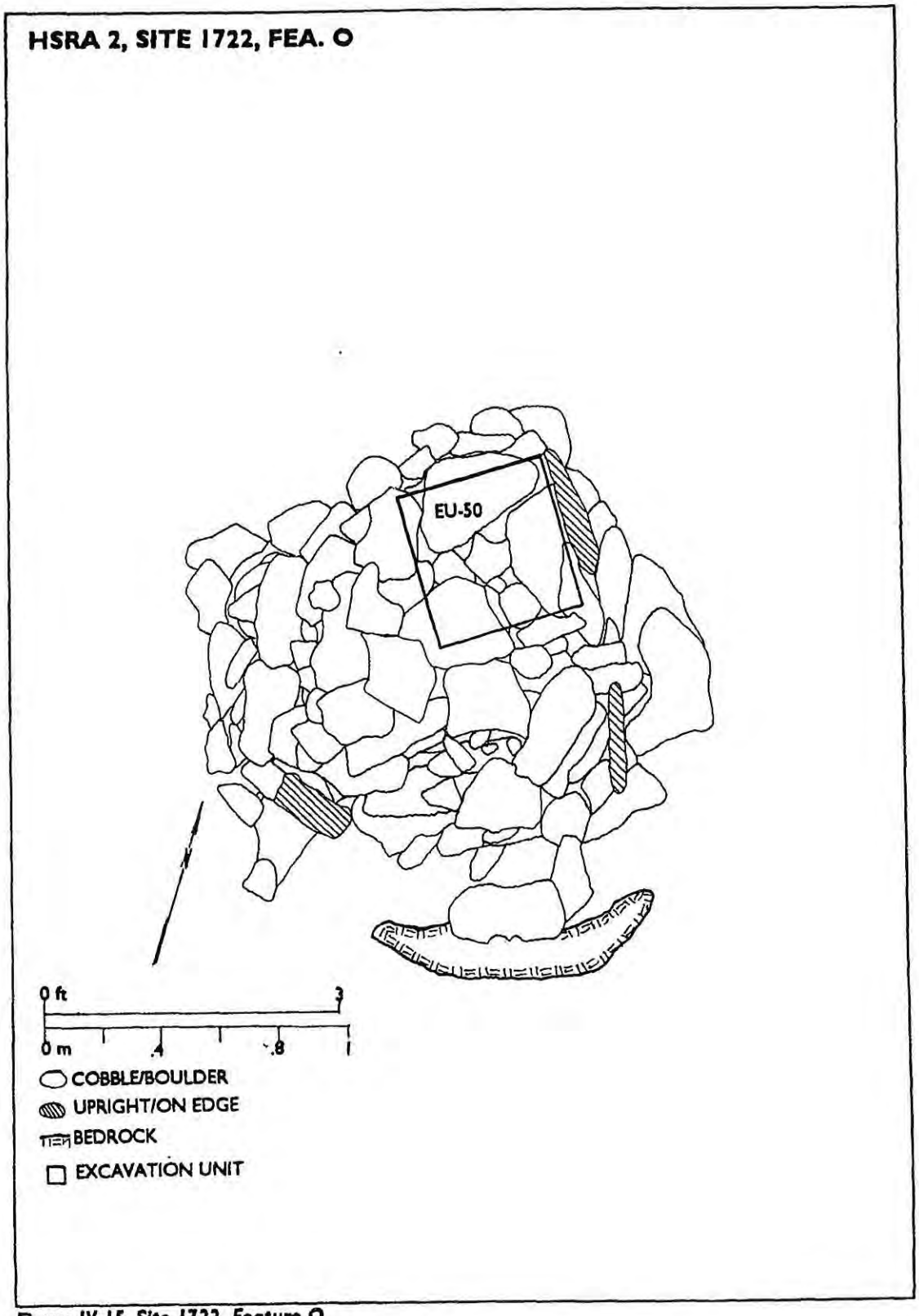


Figure IV-15. Site 1722, Feature O

Figure A-14. From Beardsley (2001).

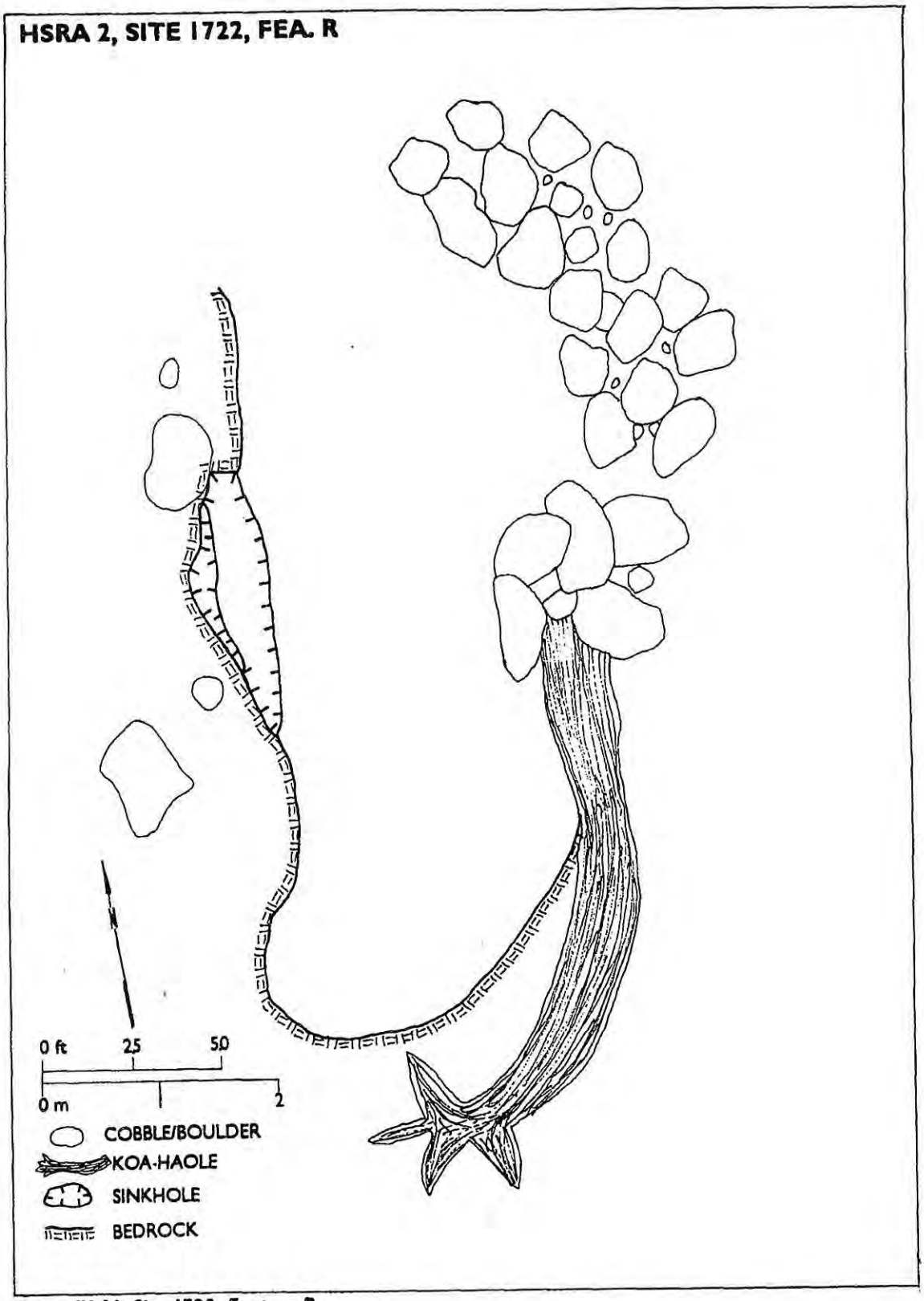


Figure IV-16. Site 1722, Feature R

Figure A-15. From Beardsley (2001).

APPENDIX B

Artifact Distribution Tables for 2011 Excavations

Artifact Tables in Appendix B

Table B-1. Distribution of Artifacts from Site 1717, Feature E.

Table B-2. Distribution of Artifacts from Site 1718, Features J and K.

Table B-3. Distibution of Artifacts from Site 7182, Features C, F and I.

Table B-4. Distribution of Surface Historic Artifacts from Site 7182, Features C, D, E, and J.

Table B-5. Distribution of Surface Historic Artifacts from Sites 1719 and 7178.

Table B-6. Distribution of Surface Historic Artifacts from Sites 7177 and 7181.

Table B-7. Distribution of Artifacts from Site 7178, Features A and B

Table B-8. Catalogue of Historic Artifacts from 2011 Site Excavations and Surface Collections at KS1 and KS2.

Table B-9. Catalogue of Historic Bottles and Bottle Fragments from 2011 Site Excavations and Surface Collections in KS1 and KS2.

Table B-10. Distribution of Artifacts from Boring Locale 1 in KS2.

Table B-1. Distribution of Artifacts from Site 1717, Feature E.		
Excavation Unit	**TU-1**	
Layer/Level	**II/1**	**Fe. E Total**
Traditional Hawaiian Artifact Type		
Basalt		
Flake fragment	3	**3**
Total Basalt Artifacts	**3**	**3**
Limestone		
Flake	1	**1**
Flake fragment	2	**2**
Total Limestone Artifacts	**3**	**3**
Total Traditonal Hawaiian Artifacts	**6**	**6**

Table B-2. Distribution of Artifacts from Site 1718, Features J and K.										
Feature	**Fe. J**					**Fe. K**				
Excavation Unit	**TU-1**	**STP1**	**STP2**	**STP5**		**TU-1**				
Layer/Level	**II/1**	**II**	**II**	**II**	**Fe. J Total**	**I/1**	**I/2**	**II/1**	**Fe. K Total**	**1718 Total**
Traditional Hawaiian Artifact Type										
Basalt										
Adze fragment	1				**1**				**0**	**1**
Total Basalt Artifacts	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
Limestone										
Flake	4	2			**6**				**0**	**6**
Flake fragment	4	2			**6**				**0**	**6**
Total Limestone Artifacts	**8**	**4**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**12**
Volcanic Glass										
Flake	10	2	1		**13**	2	5	2	**9**	**22**
Flake fragment		1			**1**		4		**4**	**5**
Core	4	2		1	**7**	1	1		**2**	**9**
Nodule	1				**1**				**0**	**1**
Total Volcanic Glass Artifacts	**15**	**5**	**1**	**1**	**22**	**3**	**10**	**2**	**15**	**37**
Total Traditional Hawaiian Artifacts	**24**	**9**	**1**	**1**	**35**	**3**	**10**	**2**	**15**	**50**

Table B-3. Distribution of Artifacts from Site 7182, Features C, F and I.											
Feature	**Feature C**			**Feature F**			**Feature I**				
Excavation Unit	**TU1**			**TU1**			**TU1**				
Layer/Level	**Surface**	**I/1**	**Fe. C Total**	**I/1**	**I/2**	**Fe. F Total**	**I/1**	**I/2**	**II/1**	**Fe. I Total**	**Site 7182 Total**
Traditional Hawaiian Artifacts											
Volcanic Glass											
Flake			**0**			**0**	2	1		**3**	**3**
Flake fragment			**0**			**0**	5			**5**	**5**
Core			**0**			**0**	2			**2**	**2**
Total Volcanic Glass Artifacts	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**1**	**0**	**10**	**10**
Total Traditional Hawaiian Artifacts	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**1**	**0**	**10**	**10**
Historic Artifacts											
Glass											
Whole bottles (brown)	14		**14**			**0**				**0**	**14**
Whole bottles (clear)	13	1	**14**			**0**	1			**1**	**15**
Bottles (fragments)		1	**1**	12	4	**16**				**0**	**17**
Total Glass Artifacts	**27**	**2**	**29**	**12**	**4**	**16**	**1**	**0**	**0**	**1**	**46**
Metal											
Screen		4	**4**			**0**				**0**	**4**
Battery		1	**1**			**0**				**0**	**1**
Can (fragments)		4	**4**			**0**	1		1	**2**	**6**
Fragment (flat, rusted)		33	**33**			**0**				**0**	**33**
License plate			**0**	1		**1**				**0**	**1**
Total Metal Artifacts	**0**	**42**	**42**	**1**	**0**	**1**	**1**	**0**	**1**	**2**	**45**
Miscellaneous											
Wood with plastic	1		**1**			**0**				**0**	**1**

Table B-3. Distribution of Artifacts from Site 7182, Features C, F and I.											
Feature	**Feature C**			**Feature F**			**Feature I**				
Excavation Unit	**TU1**			**TU1**			**TU1**				
Layer/Level	**Surface**	**I/1**	**Fe. C Total**	**I/1**	**I/2**	**Fe. F Total**	**I/1**	**I/2**	**II/1**	**Fe. I Total**	**Site 7182 Total**
Roofing Material		36	**36**			**0**				**0**	**36**
Fiberboard		2	**2**			**0**				**0**	**2**
Total Miscellaneous Artifacts	**1**	**38**	**39**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**39**
Total Historic Artifacts	**28**	**82**	**109**	**13**	**4**	**17**	**2**	**0**	**1**	**3**	**129**
Total Artifacts	**28**	**82**	**109**	**13**	**4**	**17**	**11**	**1**	**1**	**13**	**139**

Table B-4. Distribution of Surface Historic Artifacts from Site 7182, Features C, D, E, and J.

Layer/Level	Fe.C	Fe. D	Fe.E	Fe.J	Total
Historic Artifact Type					
GLASS					
Whole bottle, brown		2			**2**
Whole bottle, clear		1			**1**
Whole, jar, milk glass					**0**
TOTAL GLASS	**0**	**3**	**0**	**0**	**3**
METAL					
Canteen	1		1		**2**
Can				1	**1**
TOTAL METAL	**1**	**0**	**1**	**1**	**3**
TOTAL ARTIFACTs	**1**	**3**	**1**	**1**	**6**

Table B-5. Distribution of Surface Historic Artifacts from Sites 1719 and 7178.							
	Site 1719		Site 7178				
Feature	Fe. F	SW of Fe. A	Fe. C	Fe. B	Fe. F	Outside Feature Areas	1719 Grand Total
Historic Artifacts							
Glass							
Whole bottle (brown)	2	5					**7**
Whole bottle (clear)	3		1		1		**5**
Bottle base (brown)	3						**3**
Bottle fragment						1	**1**
Jar (clear)		1					**1**
Window Pane (fragments)	3	0	0	0		0	**3**
Total Glass	**11**	**6**	**1**	**0**	**1**	**1**	**20**
Metal							
Can (whole)	2	0	0	0		0	**2**
Comm wire	1	0	0	0		0	**1**
Total Metal	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Ceramic							
Insulator	0	0	0	1		0	1
Total Ceramic	**0**	**0**	**0**	**1**		**0**	**1**
Leather							
Boot Sole	1	**0**	**0**	**0**		**0**	1
Total Leather	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Total Historic Artifacts	**15**	**6**	**1**	**1**	**1**	**1**	**25**

Table B-6. Distribution of Surface Historic Artifacts from Sites 7177 and 7181.					
	7177		7181		
	Fe.D	Fe. D Total	Fe. B	Fe. B Total	Total Artifacts
Historic Artifacts					
Glass					
Whole bottles	1	**1**	9	**9**	**10**
Bottle fragments	5	**5**			**5**
Total Historic Artifacts	**6**	**6**	**9**	**9**	**15**

Table B-7. Distribution of Artifacts from Site 7176, Features A and B							
Feature	**Feature A**			**FeatureB**			
Excavation Unit	**TU-1**			**TU-1**			
Layer/Level	**I/1**	**I/2**	**Fe. A Total**	**I/1**	**I/2**	**Fe. B Total**	**7178 Total**
Historic Artifacts							
Glass							
Whole bottles (clear)			**0**	1		**1**	**1**
Bottles (fragments)			**0**	1	1	**2**	**2**
Total Glass Artifacts	**0**	**0**	**0**	**2**	**1**	**3**	**3**
Metal							
Barrel hoops (fragments)	35	32	**67**	0		**0**	**67**
Copper wire			**0**	1		**1**	**1**
Nail	3	7	**10**	0	1	**1**	**11**
Staple wire			**0**	2		**2**	**2**
Total Metal Artifacts	**38**	**39**	**77**	**3**	**1**	**4**	**81**
Total Historic Artifacts	**38**	**39**	**77**	**5**	**2**	**7**	**84**

Table B-8. Catalogue of Historic Artifacts from 2011 Site Excavations and Surface Collections at KS1 and KS2.

Bag #	Site	Feature	Test Unit/ Surface	Count	Material	Form	Condition	Color	Shape	Height	Base	Closure	Probable content	Date Range of Manufacture
27	7182	I	2	1	metal		frag							
36	7182	I	2	1	metal		frag							
78	7182	K	Surface	1	glass	bottle	whole		cylindrical	4.7	7.5	threaded	cosmetic	
79	7182	D	Surface	1	glass	bottle	whole	clear	cylindrical	17.0	6.5	crown cap	beer	1944-
80	7182	E	Surface	1	metal	canteen/ aluminum	whole	aluminum	kidney	18.5	10.3	threaded	water	
81	7182	C	Surface	1	metal	canteen/ aluminum	whole	aluminum	kidney	18.8	10.7	threaded	water	1918
82	7182	D	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
83	7182	C	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
84	7182	J	Surface	1	metal	can	whole		cylindrical	14.0	6.8	crown cap	beer	ca.1940
85	1719	A	Surface	1	glass	bottle	frag	green	cylindrical		5.9		cola	1941?
104	7182	C	1	1	metal	battery	whole							
104	7182	C	1	1	glass/metal	bottle/cap	whole							
104	7182	C	1	1	glass/metal	bottle/cap	frag							
104	7182	C	1	1	metal	can	frag							
104	7182	C	1	4	metal ?	screen	frag							
104	7182	C	1	33	metal		frag							
104	7182	C	1	36	organic		frag	tar paper & gravel						
104	7182	C	1	multi.	organic		frag	unknown material						
105	7182	C	1	14	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
105	7182	C	1	13	glass	bottle	whole	clear	cylindrical	17.0	6.5	crown cap	beer	1940-54
105	7182	C	1	2	fiberboard	frags.								
105	7182	C	1	multi.	metal	frags.								
112	7182	F	1	1	metal	license plate	whole		rectangular	L 32.5	W 9.5			1942
114	7182	F	1	12	glass		frag	amber						
115	7182	F	1	4	glass		frag	amber						
162	1719	F	Surface	1	glass	bottle	frag	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
163	1719	F	Surface	1	glass	bottle	whole	amber	cylindrical	10.5	4.2	threaded		1940-54

Table B-8. Catalogue of Historic Artifacts from 2011 Site Excavations and Surface Collections at KS1 and KS2.

Bag #	Site	Feature	Test Unit/ Surface	Count	Material	Form	Condition	Color	Shape	Height	Base	Closure	Probable content	Date Range of Manufacture
164	1719	F	Surface	1	glass	bottle	whole	clear	oval	10.8	6.5	threaded	cologne	
165	1719	F	Surface	1	metal	can	whole		rectangular	10.3	7.2	threaded	solvent?	
166	1719	F	Surface	2	glass	window glass	frag	green						
167	1719	F	Surface	1	metal	wire-metal	frag	copper	L 100 cm		insulated copper wire			
168	1719	F	Surface	1	glass	bottle	frag	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
169	1719	F	Surface	1	glass	bottle	whole	clear	oval	12.8	6.8	threaded	hair tonic	
170	1719	F	Surface	1	metal	can	whole		cylindrical	4.0	10.9	compression	paint?	
171	1719	F	Surface	1	glass	bottle	frag	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
172	1719	F	Surface	multi.	leather	shoe	frag							
173	1719	F	Surface	1	glass	bottle	whole	clear	cylindrical	17.2	6.5	crown cap	beer	1943
174	1719	South of F	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
175	1719	SW of Fe.A	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
176	1719	SW of Fe.A	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
177	1719	SW of Fe.A	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
178	1719	SW of Fe.A	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
179	1719	SW of Fe.A	Surface	1	glass	bottle	frag	clear	octagonal	6.5	7.0	threaded	hair tonic	1938-68
180	1719	SW of Fe.A	Surface	1	glass	bottle	whole	amber	cylindrical	7.0	8.4	threaded	medicinal	1938-ca.70
181	1719	F	Surface	1	glass	bottle	whole	clear	cylindrical	6.0	4.8	threaded	medicinal	
182	7178	B	Surface	1	ceramic/metal	insulator	whole	brown		13.0	5.0			1929
183	7178	A	Surface	1	glass	bottle	whole	clear	oval	10.2	4.5	threaded	medicinal	1940-54
184	7176	A	1	25	metal	barrel hoops	fragment							
184	7176	A	1	3	metal	nail	fragment							
189	7176	A	1	25	metal	barrel hoops	fragment							
189	7176	A	1	7	metal	nail	fragment							
196	7176	B	1	1	metal	copper wire	fragment							
197	7176	B	1	2	metal	staple wire	whole							
197	7176	B	1	1	glass		fragment	amber						
199	7176	B	1	1	glass	bottle	whole	clear	cylindrical	14.0	6.2	paper cap	milk	1941
200	7176	B	1	1	metal	nail	whole							
200	7176	B	1	1	glass		fragment	clear						

Table B-8. Catalogue of Historic Artifacts from 2011 Site Excavations and Surface Collections at KS1 and KS2.

Bag #	Site	Feature	Test Unit/ Surface	Count	Material	Form	Condition	Color	Shape	Height	Base	Closure	Probable content	Date Range of Manufacture
204	Boring locale 1		1	1	glass		fragment	amber						
207	Boring locale 1		STP 2	29	recent rubbish		fragment							
208	Boring locale 1		STP2	8	recent rubbish									
209	Boring locale 1		STP3	16	recent rubbish									
210	Boring locale 1		STP 3	1	plastic	collar	fragment							
211	Boring locale 1		STP 3	1	plastic	collar	fragment							
212	7176	A	1	10	metal	barrel hoops	fragment							
213	7176	A	1	7	metal	barrel hoops	fragment							
214	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
215	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
216	7181	B	Surface	1	glass	bottle	whole	clear	oval	13.0	5.0	threaded	hair tonic	1929-54
217	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	17.0	6.5	crown cap	beer	1944
218	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	16.8	6.5	crown cap	beer	1940-49
219	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	17.0	6.5	crown cap	beer	1944
220	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
221	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	17.5	6.5	crown cap	beer	1940-54
222	7181	B	Surface	1	glass	bottle	whole	amber	cylindrical	16.5	6.1	crown cap	beer	(1944-45)
224A	7177	D	Surface	1	glass	bottle	whole	clear	cylindrical	8.2	4.1	threaded	tooth powder	1942
224B	7177	D	Surface	1	glass	bottle	frag	amber	cylindrical	16.5	6.1	crown cap	beer	1942
224C	7177	D	Surface	1	glass	bottle	frag	amber	cylindrical	16.5	6.1	crown cap	beer	1942
224D	7177	D	Surface	1	glass	bottle	frag	amber	cylindrical	17.5	6.5	crown cap	beer	
224E	7177	D	Surface	1	glass	bottle	frag	clear	oval		6		cologne	
224F	7177	D	Surface	1	glass	bottle	frag	green	cylindrical				Coca cola	

Table B-9. Catalogue of Historic Bottles and Bottle Fragments from 2011 Site Excavations and Surface Collections in KS1 and KS2.

Bag #	Site No.	Fe. No.	Test Unit	Count	Material	Form	Bottle Type	Condition	Color	Shape	Closure	Height/Length	Diameter/width	Probable Content	Embossed Lettering	Maker Mark	Date Range of Manufacture
78	7182	K		1	glass	bottle	S-8	whole	white	cylindrical	threaded	4.7	7.5	cosmetic			
79	7182	D		1	glass	bottle	B-4	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Brownie 44	Brockway	1944-
82	7182	D		1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
83	7182	C		1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
85	1719	A		1	glass	bottle	S-9	frag	green	cylindrical			5.9	soda pop	Coco cola, San Francisco, Calif.	Owens Illinois glass Co.	1941?
104	7182	C	1	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
104	7182	C	1	1	glass	bottle		frag									
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
105	7182	C	1	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54

Table B-9. Catalogue of Historic Bottles and Bottle Fragments from 2011 Site Excavations and Surface Collections in KS1 and KS2.

Bag #	Site No.	Fe. No.	Test Unit	Count	Material	Form	Bottle Type	Condition	Color	Shape	Closure	Height/Length	Diameter/width	Probable Content	Embossed Lettering	Maker Mark	Date Range of Manufacture
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-5	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
105	7182	C	1	1	glass	bottle	B-6	whole	clear	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
162	1719	F	Surface	1	glass	bottle	B-1	frag	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
163	1719	F	Surface	1	glass	bottle	S-1	whole	amber	cylindrical	threaded	10.5	4.2		Duraglas	Owens Illinois glass Co.	1940-54
164	1719	F	Surface	1	glass	bottle	S-4	whole	clear	oval	threaded	10.8	6.5	cologne	Embossed geometric design on shoulder		
168	1719	F	Surface	1	glass	bottle	B-1	frag	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
169	1719	F	Surface	1	glass	bottle	S-5	whole	clear	oval	threaded	12.8	6.8	hair tonic	Embossed ribbon on shoulder and heal		
171	1719	F	Surface	1	glass	bottle	B-2	frag	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
173	1719	F	Surface	1	glass	bottle	B-3	whole	clear	cylindrical	crown cap	17.2	6.5	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	1943
174	1719	South of F	Surface	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
175	1719	SW of Fe.A	Surface	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
176	1719	SW of Fe.A	Surface	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
177	1719	SW of Fe.A	Surface	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54

Table B-9. Catalogue of Historic Bottles and Bottle Fragments from 2011 Site Excavations and Surface Collections in KS1 and KS2.

Bag #	Site No.	Fe. No.	Test Unit	Count	Material	Form	Bottle Type	Condition	Color	Shape	Closure	Height/Length	Diameter/width	Probable Content	Embossed Lettering	Maker Mark	Date Range of Manufacture
178	1719	SW of Fe.A	Surface	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
179	1719	SW of Fe.A	Surface	1	glass	bottle	S-6	frag	clear	octagonal	threaded	6.5	7.0	hair tonic	Barbasol	Anchor Hocking Glass Corp.	1938-68
180	1719	SW of Fe.A	Surface	1	glass	bottle	S-2	whole	amber	cylindrical	threaded	7.0	8.4	medicinal		Anchor Hocking Glass Corp.	1938-ca.70
181	7178	F	Surface	1	glass	bottle	S-7	whole	clear	cylindrical	threaded	6.0	4.8	medicinal	Cheesbrough New York	MFG	
183	7178	A	Surface	1	glass	bottle	S-3	whole	clear	oval	threaded	10.2	4.5	medicinal	3ii Duraglas Owens	Owens Illinois glass Co.	1940-54
199	7176	B	1	1	glass	bottle		whole	clear	cylindrical	paper cap	14.0	6.2	milk	Property of Dairymen's Association Half Pint	Owens Illinois glass Co.	1941
214	7181	B	Surface	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
215	7181	B	Surface	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
216	7181	B	Surface	1	glass	bottle	S-10	whole	clear	oval	threaded	13.0	5.0	hair tonic	embossed hair design	Owens Illinois glass Co.	1929-54
217	7181	B	Surface	1	glass	bottle	B-8	whole	amber	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Armstrong Cork Co. Glass Divison	1944
218	7181	B	Surface	1	glass	bottle	B-7	whole	amber	cylindrical	crown cap	16.8	6.5	beer	No deposit no return, Not to be refilled	Metro glass Co.	1940-49
219	7181	B	Surface	1	glass	bottle	B-8	whole	amber	cylindrical	crown cap	17.0	6.5	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	1944
220	7181	B	Surface	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
221	7181	B	Surface	1	glass	bottle	B-1	whole	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	1940-54
222	7181	B	Surface	1	glass	bottle	B-2	whole	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	(1944-45)
224A	7177	D	Surface	1	glass	bottle	S-12	whole	clear	cylindrical	threaded	8.2	4.1	tooth powder	(base) Dr. Lyon's Tooth Powder	Armstrong Cork Co. Glass Divison	1942
224B	7177	D	Surface	1	glass	bottle	B-2	frag	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	1942
224C	7177	D	Surface	1	glass	bottle	B-2	frag	amber	cylindrical	crown cap	16.5	6.1	beer	No deposit no return, Not to be refilled	Anchor Hocking Glass Corp.	1942
224D	7177	D	Surface	1	glass	bottle	B-1	frag	amber	cylindrical	crown cap	17.5	6.5	beer	No deposit no return, Not to be refilled, Duraglas	Owens Illinois glass Co.	
224E	7177	D	Surface	1	glass	bottle		frag	clear	oval			6	cologne	Embosed design	“R”	
224F	7177	D	Surface	1	glass	bottle		frag	green	cylindrical				Coca cola			

Table B-10. Distribution of Artifacts from Boring Locale 1 in KS2.				
Excavation Unit	**TU-1**	**STP-2**	**STP-3**	
Layer/Level	**I/1**	**I**	**I**	**T-2 Total**
Historic Artifacts				
Glass				
Bottles (fragments)	1			**1**
Total Glass Artifacts	**1**	**0**	**0**	**1**
Plastic				
Collar			2	**2**
Total Plastic Artifacts	**0**	**0**	**2**	**2**
Recent Trash		37	16	**53**
Total Trash Artifacts	**0**	**37**	**16**	**53**
Total Historic Artifacts	**1**	**37**	**18**	**56**

APPENDIX C

Faunal and Floral Distribution Tables for 2011 Excavations

Faunal and Floral Tables in Appendix C

Table C-1. Distribution of Faunal and Floral Remains from Site 1717, Feature E.

Table C-2. Distribution of Faunal and Floral Remains from Site 1717, Features G and M.

Table C-3. Distribution of Faunal and Floral Remains from Site 1718, Feature J.

Table C-4. Distribution of Faunal and Floral Remains from Site 1718, Features H and K.

Table C-5. Distribution of Faunal and Floral Remains Site 7182, Feature I.

Table C-6. Distribution of Faunal and Floral Remains Site 7182, Feature C.

Table C-7. Distribution of Faunal Remains, Site 7184, Feature A.

Table C-8. Distribution of Faunal and Floral Remains Site 7185, Feature D.

Table C-9. Distribution of Faunal and Floral Remains Site 7186, Features A and B.

Table C-10. Distribution of Faunal and Floral Remains Site 7176, Features A and B.

Table C-11. Distribution of Faunal and Floral Remains from Boring Locale 1 Excavations.

Table C-1. Distribution of Faunal and Floral Remains from Site 1717, Feature E.

Feature	Feature E							
Excavation Unit	TU-1							
Layer/Level	I/1	II/1	II/2	STP1,2,3	STP4	STP6	STP8	Fe. E Total
Sample Weight (g)	g	g	g	g	g	g	g	g
FAUNA								
MOLLUSCA								
GASTROPODS								
Conus spp.				0.6				**0.6**
Conus pennaceus		1.2						**1.2**
Nerita picea	1.8	53.8	12.0	38.5	0.4	2.6	0.4	**109.5**
UI Gastropods				0.4				**0.4**
GASTROPOD TOTAL	**1.8**	**55.0**	**12.0**	**39.5**	**0.4**	**2.6**	**0.4**	**111.7**
BIVALVES								
Brachidontes crebristratus		0.2	0.3	0.4				**0.9**
Isognomon spp.		0.3		0.2				**0.5**
Tellina palatam		2.6	0.7	0.1		0.9		**4.3**
BIVALVE TOTAL	**0.0**	**3.1**	**1.0**	**0.7**	**0.0**	**0.9**	**0.0**	**5.7**
MOLLUSCA TOTAL	**1.8**	**58.1**	**13.0**	**40.2**	**0.4**	**3.5**	**0.4**	**117.4**
ECHINODERMS								
UI mouth and body parts			0.2					**0.2**
ECHINODERMS TOTAL	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**
INVERTEBRATE FAUNA TOTAL	**1.8**	**58.1**	**13.2**	**40.2**	**0.4**	**3.5**	**0.4**	**117.6**
FAUNAL TOTAL	**1.8**	**58.1**	**13.2**	**40.2**	**0.4**	**3.5**	**0.4**	**117.6**
FLORA								
Wood charcoal		1.1	1.3					**2.4**
FLORAL TOTAL	**0.0**	**1.1**	**1.3**	**0.0**	**0.0**	**0.0**	**0.0**	**2.4**

Table C-2. Distribution of Faunal and Floral Remains from Site 1717, Features G and M.

Feature	Feature M			Feature G				
Excavation Unit	TU-1			TU-1				
Layer/Level	I/2	I/3	Fe. M Total	I/1	II/1	III/1	Fe. G Total	1717 Total
Sample Weight (g)	g	g	g	g	g	g	g	g
FAUNA								
MOLLUSCA								
GASTROPODS								
Conus pennaceus	5.7		**5.7**				**0.0**	**5.7**
Cypraea spp.	1.7		**1.7**				**0.0**	**1.7**
UI Gastropods			**0.0**	0.1			**0.1**	**0.1**
GASTROPOD TOTAL	**7.4**	**0.0**	**7.4**	**0.1**	**0.0**	**0.0**	**0.1**	**7.5**
BIVALVES								
Brachidontes crebristratus		0.1	**0.1**				**0.0**	**0.1**
Tellina palatam			**0.0**	0.3			**0.3**	**0.3**
BIVALVE TOTAL	**0.0**	**0.1**	**0.1**	**0.3**	**0.0**	**0.0**	**0.3**	**0.4**
MOLLUSCA TOTAL	**7.4**	**0.1**	**7.5**	**0.4**	**0.0**	**0.0**	**0.4**	**7.9**
ECHINODERMS								
UI mouth and body parts		<0.1	**0.0**		0.8		**0.8**	**0.8**
ECHINODERMS TOTAL	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**0.0**	**0.8**	**0.8**
INVERTEBRATE FAUNA TOTAL	**7.4**	**0.1**	**7.5**	**0.4**	**0.8**	**0.0**	**1.2**	**8.7**
FAUNAL TOTAL	**7.4**	**0.1**	**7.5**	**0.4**	**0.8**	**0.0**	**1.2**	**8.7**
FLORA								
Wood charcoal						0.4	**0.4**	**0.4**
Kukui shell fragments (charred)						0.1	**0.1**	**0.1**
FLORAL TOTAL	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**

Table C-3. Distribution of Faunal and Floral Remains from Site 1718, Feature J.

	Feature J													
Excavation Unit	**TU-1**					**STP1**	**STP2**	**STP4**	**STP5**	**STP6**	**STP7**	**STP8**	**STP9**	
Layer/Level	**I/1**	**II/1**	**II/2**	**II/3**	**II/4**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**Fe. J Total**
Sample Weight (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
MOLLUSCA														
GASTROPODS														
Conus spp.	1.6					1.1								**2.7**
Cypraea caputserpentis						0.2								**0.2**
Cypraea spp.		0.7												**0.7**
Drupa spp.	3.2	17.1				0.6								**20.9**
Hipponix spp.		0.2												**0.2**
Littorina pintado		0.3				0.3								**0.6**
Nerita picea	37.1	290.6	4.9	1.7	0.6	40.9	17.1	0.7	1.7	1.0	0.5	3.0	1.3	**401.1**
Nerita polita		0.3												**0.3**
Strombus spp.						0.3								**0.3**
Turbo spp.											0.6			**0.6**
UI Gastropods		0.7												**0.7**
GASTROPOD TOTAL	**41.9**	**309.9**	**4.9**	**1.7**	**0.6**	**43.4**	**17.1**	**0.7**	**1.7**	**1.0**	**1.1**	**3.0**	**1.3**	**428.3**
BIVALVES														
Brachidontes crebristratus	29.7	71.7	2.1	0.3		9.7	1.9	0.5		0.2			0.2	**116.3**
Isognomon spp.	0.6					0.1								**0.7**
Tellina palatam	18.6	42.7	0.6			2.7	0.8			1.0	0.1			**66.5**
UI Bivalves		0.1												**0.1**
BIVALVE TOTAL	**48.9**	**114.5**	**2.7**	**0.3**	**0.0**	**12.5**	**2.7**	**0.5**	**0.0**	**1.2**	**0.1**	**0.0**	**0.2**	**183.6**
MOLLUSCA TOTAL	**90.8**	**424.4**	**7.6**	**2.0**	**0.6**	**55.9**	**19.8**	**1.2**	**1.7**	**2.2**	**1.2**	**3.0**	**1.5**	**611.9**
ECHINODERMS														

Table C-3. Distribution of Faunal and Floral Remains from Site 1718, Feature J.

	Feature J													
Excavation Unit	**TU-1**					**STP1**	**STP2**	**STP4**	**STP5**	**STP6**	**STP7**	**STP8**	**STP9**	
Layer/Level	**I/1**	**II/1**	**II/2**	**II/3**	**II/4**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**I/II**	**Fe. J Total**
Sample Weight (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
UI mouth and body parts		1.1				0.1		0.1						**1.3**
ECHINODERMS TOTAL	**0**	**1.1**	**0**	**0**	**0**	**0.1**	**0**	**0.1**	**0**	**0**	**0**	**0**	**0**	**1.3**
CRUSTACEA	0.1	0.6				0.1								**0.8**
INVERTEBRATE FAUNA TOTAL	**90.9**	**426.1**	**7.6**	**2.0**	**0.6**	**56.1**	**19.8**	**1.3**	**1.7**	**2.2**	**1.2**	**3.0**	**1.5**	**614.0**
VERTEBRATE FAUNA														
Pervagor spp.	0.3	1.9												**2.2**
UI Fish	0.5	5.4						0.2						**6.1**
Total Fish	**0.8**	**7.3**	**0**	**0**	**0**	**0**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**8.3**
Small Mammal								0.2						**0.2**
Medium Mammal		1.7				0.9								**2.6**
Rattus spp.		0.1												**0.1**
Total Mammal	**0**	**1.8**	**0**	**0**	**0**	**0.9**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**2.9**
UI Bird		0.1												**0.1**
Total Bird	**0**	**0.1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**
Unidentified Vertebrate								0.1						**0.1**
VERTEBRATE FAUNA TOTAL	**0.8**	**9.2**	**0**	**0**	**0**	**0.9**	**0**	**0.5**	**0**	**0**	**0**	**0**	**0**	**11.4**
FAUNAL TOTAL	**91.7**	**435.3**	**7.6**	**2.0**	**0.6**	**57.0**	**19.8**	**1.8**	**1.7**	**2.2**	**1.2**	**3.0**	**1.5**	**625.4**
FLORA														
Wood charcoal		10.3				1.5								**11.8**
Kukui shell fragments (charred)		0.2												**0.2**
FLORAL TOTAL	**0**	**0.2**	**0**	**0**	**0**	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12.0**

Table C-4. Distribution of Faunal and Floral Remains from Site 1718, Features H and K.

	Feature H			Feature K					
Excavation Unit	**TU-1**			**TU-1**					
Layer/Level	**I/1**	**I/2**	**Fe. H Total**	**I/1**	**I/2**	**II/1**	**I-II**	**Fe. K Total**	**Total Features H and K**
Sample Weight (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
MOLLUSCA									
GASTROPODS									
Conus pennaceus			**0.0**		0.4			**0.4**	**0.4**
Cypraea spp.			**0.0**	0.6	0.0			**0.6**	**0.6**
Drupa spp.			**0.0**	0.1	2.0			**2.1**	**2.1**
Littorina pintado			**0.0**		0.5	0.1		**0.6**	**0.6**
Nerita picea		0.4	**0.4**	3.5	14.1		3.2	**20.8**	**21.2**
Trochus spp.			**0.0**		0.2			**0.2**	**0.2**
GASTROPOD TOTAL	**0.0**	**0.4**	**0.4**	**4.2**	**17.2**	**0.1**	**3.2**	**24.7**	**25.1**
BIVALVES									
Brachidontes crebristratus		0.1	**0.1**	1.3	1.5			**2.8**	**2.9**
Isognomon spp.			**0.0**	0.9				**0.9**	**0.9**
Tellina palatam			**0.0**	3.8	0.1			**3.9**	**3.9**
BIVALVE TOTAL	**0.0**	**0.0**	**0.0**	**6.0**	**1.6**	**0.0**	**0.0**	**7.6**	**7.6**
MOLLUSCA TOTAL	**0.0**	**0.4**	**0.4**	**10.2**	**18.8**	**0.1**	**3.2**	**32.3**	**32.7**
ECHINODERMS			**0.0**						
UI mouth and body parts			**0.0**	0.1	0.3			**0.4**	**0.4**
ECHINODERMS TOTAL	**0.0**	**0.0**	**0.0**	**0.1**	**0.3**	**0.0**	**0.0**	**0.4**	**0.4**
INVERTEBRATE FAUNA TOTAL	**0.0**	**0.4**	**0.4**	**10.3**	**19.1**	**0.1**	**3.2**	**32.7**	**33.1**
VERTEBRATE FAUNA									
UI Fish	0.1		**0.1**					**0.0**	**0.1**

Table C-4. Distribution of Faunal and Floral Remains from Site 1718, Features H and K.

	Feature H			Feature K					
Excavation Unit	**TU-1**			**TU-1**					
Layer/Level	**I/1**	**I/2**	**Fe. H Total**	**I/1**	**I/2**	**II/1**	**I-II**	**Fe. K Total**	**Total Features H and K**
Sample Weight (g)	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**	**g**
Total Fish	**0.1**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
Small Mammal			**0.0**	0.1				**0.1**	**0.1**
Rattus exulans		0.1	**0.1**					**0.0**	**0.1**
Rattus spp.	0.7	0.2	**0.9**		0.2		0.1	**0.3**	**1.2**
Total Mammal	**0.7**	**0.3**	**1.0**	**0.1**	**0.2**	**0.0**	**0.1**	**0.4**	**1.4**
Bird									
Small Passeriform	0.1		**0.1**						**0.1**
UI Bird	0.1		**0.1**					**0.0**	**0.1**
Total Bird	**0.2**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**
VERTEBRATE FAUNA TOTAL	**0.8**	**0.3**	**1.1**	**0.1**	**0.2**	**0.0**	**0.1**	**0.4**	**1.7**
FAUNAL TOTAL	**0.8**	**0.7**	**1.5**	**10.4**	**19.3**	**0.1**	**3.3**	**33.1**	**34.6**
FLORA									
Wood charcoal			**0.0**		0.9			**0.9**	**0.9**
FLORAL TOTAL	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**0.0**	**0.0**	**0.9**	**0.9**

Table C-5. Distribution of Faunal and Floral Remains Site 7182, Feature I.

Feature	Feature I							
Excavation Unit	TU-1							
Layer/Level	I/1	I/2	II/1	II/2	II/3	II/4	II/5	Fe. I Total
Weight (g)	g	g	g	g	g	g	g	g
MOLLUSCA								
GASTROPODS								
Conus spp.	9.4							**9.4**
Cypraea caputserpets		0.2						**0.2**
Nerita picea	3.5	11.9	0.9					**16.3**
Nerita polita	26.0							**26.0**
GASTROPOD TOTAL	**38.9**	**12.1**	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**51.9**
BIVALVES								
Brachidontes crebristratus	0.5	0.5				0.1		**1.1**
Isognomon spp.	0.4							**0.4**
Ctena bella	0..2							**0..2**
Tellina palatam	6.4	1.5						**7.9**
BIVALVE TOTAL	**7.3**	**2.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**9.4**
MOLLUSCA TOTAL	**46.2**	**14.1**	**0.9**	**0.0**	**0.0**	**0.1**	**0.0**	**61.3**
OTHER MARINE SHELL								
Unidentified Sea Urchin (mouth and body parts)	0.9	0.2						**1.1**
Crustacea	0.9	0.6	1.2	2.1	1.3	0.8	0.6	**7.5**
UI Shell	0.7							**0.7**
OTHER MARINE SHELL TOTAL	**2.5**	**0.8**	**1.2**	**2.1**	**1.3**	**0.8**	**0.6**	**9.3**
INVERTEBRATE FAUNA TOTAL	**48.7**	**14.9**	**2.1**	**2.1**	**1.3**	**0.9**	**0.6**	**70.6**
VERTEBRATE FAUNA								
FISH								
Pervagor spp.	0.2							**0.2**
UI Fish	1.0	0.1						**1.1**
TOTAL FISH	**1.2**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.3**
MAMMAL								
Small Mammal	0.2	0.1						**0.3**
Rattus spp.		0.1						**0.1**
Rattus exulans		0.4						**0.4**
TOTAL MAMMAL	**0.2**	**0.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**
BIRD								
Pterodroma phaeopygia		3.5						**3.5**

Table C-5. Distribution of Faunal and Floral Remains Site 7182, Feature I.

Feature	Feature I							
Excavation Unit	TU-1							
Layer/Level	I/1	I/2	II/1	II/2	II/3	II/4	II/5	Fe. I Total
Weight (g)	g	g	g	g	g	g	g	g
Puffinus pacificus		1.3						**1.3**
Strigiform cf. *Gallistrix* spp.		0.2						**0.2**
Medium Procellariid		2.1						**2.1**
Medium Aves			2.6					**2.6**
Small Passeriform		0.1						**0.1**
Falconiform cf. Accipiter spp.?		0.3						**0.3**
Unidentfied Bird Bone	0.3			2.6	1.1			**4.0**
Total Bird	**0.3**	**7.5**	**2.6**	**2.6**	**1.1**	**0.0**	**0.0**	**14.1**
VERTEBRATE FAUNA TOTAL	**1.7**	**8.2**	**2.6**	**2.6**	**1.1**	**0.0**	**0.0**	**16.2**
FAUNAL TOTAL	**50.4**	**23.1**	**4.7**	**4.7**	**2.4**	**0.9**	**0.6**	**86.8**
FLORA								
Wood charcoal	2.8	16.1	0.2	0.2				**19.3**
FLORAL TOTAL	**2.8**	**16.1**	**0.2**	**0.2**	**0.0**	**0.0**	**0.0**	**19.3**

Table C-6. Distribution of Faunal and Floral Remains Site 7182, Feature C.

Feature	Feature C						
Excavation Unit	TU-1						
Layer/Level	II/1	II/2	II/3	II/4	II/5	II/6	Fe. C Total
Sample Weight (g)	g	g	g	g	g	g	g
FAUNA							
MAMMAL							
Small Mammal				0.1			**0.1**
Medium Mammal			0.3				**0.3**
Rattus exulans		0.1					**0.1**
TOTAL MAMMAL	**0.0**	**0.1**	**0.3**	**0.1**	**0.0**	**0.0**	**0.5**
BIRD							
Strigiform cf. *Gallistrix* spp.	0.1						**0.1**
Medium Aves	0.7						**0.7**
Pterodroma cf. *jugabilis*	0.1						**0.1**
Unidentfied Bird Bone	0.1	0.2	0.1	0.4		0.1	**0.9**
Total Bird	**1.0**	**0.2**	**0.1**	**0.4**	**0.0**	**0.1**	**1.8**
Unidentified Vertebrate					0.2		**0.2**
VERTEBRATE FAUNA TOTAL	**1.0**	**0.3**	**0.4**	**0.5**	**0.2**	**0.1**	**2.5**
FAUNAL TOTAL	**1.0**	**0.3**	**0.4**	**0.5**	**0.2**	**0.1**	**2.5**

Table C-7. Distribution of Faunal Remains, Site 7184, Feature A.

Feature	Feature A					
Excavation Unit	TU-1					
Layer/Level	I/2	I/3	I/4	I/5	I/6	Fe. A Total
Sample Weight (g)	g	g	g	g	g	g
FAUNA						
BIVALVES						
Brachidontes crebristratus				0.2	0.1	**0.3**
BIVALVE TOTAL	**0.0**	**0.0**	**0.0**	**0.2**	**0.1**	**0.3**
INVERTEBRATE FAUNA TOTAL	**0.0**	**0.0**	**0.0**	**0.2**	**0.1**	**0.3**
VERTEBRATE FAUNA						
UI Fish		0.1				**0.1**
Total Fish	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.1**
Mammal						
Small Mammal	0.1		0.1			**0.2**
Rattus spp.				0.1	0.1	**0.2**
Total Mammal	**0.1**	**0.0**	**0.1**	**0.1**	**0.1**	**0.4**
Unidentified Vertebrate	0.1					**0.1**
VERTEBRATE FAUNA TOTAL	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.6**
FAUNAL TOTAL	**0.2**	**0.1**	**0.1**	**0.3**	**0.2**	**0.9**

Table C-8. Distribution of Faunal and Floral Remains Site 7185, Feature D.

Feature	Feature D			
Excavation Unit	TU-1			
Layer/Level	I/1	I/2	I/1-2	Fe. D Total
Sample Weight (g)	g	g	g	g
FAUNA				
GASTROPODS				
Conus spp.	11.6			**11.6**
GASTROPOD TOTAL	**11.6**	**0.0**	**0.0**	**11.6**
INVERTEBRATE FAUNA TOTAL	**11.6**	**0.0**	**0.0**	**11.6**
VERTEBRATE FAUNA				
Mammal				
Rattus spp.	0.4	0.2	0.2	**0.8**
Total Mammal	**0.4**	**0.2**	**0.2**	**0.8**
Bird				
UI Bird	0.2			**0.2**
Total Bird	**0.2**	**0.0**	**0.0**	**0.2**
VERTEBRATE FAUNA TOTAL	**0.6**	**0.2**	**0.2**	**1.0**
FAUNAL TOTAL	**12.2**	**0.2**	**0.2**	**12.6**
FLORA				
Wood charcoal	3.1	4.2		**7.3**
FLORAL TOTAL	**3.1**	**4.2**	**0.0**	**7.3**

Table C-9. Distribution of Faunal and Floral Remains Site 7186, Features A and B.

Feature	Feature A			Feature B			
Excavation Unit		TU-1		TU-2			
Layer/Level	II/1	I-III	Fe A Total	I/1	I/2	Fe B Total	7186 Total
Sample Weight (g)	g	g	g	g	g	g	g
FAUNA							
GASTROPODS							
Nerita picea			**0.0**	0.1		**0.1**	**0.1**
GASTROPOD TOTAL	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.1**	**0.1**
BIVALVES							
Isognomon spp.			**0.0**	0.3	0.8	**1.1**	**1.1**
BIVALVE TOTAL	**0.0**	**0.0**	**0.0**	**0.3**	**0.8**	**1.1**	**1.1**
INVERTEBRATE FAUNA TOTAL	**0.0**	**0.0**	**0.0**	**0.4**	**0.8**	**1.2**	**1.2**
VERTEBRATE FAUNA							
*Bos taurus (*mandibular incisor*)*		0.4	**0.4**			**0.0**	**0.4**
Medium Mammal	0.3	0.0	**0.3**			**0.0**	**0.3**
Rattus spp.	0.1	0.0	**0.1**			**0.0**	**0.1**
Total Mammal	**0.4**	**0.4**	**0.8**	**0.0**	**0.0**	**0.0**	**0.8**
Bird							
UI Bird			**0.0**	0.1		**0.1**	**0.1**
Total Bird	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.1**	**0.1**
Unidentified Vertebrate			**0.0**	0.1		**0.1**	**0.1**
VERTEBRATE FAUNA TOTAL	**0.4**	**0.4**	**0.8**	**0.2**	**0.0**	**0.2**	**1.0**
FAUNAL TOTAL	**0.4**	**0.4**	**0.8**	**0.6**	**0.8**	**1.4**	**2.2**
FLORA							
Wood charcoal	16.2		**16.2**			**0.0**	**16.2**
FLORAL TOTAL	**16.2**	**0.0**	**16.2**	**0.0**	**0.0**	**0.0**	**16.2**

Table C-10. Distribution of Faunal and Floral Remains Site 7176, Features A and B.

Feature	Feature A						Feature B			
Excavation Unit	TU-1				STP-1		TU-1			
Layer/Level	I/1	I/2	II/1	II/2	II	Fe A Total	I/1	I/2	Fe B Total	7176 Total
Sample Weight (g)	g	g	g	g	g	g	g	g	g	g
FAUNA										
GASTROPODS										
Cypraea spp.				0.4		0.4				**0.4**
Nerita picea	4.3	7.1	0.6		1.8	**13.8**			**0.0**	**13.8**
GASTROPOD TOTAL	**4.3**	**7.1**	**0.6**	**0.4**	**1.8**	**14.2**	**0.0**	**0.0**	**0.0**	**14.2**
BIVALVES										
Brachinodontes crebristiatus				0.3		**0.3**			**0.0**	**0.3**
Tellina palatam	0.8		0.4			**1.2**			**0.0**	**1.2**
Unidentified Bivalve				<0.1		**<0.1**			**0.0**	**<0.1**
BIVALVE TOTAL	**0.8**	**0.0**	**0.4**	**0.3**	**0.0**	**0.8**	**0.0**	**0.0**	**0.0**	**0.8**
OTHER MARINE SHELL										
Unidentified Sea Urchin (mouth and body parts)	0.2	2.9				**3.1**			**0.0**	**3.1**
OTHER MARINE SHELL TOTAL	**0.2**	**2.9**	**0.0**	**0.0**	**0.0**	**3.1**	**0.0**	**0.0**	**0.0**	**3.1**
INVERTEBRATE FAUNA TOTAL	**5.3**	**10.0**	**1.0**	**0.7**	**1.8**	**15.0**	**0.0**	**0.0**	**0.0**	**15.0**
VERTEBRATE FAUNA										
MAMMAL										
Rattus spp.	2.8	1.0				**3.8**	0.2		**0.2**	**4.0**
Total Mammal	**2.8**	**1.0**	**0.0**	**0.0**	**0.0**	**3.8**	**0.0**	**0.0**	**0.2**	**4.0**
VERTEBRATE FAUNA TOTAL	**2.8**	**1.0**	**0.0**	**0.0**	**0.0**	**3.8**	**0.0**	**0.0**	**0.0**	**3.8**
FAUNAL TOTAL	**8.1**	**11.0**	**1.0**	**0.7**	**0.0**	**18.8**	**0.0**	**0.0**	**0.0**	**18.8**
FLORA										
Wood charcoal	0.2	2.5			0.9	**3.6**			**0.0**	**0.0**
FLORAL TOTAL	**0.2**	**2.5**	**0.0**	**0.0**	**0.9**	**3.6**	**0.0**	**0.0**	**0.0**	**0.0**

Table C-11. Summary of Faunal Remains from Boring Locale 1 Excavations.

Excavation Unit	STP-1	STP-2	STP-3	TOTAL
Layer/Level	I	I	I	
Sample Weight (g)	g	g	g	g
FAUNA				
GASTROPODS				
Unidentified Gastropods		0.1		0.1
GASTROPOD TOTAL	0.0	0.1	0.0	0.1
BIVALVES				
Ceneta bella		<0.1		<0.1
Unidentified Bivalve			<0.1	<0.1
BIVALVE TOTAL	0.0	<0.1	<0.1	<0.1
INVERTEBRATE FAUNA TOTAL	0.0	0.1	<0.1	0.1
VERTEBRATE FAUNA				
MAMMAL				
Canis familiaris			209.1	209.1
Rattus spp.	<0.1		<0.1	<0.1
Unidentified Mammal		0.2		0.2
Total Mammal	<0.1	0.2	209.1	209.3
VERTEBRATE FAUNA TOTAL	<0.1	0.2	209.1	209.3

APPENDIX D

Wood Charcoal Identification Data for 2011 Excavations

RADIOCARBON SCREENING RESULTS FOR THE KALAELOA SOLAR POWER PROJECT 1, PCSI PROJECT NO. 086.02 TASK 6B

Gail M. Murakami
International Archaeological Research Institute, Inc.

July 5, 2011

Four charcoal samples from the Kalaeloa Solar Power Project 1 were examined for taxa identification to select appropriate radiocarbon dating samples. The results are summarized in Table 1. Descriptions of the taxa identified from the charcoal samples are presented below.

TAXA NOTES

Aleurites moluccana (L.) Willd. (*Kukui*)

Once cultivated, this Polynesian introduction has escaped into the native forest, where the pale foliage of the 10 to 20 m trees (Wagner et al. 1990:598) can be seen in abundance in moist gulches and valleys. Dyes were once extracted from the bark and roots (Buck 1957:187), the oily kernel was burned for light (Buck 1957:107) or eaten as a relish after baking (Buck 1957:48), and net floats and dugout canoes were made from the soft wood (Buck 1957:297).

Chamaecyse spp. (*ʻAkoko*)

The distribution of the 15 endemic shrubs and small trees in this genus range from coastal environments to upper forest zones on the main Hawaiian Islands. Nine of these native species are found on Oʻahu (Wagner et al. 1990:602-617; Rock 1974:243-262). *ʻAkoko* was once valued for firewood by the Hawaiians (Hillebrand 1981:396). The milky sap was once considered a possible source for rubber (Rock 1974:261).

Chenopodium oahuense (Meyen) Aellen (*ʻĀheahea*, *ʻāweoweo*)

This endemic species is usually a shrub in the coastal lowlands but may become arborescent at higher elevations (Hillebrand 1981:380). Its known distribution in the main Hawaiian Islands includes coastal, dry forest, and subalpine shrubland at 0 to 2,520 meters elevation (Wagner et al. 1990:538). The soft wood is not known to have been used by the ancient Hawaiians but the leaves were cooked and eaten as greens (Hillebrand 1981:380; Malo 1951:23).

Table 1. Taxa Identification Results of Charcoal Samples from the Kalaeloa Solar Power Project 1.

Sample/ Bag No.	**Site/Fe.**	**Unit**	**Layer/ level**	**WIDL No.**	**Taxa**	**Common/Hawaiian Name**	**Status/Habit**	**Part**	**Count**	**Weight, g**
1/149	1718/J	1	II/1	1112-1	*Aleurites moluccana*	*Kukui*, candlenut	Polynesian Introduction/Tree	Nutshell	8	0.23
				1112-2	*Chenopodium oahuense*	*ʻĀheahea, ʻāweoweo*		Wood	3	0.08
				1112-3	Not identified			Bark	1	0.02
2/56	T-4/4	1	I/2	1112-4	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	15	2.86
3/120	T-5/1	1	II/1	1112-5	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	8	0.14
4/122	T-5/1	1	II/1	1112-6	*Chamaesyce* spp.	*ʻAkoko*	Native/Shrub	Wood	20	1.54

REFERENCES CITED

Buck, Peter H. (Te Rangi Hiroa)
1957 *Arts and Crafts of Hawaii*. Bishop Museum Special Publication 45, Honolulu.

Hillebrand, William
1981 *Flora of the Hawaiian Islands: A Description of their Phanerograms and Vascular Cryptogams.* Lubrecht & Cramer, New York. Originally published in 1888.

Malo, David
1951 *Hawaiian Antiquities (Moolelo Hawaii)*. Translated by Nathaniel B. Emerson, 1898. Bishop Museum Special Publication 2 (2nd ed.), Honolulu.

Rock, Joseph F.
1913 *The Indigenous Trees of the Hawaiian Islands*. Published privately, Honolulu. (Reprint. Rutland: Charles E. Tuttle Co., 1974.)

Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer
1990 *Manual of the Flowering Plants of Hawai‘i*. University of Hawaii and Bishop Museum Presses, Honolulu.

APPENDIX E

Beta Analytic Radiocarbon Data Sheets for 2011 Excavations

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305 667 5167
Fax: 305 663 0964
Beta@radiocarbon.com
www.radiocarbon.com

Consistent Accuracy . . .
. . . Delivered On-time

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

August 1, 2011

Mr. Stephan D. Clark
Pacific Consulting Services
720 Iwilei Road
Suite 424
Honolulu, HI 96817
USA

RE: Radiocarbon Dating Results For Samples Kalaeloa.1, Kalaeloa.2, Kalaeloa.3

Dear Mr. Clarke:

Enclosed are the radiocarbon dating results for three samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. The report sheet also contains the method used, material type, and applied pretreatments and, where applicable, the two-sigma calendar calibration range.

As always, this report has been both mailed and sent electronically. All results (excluding some inappropriate material types) which are less than about 20,000 years BP and more than about ~250 BP include this calendar calibration page (also digitally available in Windows metafile (wmf) format upon request). The calibrations are calculated using the newest (2004) calibration database with references quoted on the bottom of each page. Multiple probability ranges may appear in some cases, due to short-term variations in the atmospheric 14C contents at certain time periods. Examining the calibration graphs will help you understand this phenomenon. Don't hesitate to contact us if you have questions about calibration.

We analyzed these samples on a sole priority basis. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

Information pages are also enclosed with the mailed copy of this report. If you have any specific questions about the analyses, please do not hesitate to contact us.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Stephan D. Clark — Report Date: 8/1/2011

Pacific Consulting Services — Material Received: 7/11/2011

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 302261	30 +/- 30 BP	-10.9 o/oo	260 +/- 30 BP

SAMPLE : Kalaeloa.1
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1530 to 1560 (Cal BP 420 to 390) AND Cal AD 1630 to 1670 (Cal BP 320 to 280)
Cal AD 1780 to 1790 (Cal BP 160 to 160)

Beta - 302262	100.7 +/- 0.4 pMC	-11.0 o/oo	170 +/- 30 BP

SAMPLE : Kalaeloa.2
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1660 to 1700 (Cal BP 290 to 250) AND Cal AD 1720 to 1820 (Cal BP 230 to 130)
Cal AD 1840 to 1880 (Cal BP 110 to 70) AND Cal AD 1920 to 1950 (Cal BP 40 to 0)

Beta - 302263	60 +/- 30 BP	-22.6 o/oo	100 +/- 30 BP

SAMPLE : Kalaeloa.3
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1680 to 1740 (Cal BP 270 to 210) AND Cal AD 1800 to 1940 (Cal BP 150 to 20)
Cal AD 1950 to 1960 (Cal BP 0 to 0)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

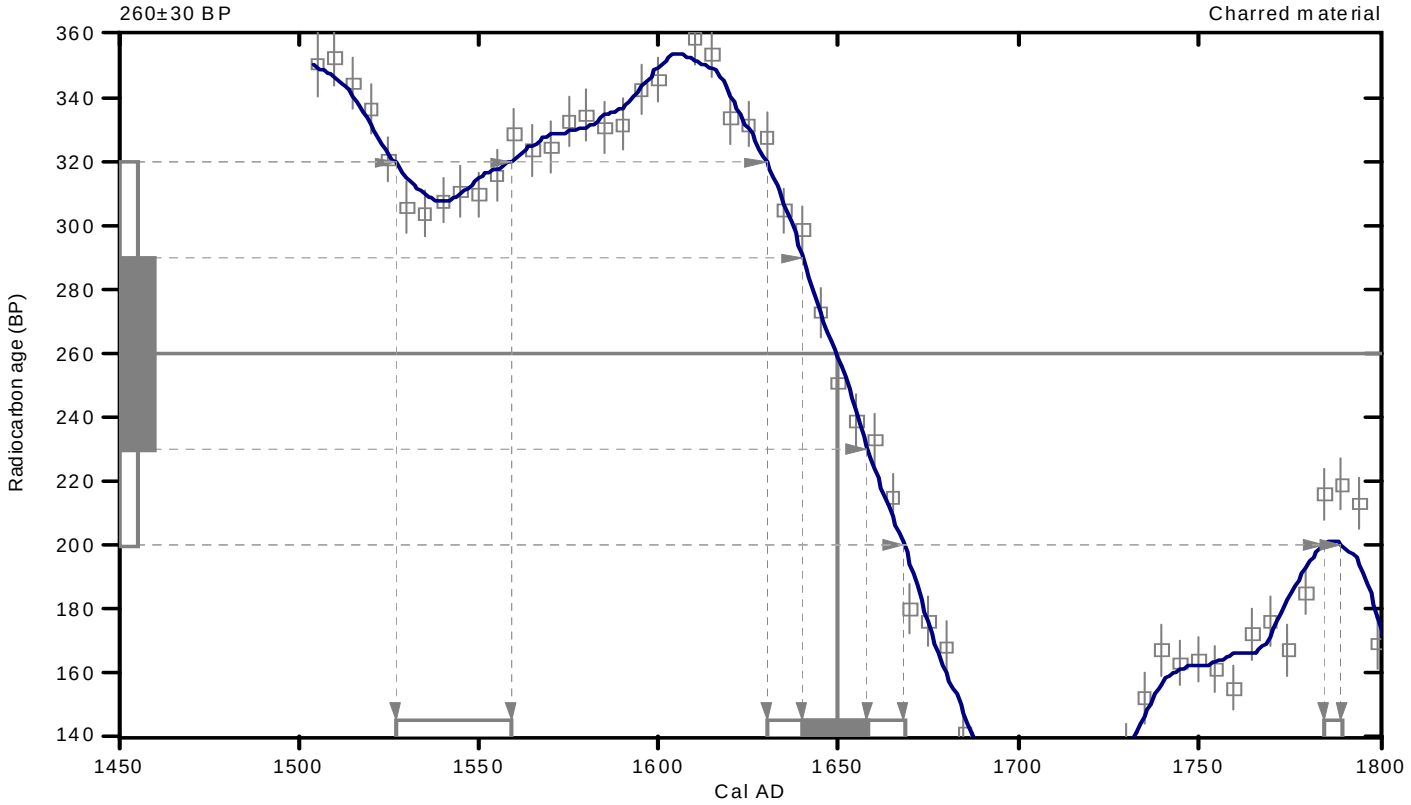
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-10.9:lab. mult=1)

Laboratory number:	**Beta-302261**
Conventional radiocarbon age:	**260±30 BP**
2 Sigma calibrated results: (95% probability)	**Cal AD 1530 to 1560 (Cal BP 420 to 390) and Cal AD 1630 to 1670 (Cal BP 320 to 280) and Cal AD 1780 to 1790 (Cal BP 160 to 160)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 1650 (Cal BP 300)
1 Sigma calibrated result: (68% probability)	Cal AD 1640 to 1660 (Cal BP 310 to 290)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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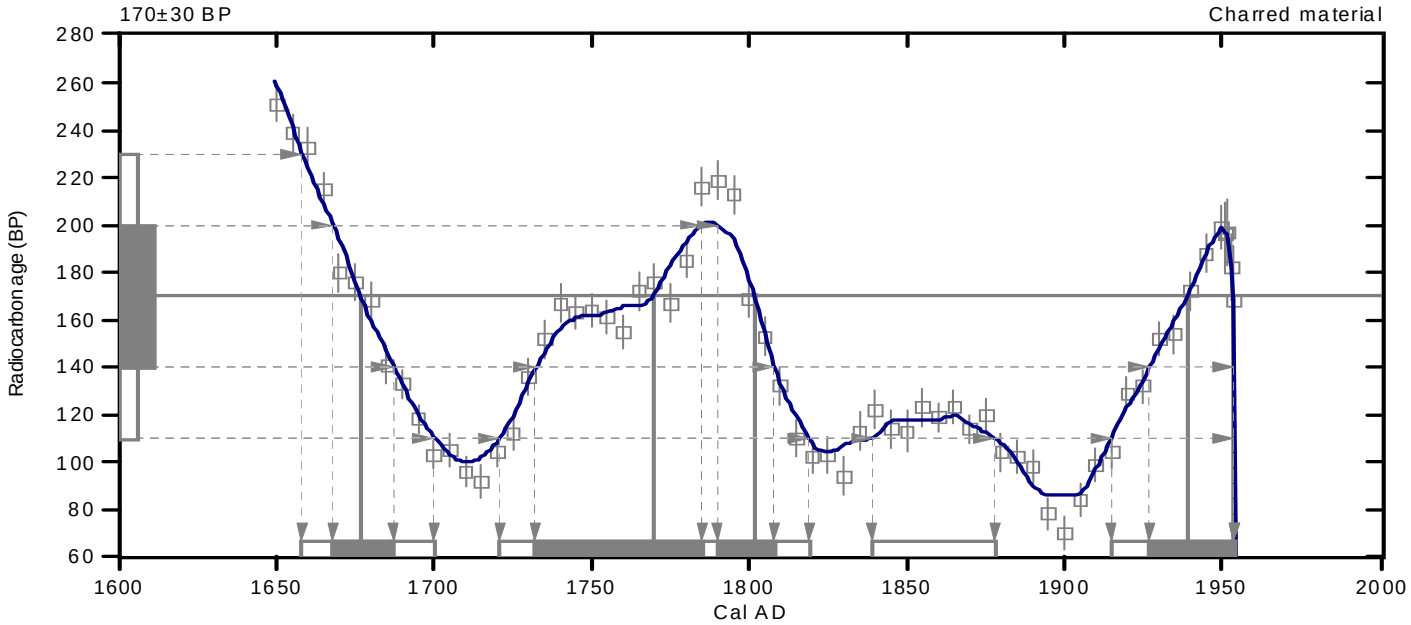
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-11:lab. mult=1)

Laboratory number:	**Beta-302262**
Conventional radiocarbon age:	**170±30 BP**
2 Sigma calibrated results: **(95% probability)**	**Cal AD 1660 to 1700 (Cal BP 290 to 250) and** **Cal AD 1720 to 1820 (Cal BP 230 to 130) and** **Cal AD 1840 to 1880 (Cal BP 110 to 70) and** **Cal AD 1920 to 1950 (Cal BP 40 to 0)**

Intercept data

Intercepts of radiocarbon age with calibration curve:	Cal AD 1680 (Cal BP 270) and Cal AD 1770 (Cal BP 180) and Cal AD 1800 (Cal BP 150) and Cal AD 1940 (Cal BP 10) and Cal AD 1950 (Cal BP 0)
1 Sigma calibrated results: (68% probability)	Cal AD 1670 to 1690 (Cal BP 280 to 260) and Cal AD 1730 to 1780 (Cal BP 220 to 160) and Cal AD 1790 to 1810 (Cal BP 160 to 140) and Cal AD 1930 to 1950 (Cal BP 20 to 0)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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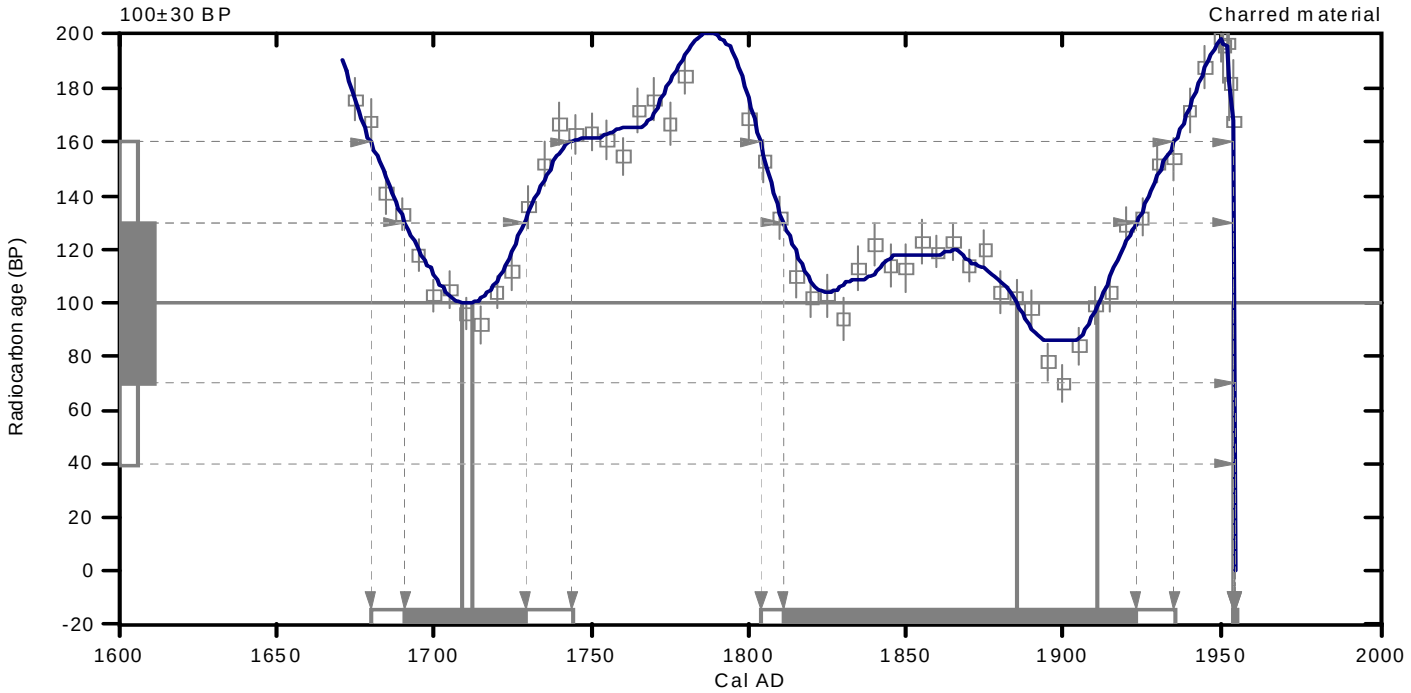
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.6:lab. mult=1)

Laboratory number:	**Beta-302263**
Conventional radiocarbon age:	**100±30 BP**
2 Sigma calibrated results: **(95% probability)**	**Cal AD 1680 to 1740 (Cal BP 270 to 210) and** **Cal AD 1800 to 1940 (Cal BP 150 to 20) and** **Cal AD 1950 to 1960 (Cal BP 0 to 0)**

Intercept data

Intercepts of radiocarbon age with calibration curve:	Cal AD 1710 (Cal BP 240) and Cal AD 1710 (Cal BP 240) and Cal AD 1880 (Cal BP 60) and Cal AD 1910 (Cal BP 40) and Cal AD 1950 (Cal BP 0)
1 Sigma calibrated results: (68% probability)	Cal AD 1690 to 1730 (Cal BP 260 to 220) and Cal AD 1810 to 1920 (Cal BP 140 to 30) and Cal AD 1950 to 1960 (Cal BP 0 to 0)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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APPENDIX F

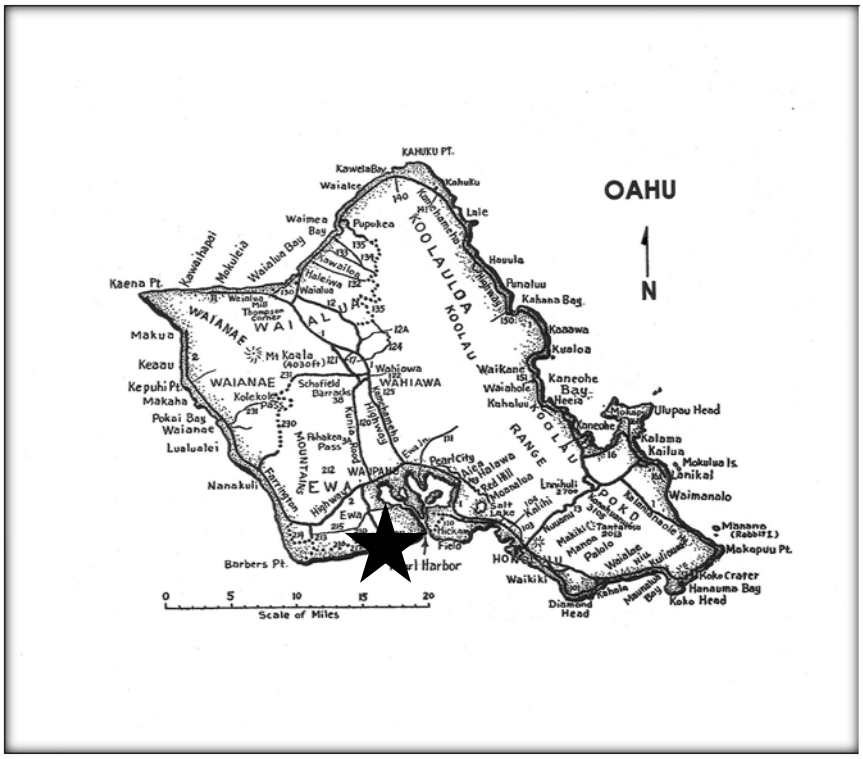
Military Defense and Infrastructure Information by

John Bennett

WWII PILLBOX DEFENSES:
NAVAL AIR STATION BARBERS POINT
ISLAND OF OAHU, HAWAII

John D. Bennett

This essay embodies an attempt by the author to identify and classify various World War Two machine gun pillboxes found on the coastline, and inland, at the former Naval Air Station Barbers Point (NASBPT) at Kalaeloa. The classifications used in the report do not represent any official identification of the structures, but serve merely as a means of illustrating the several types found at the former naval air station.

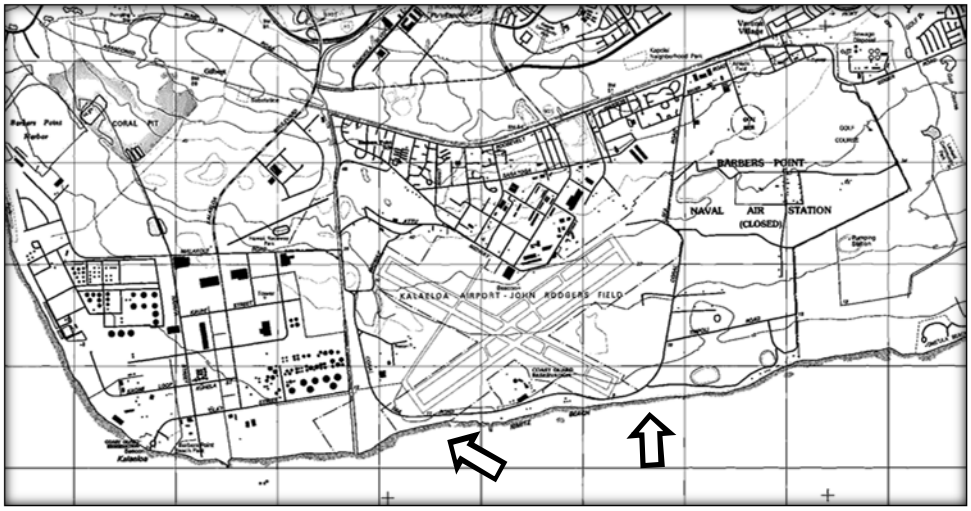


Island of Oahu. Arrow points to general location of the former NAS Barbers Pt.

Site Reconnaissance

The author first visited Nimitz Beach at the former NASBPT shortly after the air station was decommissioned in August of 1999. World War Two defense works were discovered at the beach in the form of several different designs of concrete machine gun pillboxes. The shoreline was named for the World War Two Commander in Chief of the Pacific, Fleet Admiral Chester W. Nimitz who maintained his headquarters at Pearl Harbor.

Three distinctive types of pillboxes were found along the shore. The majority were determined to be in good condition with a few rated in fair condition by the author.



Most of the pillboxes described in this report are found between the arrows along Nimitz Beach.
Adapted from N.G.S. Ewa Quadrant Map.

Type-I Pillbox

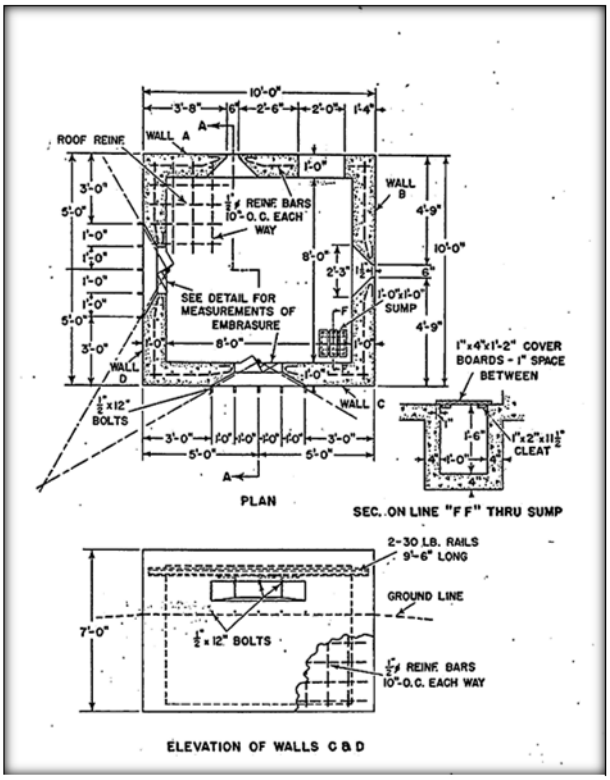
This variant was mass-produced during World War-II and found in numbers on Oahu's shores after the war; however most have been demolished to make way for development. It was built of reinforced concrete, square shaped and averaged eight feet square, with some being 10 feet square, with four firing embrasures, one to each wall. Access was made through an opening at the rear, either incorporated into the firing embrasure or a separate opening in the rear wall. Several examples found on Oahu incorporated U-shaped rebar hoops just below the roof at each corner.

The pillboxes were usually pre-cast in army engineer base yards, after a sufficient curing period, the structure was hoisted by a crane by fastening cable hooks to the rebar hoops, then placed atop a motorized conveyance and transported to the site. Some were built on site due to their being located in hilly locales where motor transport was not able to service.

The example at Nimitz Beach was discovered southwest of the present U.S. Coast Guard Air Station at: N21.298419° - W158.074093°courtesy of "Google Earth ©2010 Google™ including other coordinates mentioned in this essay.

The pillbox has been registered with the Historic American Buildings Survey (HABS) as HABS No. HI-279-AF and classified by the registrant as a "Type 2 Pillbox" for purposes of recordation.[1]

Type-I mass-produced square-type pillbox located
at the former NASBPT. (Photo by the author)



U.S. Army Engineers type plan for a 10 foot square pillbox. From Field Manual 5-15.

Type-II Pillbox

The Type-II reinforced concrete pillbox was rectangular shaped with a single firing embrasure at the curved front wall. Access to the interior was accomplished by means of a small rectangular doorway located either on the left or right side wall. The type included one pintle to mount a machine gun.

Although no Type-IIs have been found at the former NASBPT, several are found two miles to the east at Oneula Beach, one at Kualoa Beach on the east side of the island and several at Nanakuli Beach on the west shore. It is not clear as to whether the structures were pre-cast or built on site. Based on the different locations that this type has been found, it appeared they were built by the Army Corps of Engineers or their civilian contractors.

Type-II at Kualoa Beach. (Photo by the author)

Type-IIA Pillbox

The structure is described as a reinforced concrete "double-ended" pillbox, rectangular shaped with two curved ends that included firing embrasures at either end. The structure was composed of two sections which abutted at the rear walls. Placement of two sections together at the ends gave the appearance of one oblong structure. Exterior walls were smooth finished with a rough textured flat roof. It appeared to have been constructed of two Type-II sections joined at the ends. The type included one pintle to mount a machine gun.

Type-IIA - External Measurements

Length: North section: 8' -0"; South section: 14' -0".
Width (both sections): 7' -0".
Embrasures: (both sections): Length: 4' -3".
Height: 8' -0".
Wall thickness (both sections): 12.5".

Entry chute: Width: 3' -6"; Length: 10' -4".
Entry wall Height: 3' -6" (estimated).
Entryway into chambers: Height: 4' -1"-; Width: 3' -8".

One obvious difference in the design was displayed on the south segment which incorporated a thick shelf located five inches below the embrasure that projected two feet, and measured 2' -6" tall, the addition conformed to the curve of the wall. It is the author's supposition that the addition functioned as a bumper to provide some measure of protection to the pillbox from damage and being inundated with seawater during storms and extremely high tides.

Left side wall of the Type-IIA pillbox found at Nimitz Beach. Photo shows the two separate sections that abutted; both sections have since separated. (Photo by the author, 1999)

Type-III pillbox at the left, and the Type IIA on the right halved in two sections. (Photo by the author, 1999)

The Type-IIA example that follows was sited at the edge of a lithified limestone shelf with the slightly raised north section facing inland and the south section facing the ocean.

Several Type-IIAs were discovered west of the example depicted below. The first was situated approximately ½ mile WSW at: N21.298490° - W158.075927°, others ran in the westerly direction along the seashore. The majority of the Type-IIAs were judged to have been in fair to good conditions in 1999. The design allowed for defense of attack from the land or ocean.

Photo shows the Type IIA Pillbox. Note the thick shelf below the embrasure on the right of the pillbox which sets it apart from the Type-IIA . (Photo by the author, 1999)

Large shelf of a Type-IIA is shown above. (Photo by the author, 1999)

Type-III Pillbox

The sole example was a rectangular shaped reinforced-concrete structure with slab walls and roof, similar to examples located on Midway and Palmyra Islands during World War Two. The structure measured about 10' x 10' x 6' tall.

It was entered by way of a small rectangular entry at the rear wall. The front wall included an embrasure that ran its length. The exterior surface of the roof was rough textured, and all exterior sidewalls were smooth surfaced. It was situated about 236 feet south of Coral Sea Road and 163 yards ESE of the Navy's recreational cabins at coordinates: N21.299784° - W158.064542.

Type-III pillbox showing entryway at the rear. (Photo by the author, 1999)

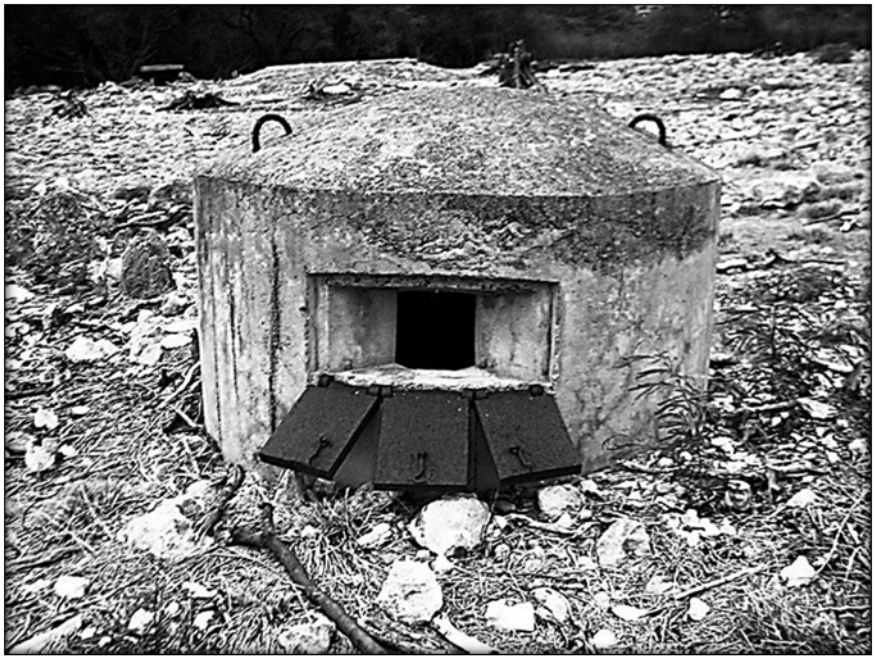
Front of the Type-III showing the large firing embrasure and spalling to the roof.
(Photo by the author, 1999)

Three vertical pintle bolts were mounted on the inner shelf at the bottom of the embrasure; the center pintle was larger in diameter than the other two, which indicated that a larger gun had been mounted upon it. The author has no details as to the caliber and type of weapon(s) mounted in the pillbox. Most World War Two pillboxes in the Hawaiian Islands were usually armed with one Browning caliber .30 air or water-cooled machine gun, although Lewis machine guns and Browning caliber .30 automatic rifles may have been substituted in some instances.

The Type-III may have been built with type plans by "Contractors, Pacific Naval Air Bases" (PNAB) which started construction of navy air stations at Midway, Palmyra and Wake Islands and at Tutuila, American Samoa before being replaced by Naval Construction Battalions (Seabees) in early 1942.

The front wall showed sign of spalling on the left front corner of the roof which exposed reinforcing steel rods. Weathering and vandalism have contributed to its present condition, which was estimated to be in a fair state.

The structure is registered with the State Inventory of Historic Places as No.50-80-12-5125 Feature G, and with the HABS as No. HI-279-AG.[2]



Firing embrasure of a Type-IV pillbox found at ex-NASBPT.
Note metal hoops for lifting structure into place (Author's collection)

Type-IV Pillbox

The author has classified the last type of pillbox found at the former NASBPT as Type-IV. One of two known examples was examined by the author near the southwestern portion of the tract.

Type-IV pillboxes were cylindrical shaped reinforced concrete structures with a bell or domed shaped roof, equipped with a single firing embrasure that could be covered by three cast metal shutters hinged on the outside that opened to allow a weapon to be fired. The structure appeared large enough to accommodate two men. It was entered by means of a crawl through opening at the bottom of the rear wall. It is unclear what type of weapon was used.

Cast metal pillboxes used for defense of Army airfields on Oahu during World War Two were armed with a single .30 caliber air-cooled machine gun, Type-IVs may have been similarly armed. One such example is on static display on the grounds of the U.S. Army Museum Hawaii at Battery Randolph, Fort DeRussy Armed Forces Recreational Area.

Based on the metal hoops imbedded on either side of the domed roof of the above example, the pillbox was probably cast in an engineer base yard then lifted onto a conveyance and transported to the site. Two examples are known to exist at ex-NASBPT. Type-IVs appeared to have been employed for inner and perimeter defense of the air station based on the locations of the both examples pictured above.

Rear of a Type-IV pillbox. Arrow points to the semi-concealed entryway. Structure sits on railroad ties. (Photo by author, 2010)

Photo depicts two domed pillboxes encased in wooden forms at Ewa Field shortly after the December 7, 1941 attack (U.S. Marine Corps Photo No. 145135, from East Wind Rain)

The above photo taken shortly after the December 7, 1941 attack of Ewa Field by aircraft of the Imperial Japanese Navy clearly shows two dome-shaped pillboxes encased in wooden forms during a curing period. The photo appeared in the book "East Wind Rain."[3] Construction of the pillboxes at Ewa Field also known as Ewa Mooring Mast would indicate that they were designed and built by navy engineers or PNAB.

The structure is of great historical value as it represents a specific and unique means of defense against enemy ground attack that was designed and constructed before America's involvement in World War Two.

Concluding Remarks

The former NASBPT (1942-1999) was situated on the southwest shore of Oahu. Due to the relative isolation that the former base enjoyed from prying civilians bent on destruction and vandalism, most pillboxes weathered the post-war years in fair to good condition, although in 2011, the examples along the shoreline were beginning to display the effects of weathering, and contact with civilians.

In 1999, one Type-IIA pillbox situated at the west end of Coral Sea Road bore a sign painted on the left wall stating that the structure was eligible to be included in the National Register of Historic Places, and asked that it be kept in as original condition as possible by those that used the beach.

All examples of machine-gun pillboxes found along the shoreline of Nimitz Beach have been registered with the State Historic Preservation Division, Department of Land and Natural Resources as Site No. 50-80-12-5125, Features A-I inclusive. They have also been registered with the Historic American Buildings Survey under HABS No. 279, Naval Air Station Barbers Point, Shore Pillbox Complex.

The Type-IV domed shaped pillbox represents a unique and rare design of World War Two pillbox construction that should qualify it to be left in situ or placed in a museum for display if it is to be demolished.

Caveat: The essay has been revised to conform to the pillbox classifications as described in Bennett, May 2008 below, with the addition of the Type-IV classification. This revision supersedes all previous versions. All errors and omissions are those of the author. All rights reserved.

Notes

1. Historic American Buildings Survey, "Naval Air Station Barbers Point, Shore Pillbox Complex – Type Index to Photographs,"HI-279-AF.

2. Ibid., HABS No. HI-279-AG.

3. Stan Cohen, *East Wind Rain*, Missoula, MT: Pictorial Hill Publishing Co., July 1999, Ninth Edition, p. 219.

Additional Sources

Bennett, John D. "World War II Machine-Gun Pillboxes, and Other Coast Defense and Other Stations in the Hawaiian Islands, *The Coast Defense Journal*, Vol. 22, No. 2 (May 2008), 28 pp.

War Department Field Manual FM 5-15, *Corps of Engineers: Field Fortifications,* Washington, D.C.: U.S. Government Printing Office, 14 February, 1944

STRUCTURES ASSOCIATED WITH SEWER OUTFALLS ON ARMY RESERVATIONS

John D. Bennett

Two separate sites on the Island of Oahu were briefly examined by the writer which was associated with sewage ejector systems that discharged wastewater into the ocean. Both are depicted below:

Site 1 Former Camp Kaena

The below pictured structure was found on the makai side of Farrington Highway in the District of Waialua, Island of Oahu adjacent to the western border of the Y.M.C.A. Camp Erdman.

One ammunition bunker and several concrete footings were extant during a 2000 site examination by the writer.

Photograph depicts what appeared to be a rectangular concrete structure with a subterranean vault. Access was by way of two manholes; the deeper chamber included of rebar rungs affixed to the manhole shown at the left.

View looking into the larger manhole situated on the north.

The manhole closest to the ocean is pictured above. A gate valve was found inside with a pipeline that ran out onto the reef slightly in a northwest to southeast line.

Note: It is believed that the structure was built by Army Corps of Engineers and may have served as the outfall system for Mokuleia Army Airfield, now known as Dillingham Airfield. The structure was not thought to have been in service during a 2001 examination by the writer.

Site 2 Puu o Hulu-kai

The second site also believed to have been part of a sewage ejector system was discovered at the former Puu o Hulu Military Reservation on lands belonging to the Department of Lands and Natural Resources, State of Hawaii at Maili in the District of Waianae, Island of Oahu.

Structure thought to be part of the sewage ejector system for the former military reservation at Puu o Hulu-kai is described as rectangular in shape, built of reinforced concrete with two manholes at either end (east and west), A cast iron pipe at least 8-inches in diameter protruded outside of the east manhole (pictured at the top). The structure faced Farrington Highway and towards the ocean.

Rebar rungs leading into the east manhole of the Puu o Hulu-kai structure.

Note: Due to its similar design with the Camp Kaena structure and its proximity to the ocean it was the writer's belief this structure also functioned as part of the ex-military reservation's sewage ejector system.

Caveat: Any omissions or errors are those of the writer. Dated July 14, 2011.

APPENDIX C

BOTANICAL SURVEY REPORT

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Art Whistler, Ph.D.
ISLE BOTANICA, Publishers and Botanical Consultants
2814 Kalawao St., Honolulu, Hawaii 96822
PH/FAX (808) 988 1771
E-Mail: whistler@hawaii.edu

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23 October 2010

Submitted to:
Glenn Metzler
TEC Inc.
1003 Bishop St., Suite 1550
Honolulu, HI 96813

Kalaeloa Solar One
Botanical Survey of TMK (1) 9-1-13:28 (portion)
Land Parcel at Kalaeloa (the former Naval Air Station, Barbers Point)
with Special Focus on ***'Akoko*** (*Chamaesyce skottsbergii* var. *kalaeloana*)

INTRODUCTION

The study site comprises an 80-acre parcel of land belonging to the Department of Hawaiian Home Lands located near the northwest corner of Kalaeloa (the former Naval Air Station, Barbers Point). The parcel is bounded on the west side by a fence and road marking the western side of the former base, on the north side by Boxer Road, and on the south by a line extending east-west across the property. The land is being developed as a solar farm and an Environmental Assessment (EA) is being prepared by TEC Inc. Several botanical surveys have been done in the area over the years, and the presence a federally listed Endangered Species, *Chamaesyce skottsbergii* var. *kalaeloana* (***'akoko***), was documented in the project area. This additional survey was conducted at greater field coverage to determine if this species is found in the area planned for development, and if present, where and in what numbers it occurs.

Kalaeloa is one of the few remaining places where this ***'akoko*** has been identified, and has been reported in or near the parcel during two previous studies by the author (one specifically in the area and one just outside of it). However, it is noted that the last survey conducted on the parcel in the wet season (Whistler 2008) did not find any individuals of this endangered plant.

METHODOLOGY

The area was visited during October 18th and 19th 2010 by the Consultant, along with Tec Inc. representative Glenn Metzler. Mr. Metzler also visited the site on the 21st and 23rd October without the consultant. A normal 100% survey conducted in searches for rare plants involves transects 30 feet apart. However, because this survey was done in the dry season (of a drought year) when the ***'akoko*** plants are often leafless, the methodology was modified somewhat to do closer transects, particularly in areas of suitable habitat. Determination of suitable habitat was based on observations during the author's numerous previous surveys in the area. ***'Akoko*** does not occur uniformly on the site, instead being virtually restricted to a certain type of microhabitat in the *Prosopis pallida* (***kiawe***) forest present on the property. The plant is rarely found under forest shade or in grassy areas. Instead it prefers open areas of flat limestone rock devoid of the dominant grass in the area, *Cenchrus ciliaris* (Buffelgrass), which are

scattered throughout, but not commonly in, the area (This habitat is more common elsewhere at Kalaeloa). Additional field effort was focused in these areas of suitable habitat.

The transect lines run by the Consultant and Glenn Metzler were marked by color flagging tape, with alternating colors in different rows. This was done to facilitate straight lines so that no part of the study area would be missed. It was supplemented by the use of a handheld GPS unit that indicated where the boundaries were and how the transect lines had been walked. The lines were run south from Boxer Road, with return runs in the opposite direction. As mentioned, places with suitable habitat (open places on rocky ground) were given extra attention. A checklist was completed for all plant species found (see Table 1) to document the flora and to make sure that no other critical plant species occur on the site.

RESULTS

Flora

Fifty-two species were recorded at the study site (see Table 1) during the present study. Only eight of the 52 species are native, six of them indigenous (***nena***, ***ʻuhaloa***, ***ʻilima***, ***huehue***, ***ilieʻe***, and ***kaunaʻoa pehu***), and two of them endemic (***wiliwili***, ***maiapilo***). Indigenous plants are species native to a region or place, but which are also found elsewhere. Endemic plants are species restricted to a single region or area, i.e., in the case of Hawaiʻi, they are found only in Hawaiʻi. In biodiversity terms, the endemic status is the more important of the two categories, because if a species belonging to it is endangered or threatened in Hawaiʻi, it would likewise be classified globally. Indigenous species, however, can be rare in Hawaiʻi, but may be common elsewhere in the Pacific. Over 90% of the native plants in Hawaiʻi are endemic, one of the highest rates in the world. The vast majority of the 52 species encountered during the survey are naturalized or weedy "alien" plants that were accidentally or intentionally introduced to Hawaiʻi, but which have now become established in the islands and can spread on their own. Most of these native species are common in Hawaiʻi, and none are Threatened or Endangered.

Vegetation

The vegetation at the site is mostly a ***kiawe***/***koa haole*** forest (= *Prosopis*/*Leucaena* forest) described by Char and Balakrishnan (1979), dominated by large trees of *Prosopis pallida* (***kiawe***, mesquite) up to 10 m or more in height, with smaller amounts of shorter and thinner *Leucaena leucocephala* (***koa haole***). The Chinese banyan (*Ficus microcarpa*) is scattered throughout the site, and during this drought period, was virtually the only tree with conspicuous leaves. The canopy of the ***kiawe*** trees produces a variable shade beneath it, which results in a ground cover dominated by more shade-tolerant plants, such as Guinea grass (*Panicum maximum*), Chinese violet (*Asystasia gangetica*), but these were severely affected by the drought and mostly dead or leafless. In the more open areas, the ground cover is typically dominated by the less shade tolerant Buffelgrass (*Cenchrus ciliaris*). The shrubs ***ʻilima*** (*Sida fallax*) and ***klu*** (*Acacia farnesiana*) are occasional in these sunnier areas. Areas with the combination of ***koa haole*** and ***ʻilima*** comprise the prime habitat for ***ʻakoko*** plants, which are, however, uncommon in the area (especially live ones). In areas with few or no trees, the vegetation is typically a grassland dominated by Buffelgrass, often with scattered ***koa haole*** and ***ʻilima*** shrubs. The distinction between the ***kiawe/koa haole*** forest and Buffelgrass grassland is blurred because they blend into each other.

DISCUSSION

During the survey, a population of what appeared to be *Chamaesyce skottsbergii* var. *kalaeloana* was found on the eastern portion of the property within the development area. (Note: the location was collected with a Garmin GPS76 by Glenn Metzler and is shown on Figure 3.6 of the draft EA). The site is ideal ***ʻakoko*** habitat with a flat rock surface having cover and no shade. About a dozen individuals of a species of *Chamaesyce* were found, all but about three of them dead. The largest of the dead individuals appeared to be the Endangered ***ʻakoko***, but upon closer examination, the withered flowers, in clusters

rather than solitary, indicated that this dead individual was probably *Chamaesyce hypericifolia* instead. This latter species is an alien weed reported to be an annual rather than a woody perennial plant, but the large dead individual in question seemed clearly to be a woody perennial. Since most of the other individuals do not appear to be woody, and on the live ones the flowers are in clusters, it is likely that the large individual is just an aberrant *Chamaesyce hypericifolia*. It may be a moot point, because the only specimen in question was dead. The difficulty in identifying the plant is exacerbated by the fact that the "key" to determining the difference between the two species (Wagner et al. 1990) separates the Hawaiian species first into native and non-native species, so if one does not know the answer to that question, then the step in the key is useless.

Perhaps the best way to remove any uncertainty about the identification of the plants is to have an expert from the Hawaii DLNR, USFWS, or Bishop Museum examine them and give a determination.

Other than these specimens, the only interesting botanical resources are the presence of two endemic species, *Erythrina sandwicensis* (***wiliwili***) and *Capparis sandwichiana* (***maiapilo*** or ***pua pilo***). (Note: the locations were collected with a Garmin GPS76 by Glenn Metzler and are shown on Figure 3.6 of the draft EA). These were found on the eastern side of the survey area. It would be desirable if the individuals of these species can be preserved, since they are uncommon on O‘ahu. About 10 live individuals of ***wiliwili*** were recorded, and about five of the ***pua pilo***. These were marked with flagging and should be avoided, if possible, when the site is developed.

RELEVANT REFERENCES

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St. John, H. 1973. List and summary of the flowering plants in the Hawaiian Islands. Pacific Tropical Botanical Garden Memoir 1: 1–519.

Wagner, W. L., D. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai‘i. Bishop Museum and University of Hawaii Press, Honolulu. 2 vols.

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Whistler, W. A. 1998. *Chamaesyce skottsbergii* botanical survey of the Naval Air Station, Barbers Point, Oahu, Hawai’i. Unpublished report prepared for Belt Collins Hawaii. 10 pp.

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Table 1. Plant Species Checklist

The following is a checklist of the vascular plants inventoried during the field study on the ca. 80 acre study site at Kalaeloa. The plants are divided into two groups: monocots, and dicots. Within these groups, the species are presented taxonomically by family, with each family and each species in the family in alphabetical order. The taxonomy and nomenclature of the ferns follow Palmer 2003 and the flowering plants (monocots and dicots) follow Wagner *et al*. (1990). In most cases, common English and/or Hawaiian names listed here have been taken from St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used.
   E = endemic (found only in Hawai‘i).
   I = indigenous (native to Hawai‘i as well as other geographic areas).
   P = Polynesian introduction (introduced to Hawai‘i by Polynesians before the advent of the Europeans).
   X = Introduced or alien (not native, introduced to Hawai‘i, either accidentally or intentionally, after the advent of the Europeans).

Species	Common Names	Status[1]
MONOCOTS		
AGAVACEAE (Agave Family)		
Cordyline fruticosa (L.) A. Chev.	ti, ki	P
COMMELINACEAE (Spiderwort Family)		
Commelina benghalensis L.	hairy honohono	X
POACEAE (Grass Family)		
Cenchrus ciliaris L.	Buffelgrass	X
Chloris barbata (L.) Sw.	swollen fingergrass	X
Cynodon dactylon (L.) Pers.	Bermuda grass	X
Eragrostis cilianensis (All.) Link	stink grass	X
Panicum maximum Jacq.	Guinea grass	X
Sporobolus diander (Retz.) P.Beauv.	Indian dropseed	X
	DICOTS	
ACANTHACEAE (Acanthus Family)		
Asystasia gangetica (L.) T. Anderson	Chinese violet	X
Barleria cristata L.	Philippine violet	X
AMARANTHACEAE (Amaranth Family)		
Achyranthes aspera L.	----------	X
ARALIACEAE		
Schefflera actinophylla (Endl.) Harms	octopus tree	X
ASCLEPIADACEAE (Milkweed Family)		
Cryptostegia grandiflora Roxb. ex Br.	panay rubber vine	X
Stapelia gigantea N.E. Brown	carrion flower	X

Species	Common Names	Status[1]
ASTERACEAE (Sunflower Family)		
Pluchea indica (L.) Less.	Indian pluchea	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X
BIGNONIACEAE (Bignonia Family)		
Spathodea campanulata P. Beauv.	African tulip tree	X
BORAGINACEAE (Heliotrope Family)		
Heliotropium curassavicum L.	nena	I
CACTACEAE (Cactus Family)		
Opuntia ficus-indica (L.) Mill.	prickly pear, panini	X
CAPPARACEAE (Caper Family)		
Capparis sandwichiana DC	pua pilo	E
CASSYTHACEAE (Cassytha Family)		
Cassytha filiformis L.	kauna‘oa pehu	I
CLUSIACEAE (Mangosteen Family)		
Clusia rosea Jacq.	autograph tree	X
CONVOLVULACEAE (Morning-Glory Family)		
Ipomoea cairica (L.) Sweet	koali	X
CUCURBITACEAE (Gourd Family)		
Coccinea grandis (L.) Voigt	ivy gourd	X
EUPHORBIACEAE (Spurge Family)		
Chamaesyce hirta (L.) Millsp.	garden spurge	X
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X
Euphorbia lactea Haw.	milk-stripe spurge	X
Pedilanthus tithymaloides (L.) Poit.	slipper plant	X
FABACEAE (Pea Family)		
Acacia farnesiana (L.) Willd.	klu	X
Erythrina sandwicensis Deg.	wiliwili	E
Glycine wightii (Wight & Arn.) Verdc.	----------	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Pithecellobium dulce (Roxb.) Benth.	‘opiuma, Manila tamarind	X
Prosopis pallida (Humb. & Bonpl.ex Willd.) Kunth	kiawe, mesquite	X
LAMIACEAE (Mint Family)		
Ocimum gratissimum L.	wild basil	X
MALVACEAE (Mallow Family)		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X
Malvastrum coromandelianum (L.) Garcke	false mallow	X
Sida ciliaris L.	----------	X
Sida fallax Walp.	‘ilima	I
Sida rhombifolia L.	Cuba jute	X

Species	Common Names	Status[1]
MENISPERMACEAE (Moonseed Family)		
Cocculus trilobus (Thunb.) DC.	huehue	I
MORACEAE (Mulberry Family)		
Ficus microcarpa L. f.	Chinese banyan	X
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	love-in-a-mist	X
PLUMBAGINACEAE (Leadwort Family)		
Plumbago zeylanica L.	‘ilie‘e	I
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	common purslane	X
Portulaca pilosa L.	‘ihi	X
RUBIACEAE (Coffee Family)		
Morinda citrifolia L.	Indian mulberry, noni	P
SOLANACEAE (Nightshade Family)		
Solanum seaforthianum Andr.	blue potato-vine	X
STERCULIACEAE (Cacao Family)		
Waltheria indica L.	‘uhaloa	I
VERBENACEAE (Verbena Family)		
Lantana camara L.	lantana	X
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, oi, owi	X

[1]E = endemic; I= Indigenous; X = alien; P = Polynesian introduction.

SUPPLEMENT FOR THE SEPARATE SOUTHWEST PROJECT AREA PARCEL OF THE PROPOSED SOLAR SITE

PREPARED BY TEC INC.

Glenn Metzler, senior biologist with TEC Inc. conducted the endangered plant survey of the noncontiguous southernmost portion of the study area on October 21 using the same methodology as described above for the other proposed project areas. The only exception to the survey methodology was that only a cursory inspection was conducted for the southwestern corner of the parcel (over ½ of the entire parcel) because it has been bulldozed relatively recently and the vegetation there consists entirely of sparse ***koa haole*** and thick Buffelgrass. The area not bulldozed was very similar to the ***kiawe***/***koa haole*** forest vegetation observed on the other project areas that were described above. The species observed on this parcel were all also recorded in the project areas described previously and listed in Table 1 (not all of the species in Table 1 were present) with the exception of one additional plant observed at one location, *Ricinus communis* (castor bean). The only indigenous species observed were *Sida fallax* (***‘ilima***) and *Cassythia filiformis* (**kauna‘oa pehu**). There was minimal area with the combination of ***koa haole*** and ***‘ilima*** and bare rock areas with full sun which comprise the prime habitat for ***‘akoko*** plants in the area. No native ***‘akoko*** plants have ever been reported in this area in the previous surveys that have been conducted or as reported by the Hawaii Biodiversity and Mapping Program, Hawaii DLNR, or USFWS.

PHOTO LOG

Typical somewhat open, primarily koa haole forest with bufflegrass understory vegetation on the western side of the northern project area.

Typical kiawe/koa haole forest with denser overstory on the western side of the northern project area.

Open area where *Chamaesyce* sp. was found; the dead clump of questionable identification is the reddish upright dead plant to the left of the backpack.

Typical sinkhole on the eastern side of the northern project area.

Trees often grow from shallow sinkhole features.

Part of the wiliwili (*Erythrina sandwicensis*) grove with a moderate-sized wiliwili on the left (orange-green bark); non-native trees are intermixed.

Maiapilo (*Capparis sandwichiana*) shrub near a sinkhole entrance.

The bulldozed southwestern part of the southern project area, completely dominated by koa haole and bufflegrass.

APPENDIX D

FAA DETERMINATION LETTERS

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APPENDIX D: FAA DETERMINATION LETTERS

In compliance with FAA regulations, KSP met with FAA and DOT-Airports, and filed Form 7460-1: Notice of Proposed Construction or Alteration with the FAA. KSP provided information on the notional siting of all facilities and buildings associated with the proposed action to the FAA.

In response to the information submitted, FAA conducted a series of twenty-three aeronautical studies (study numbers 2010-AWP-6926-OE, 2010-AWP-6927-OE, 2010-AWP-6928-OE, 2010-AWP-6929-OE, 2010-AWP-6930-OE, 2011-AWP-694-OE, 2011-AWP-695-OE, 2011-AWP-696-OE, 2011-AWP-697-OE, 2011-AWP-698-OE, 2011-AWP-699-OE, 2011-AWP-700-OE, 2011-AWP-701-OE, 2011-AWP-1093-OE, 2011-AWP-1088-OE, 2011-AWP-1091-OE, 2011-AWP-1089-OE, 2011-AWP-1087-OE, 2011-AWP-1090-0E, 2011-AWP-1092-OE, 2011-AWP-702-OE, 2011-AWP-703-OE, 2011-AWP-704-OE). Each study resulted in a Determination of No Hazard to Air Navigation. The Determination Letters are provided below.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2010-AWP-6926-OE

Issued Date: 03/10/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel - Kalaeloa Solar One - Corner A
Location:	Kapolei, HI
Latitude:	21-19-16.00N NAD 83
Longitude:	158-05-08.00W
Heights:	6 feet above ground level (AGL)
	46 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/10/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-AWP-6926-OE.

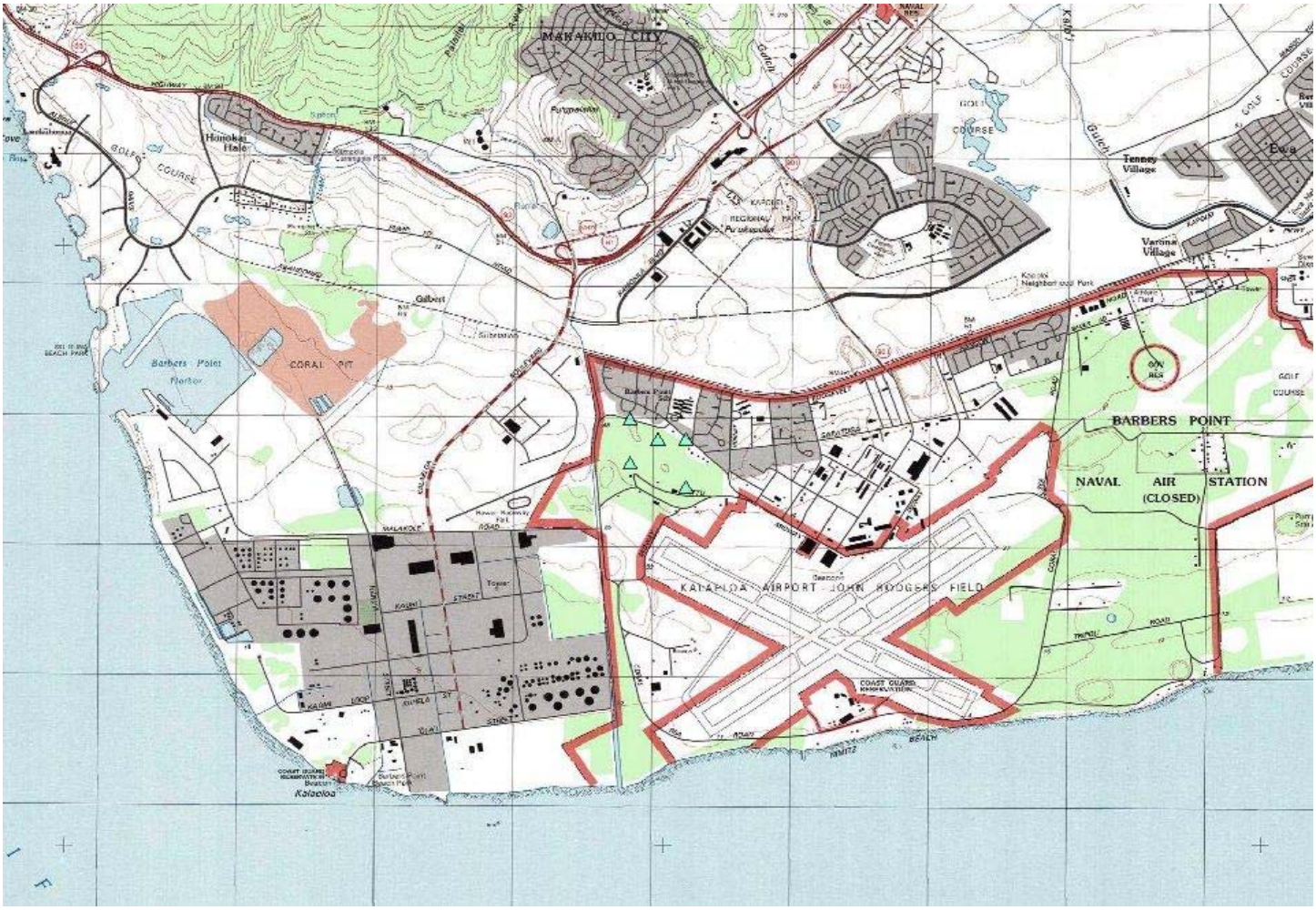
Signature Control No: 132547838-138556911 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Case Description for ASN 2010-AWP-6926-OE

Kalaeloa Solar One is a solar power plant consisting of a solar collector array, equipment and control buildings, and outdoor storage tanks.

Verified Map for ASN 2010-AWP-6926-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2010-AWP-6927-OE

Issued Date: 03/10/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel - Kalaeloa Solar One - Corner B
Location:	Kapolei, HI
Latitude:	21-19-11.00N NAD 83
Longitude:	158-04-54.00W
Heights:	6 feet above ground level (AGL)
	52 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/10/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

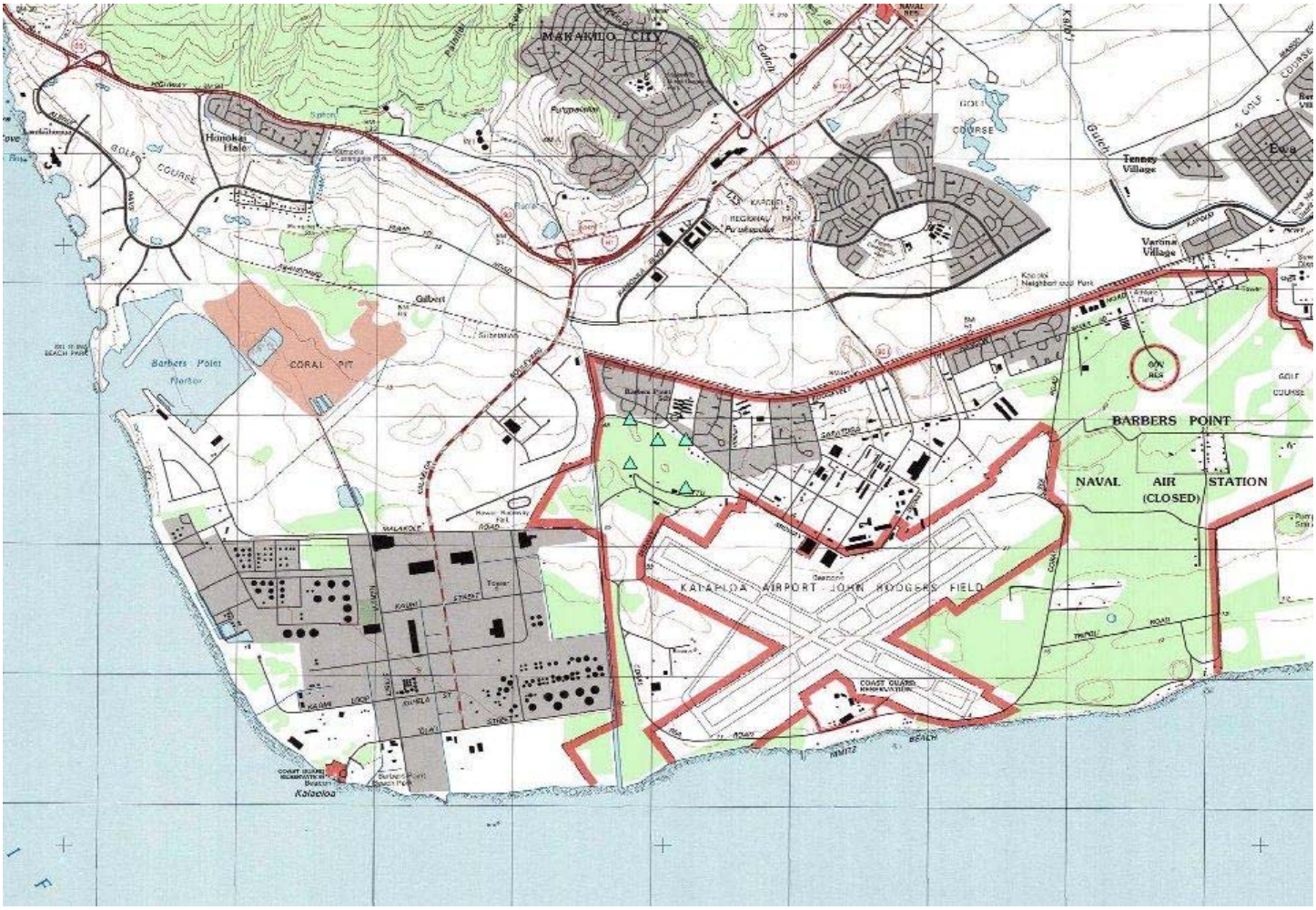
If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-AWP-6927-OE.

Signature Control No: 132547840-138556912 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Kalaeloa Solar One is a solar power plant consisting of a solar collector array, equipment and control buildings, and outdoor storage tanks.

Verified Map for ASN 2010-AWP-6927-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2010-AWP-6928-OE

Issued Date: 03/10/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel - Kalaeloa Solar One - Corner C
Location:	Kapolei, HI
Latitude:	21-18-59.00N NAD 83
Longitude:	158-04-54.00W
Heights:	6 feet above ground level (AGL)
	49 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/10/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-AWP-6928-OE.

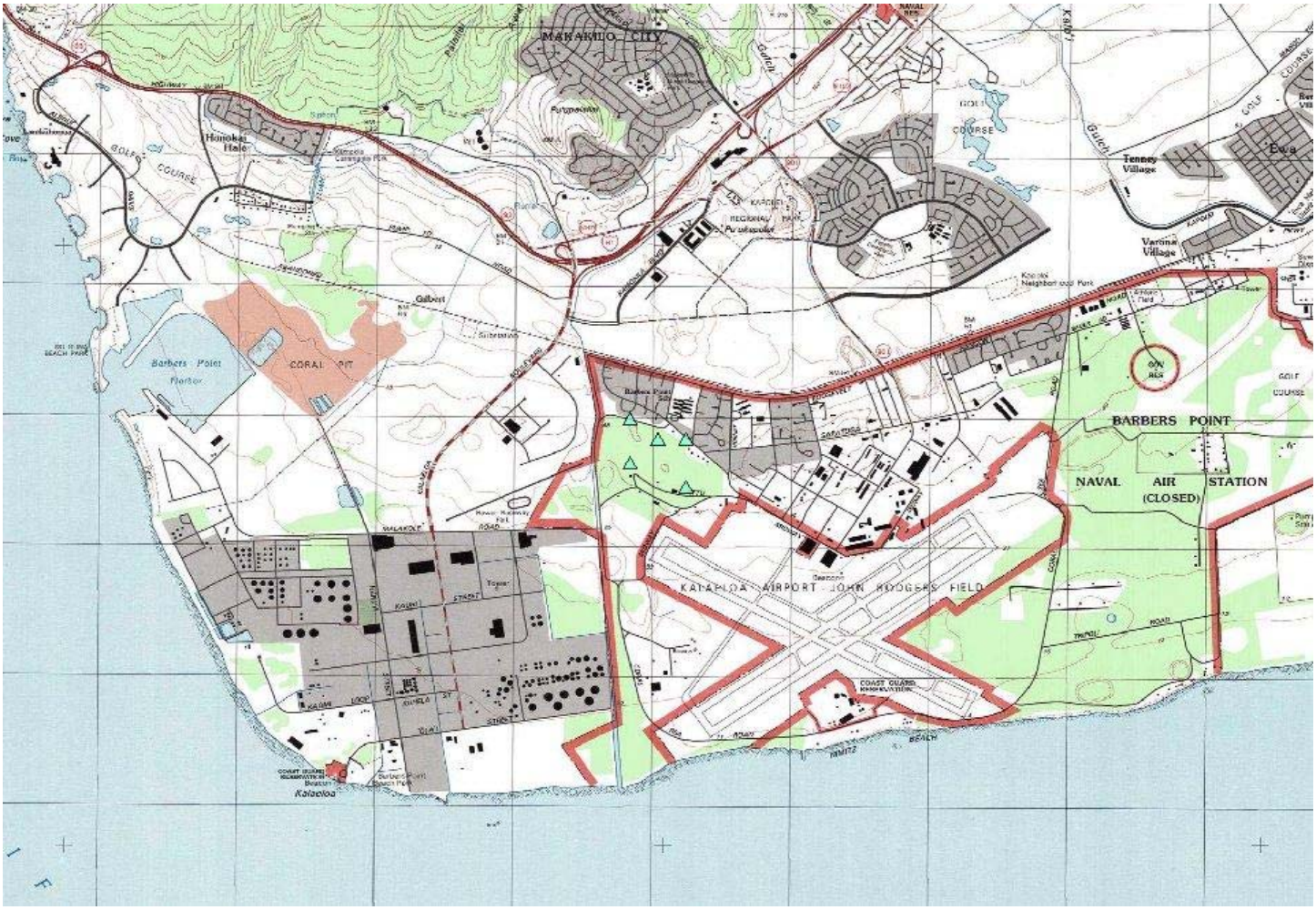
Signature Control No: 132547842-138556915 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Case Description for ASN 2010-AWP-6928-OE

Kalaeloa Solar One is a solar power plant consisting of a solar collector array, equipment and control buildings, and outdoor storage tanks.

Verified Map for ASN 2010-AWP-6928-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2010-AWP-6929-OE

Issued Date: 03/10/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel - Kalaeloa Solar One - Corner D
Location:	Kapolei, HI
Latitude:	21-19-05.00N NAD 83
Longitude:	158-05-08.00W
Heights:	6 feet above ground level (AGL)
	49 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

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(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

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If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-AWP-6929-OE.

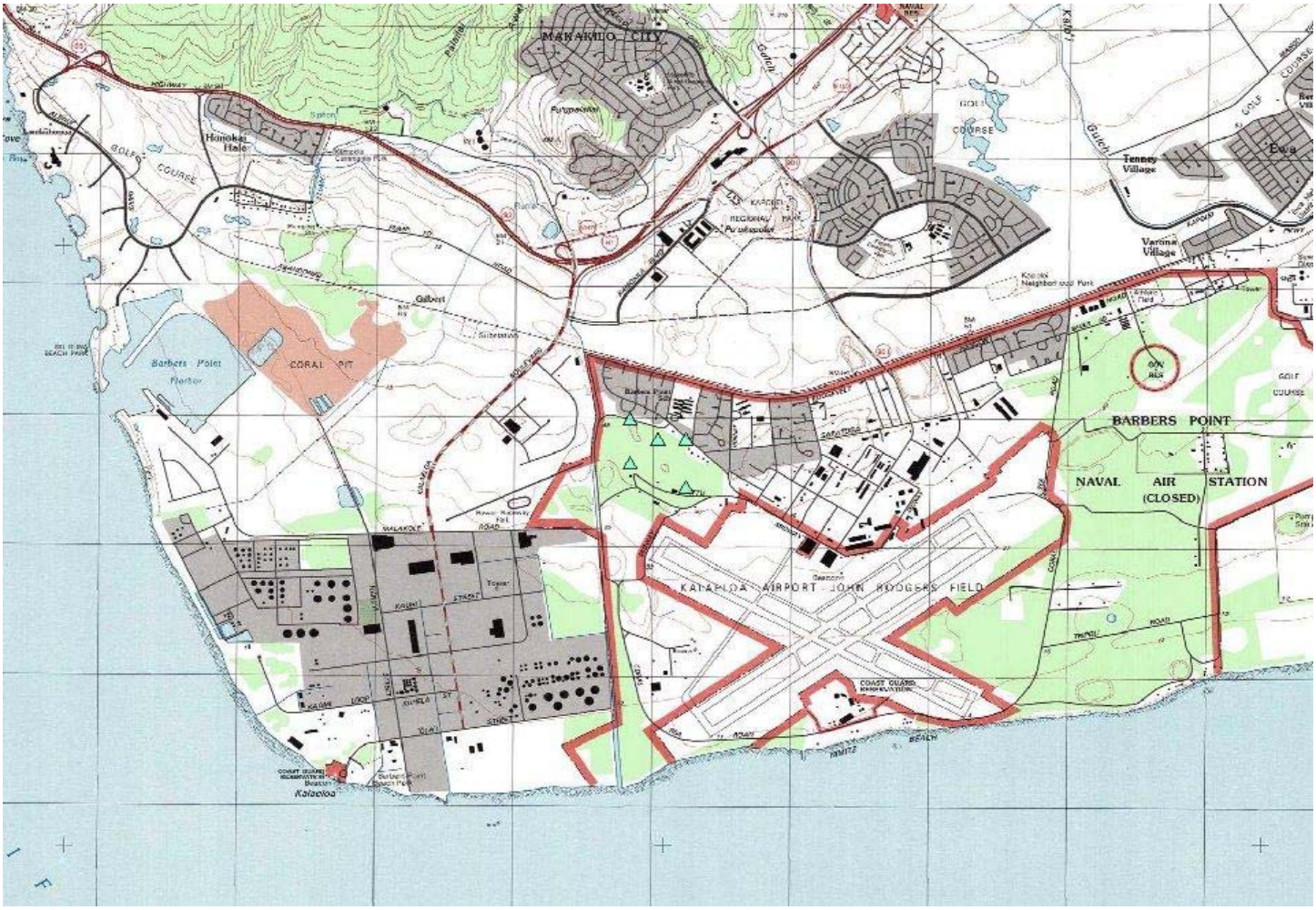
Signature Control No: 132547844-138556914 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Case Description for ASN 2010-AWP-6929-OE

Kalaeloa Solar One is a solar power plant consisting of a solar collector array, equipment and control buildings, and outdoor storage tanks.

Verified Map for ASN 2010-AWP-6929-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2010-AWP-6930-OE

Issued Date: 03/10/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Building - Kalaeloa Solar One - Building E
Location:	Kapolei, HI
Latitude:	21-19-11.00N NAD 83
Longitude:	158-05-01.00W
Heights:	40 feet above ground level (AGL)
	83 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/10/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2010-AWP-6930-OE.

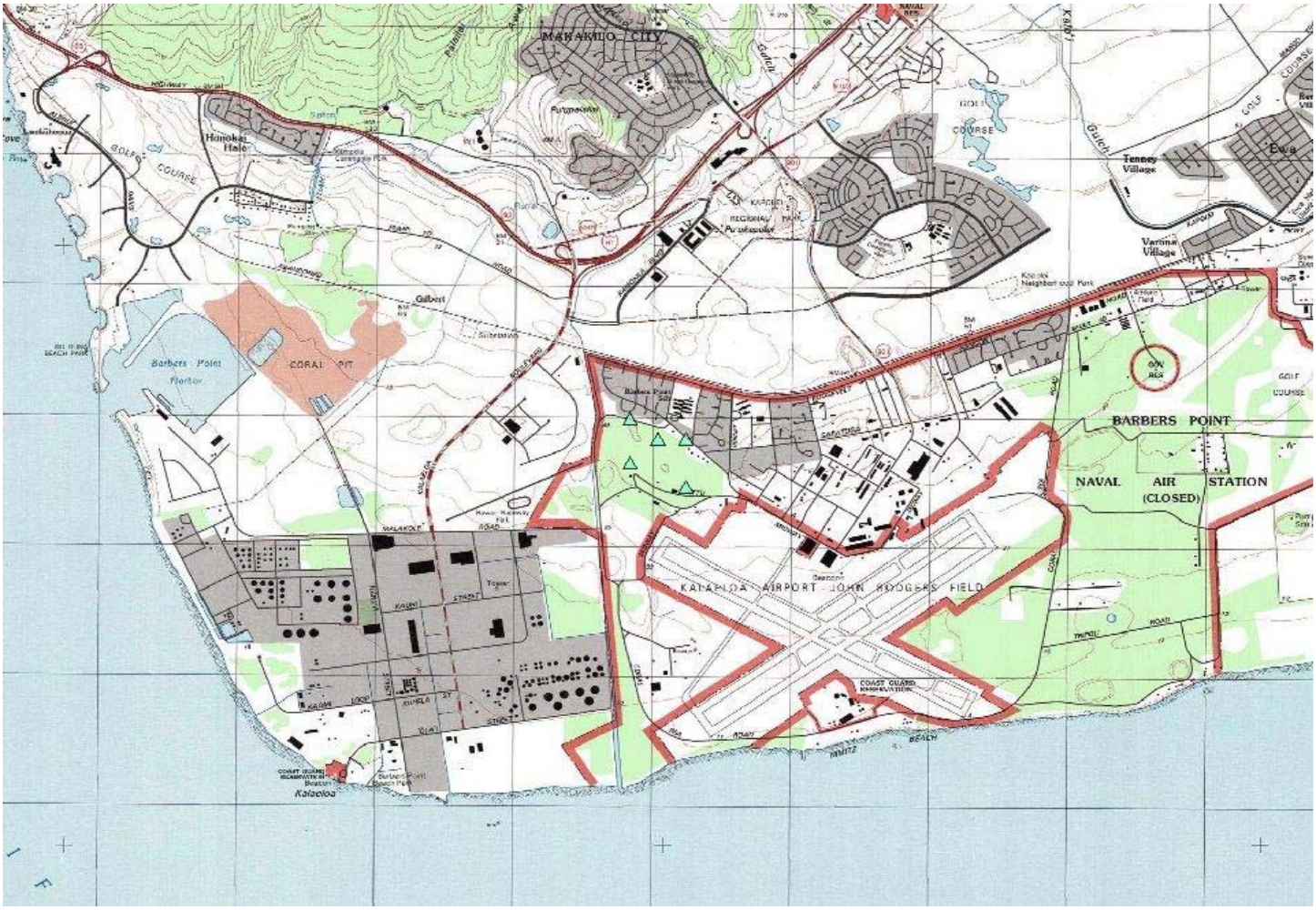
Signature Control No: 132547846-138556913 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Case Description for ASN 2010-AWP-6930-OE

Kalaeloa Solar One is a solar power plant consisting of a solar collector array, equipment and control buildings, and outdoor storage tanks.

Verified Map for ASN 2010-AWP-6930-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-694-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Building - KS1 Building NW Corner "F"
Location:	Kapolei, HI
Latitude:	21-19-03.92N NAD 83
Longitude:	158-05-05.13W
Heights:	35 feet above ground level (AGL)
	81 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

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If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-694-OE.

Signature Control No: 136865493-139009029 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

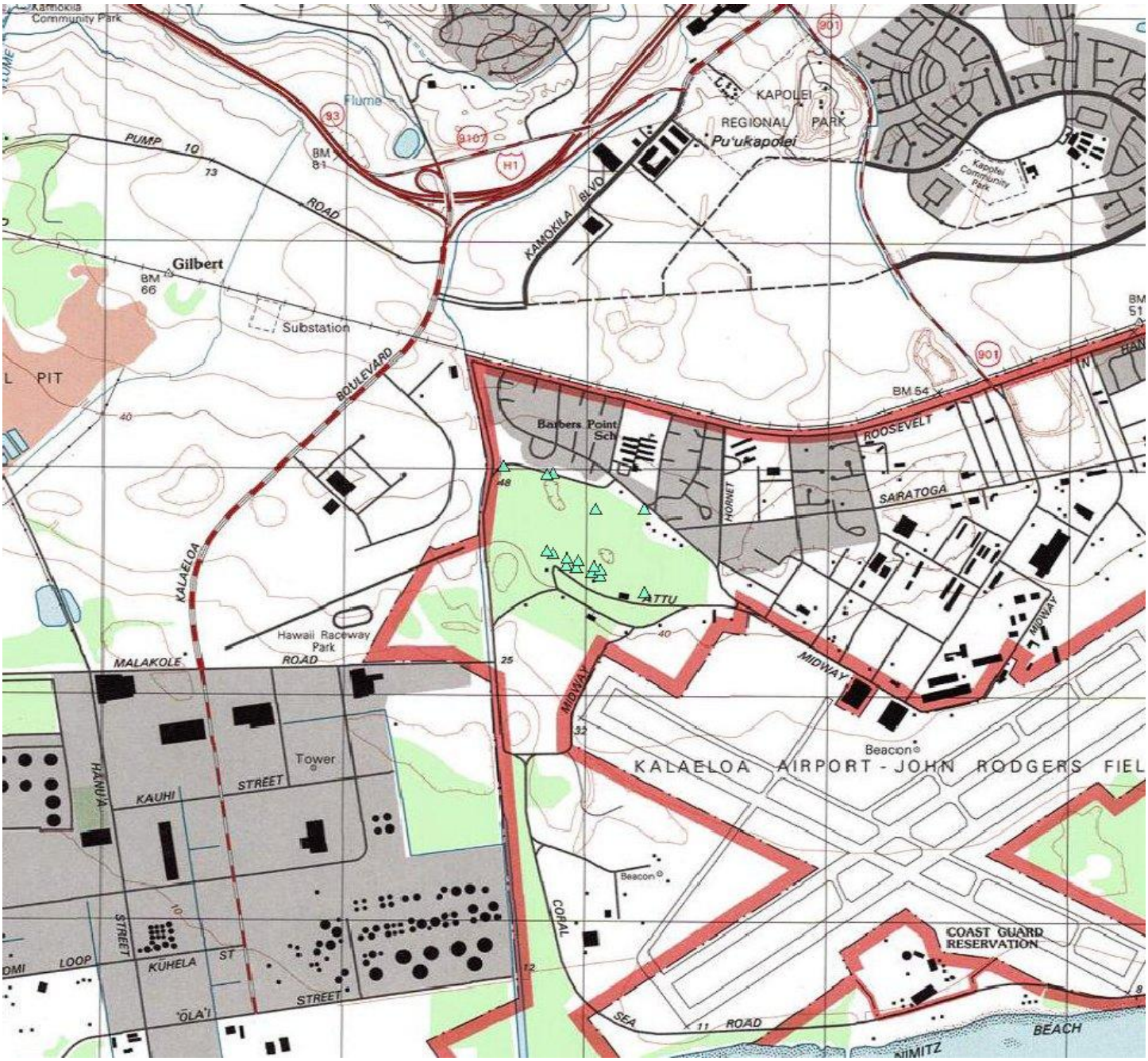
Additional information for ASN 2011-AWP-694-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-694-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-694-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-695-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Building - KS1 Building NE Corner "G"
Location:	Kapolei, HI
Latitude:	21-19-03.59N NAD 83
Longitude:	158-05-03.51W
Heights:	35 feet above ground level (AGL)
	81 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

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(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

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This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

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If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-695-OE.

Signature Control No: 136865495-139009036 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

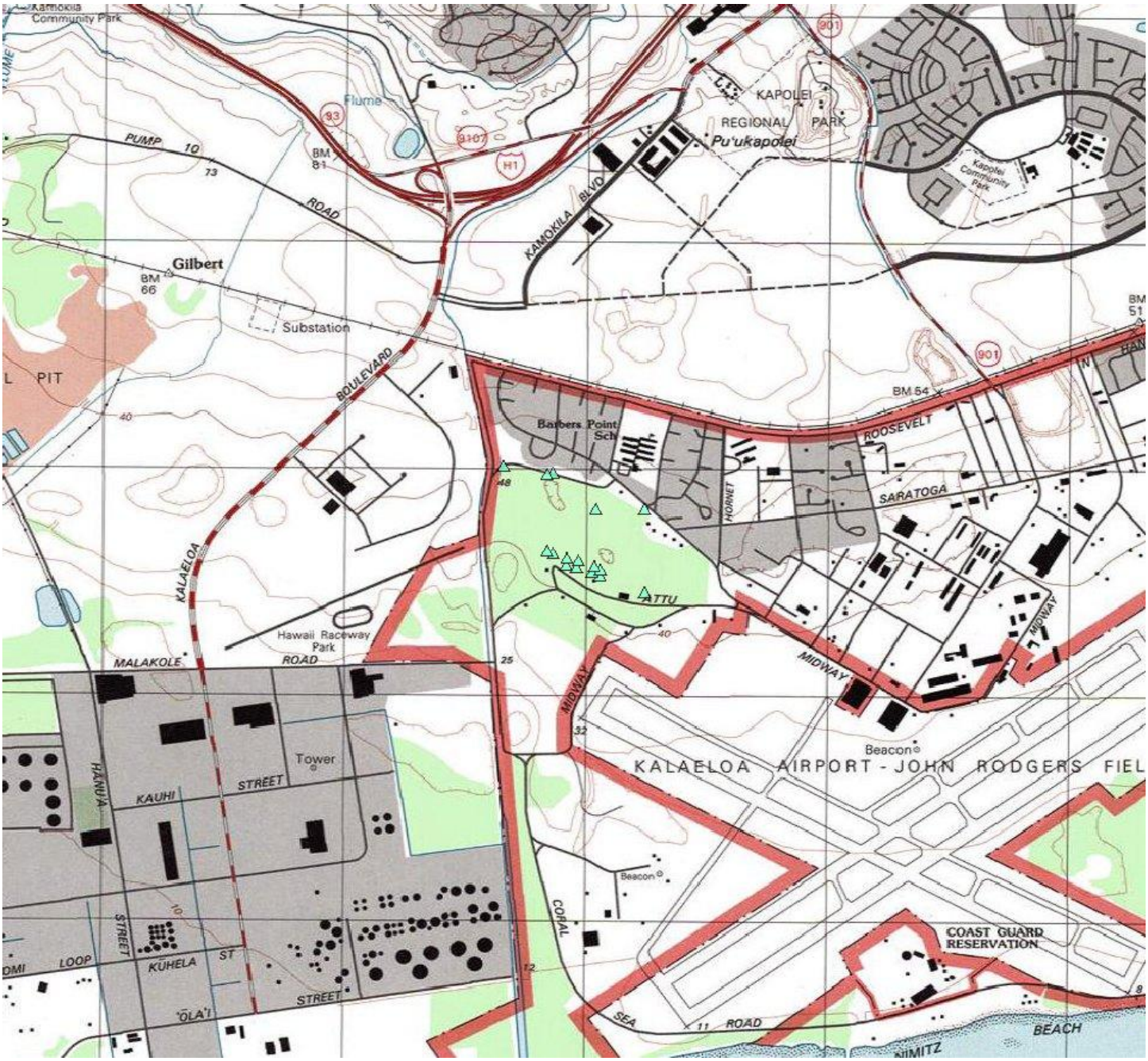
Additional information for ASN 2011-AWP-695-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-695-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-695-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-696-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Building - KS1 Building SW Corner "H"
Location:	Kapolei, HI
Latitude:	21-19-02.94N NAD 83
Longitude:	158-05-05.25W
Heights:	35 feet above ground level (AGL)
	81 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

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If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-696-OE.

Signature Control No: 136865497-139009033 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

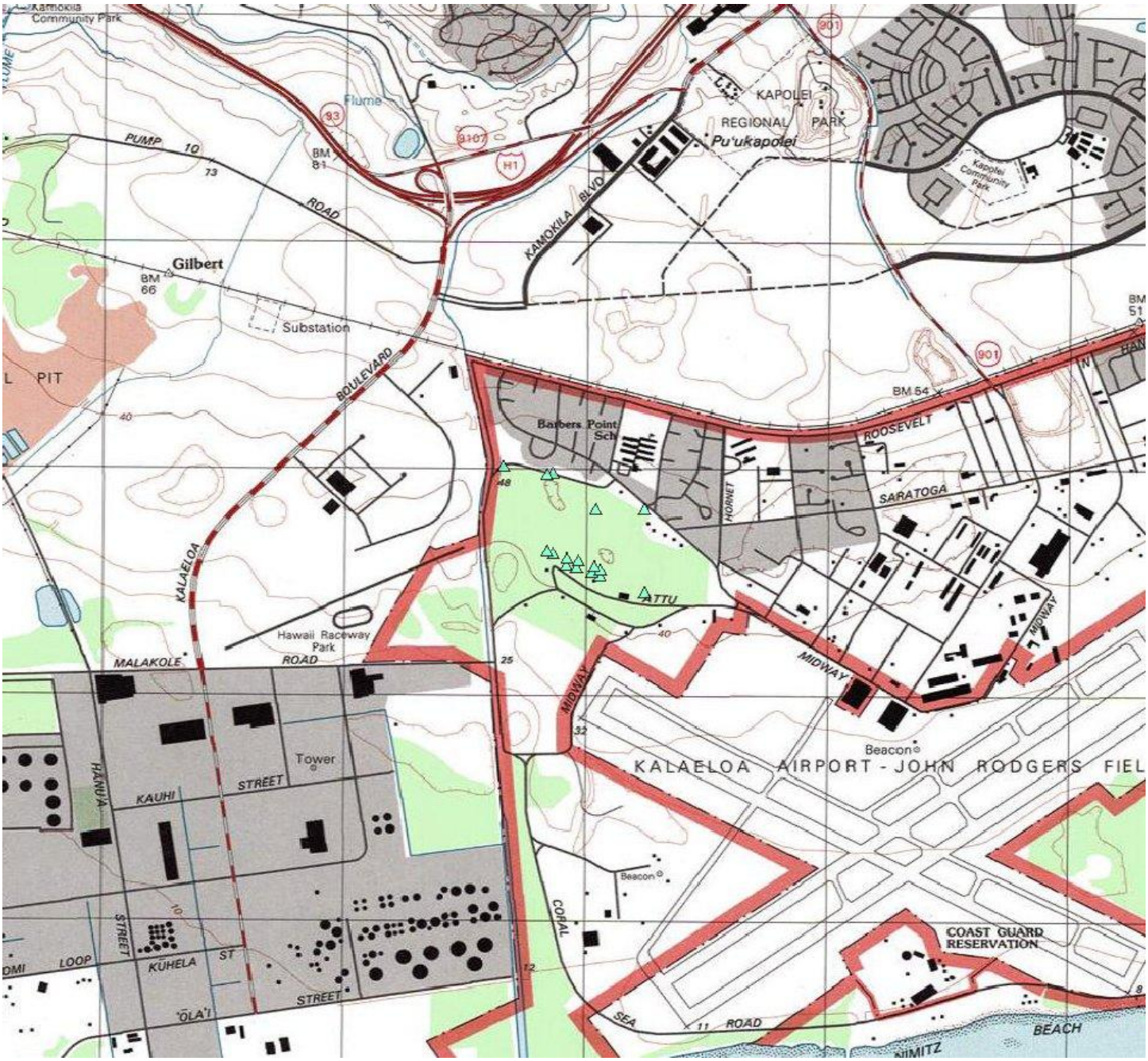
Additional information for ASN 2011-AWP-696-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-696-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-696-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-697-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Building - KS1 Building SE Corner "I"
Location:	Kapolei, HI
Latitude:	21-19-02.62N NAD 83
Longitude:	158-05-03.78W
Heights:	35 feet above ground level (AGL)
	81 feet above mean sea level (AMSL)

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This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-697-OE.

Signature Control No: 136865499-139009030 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

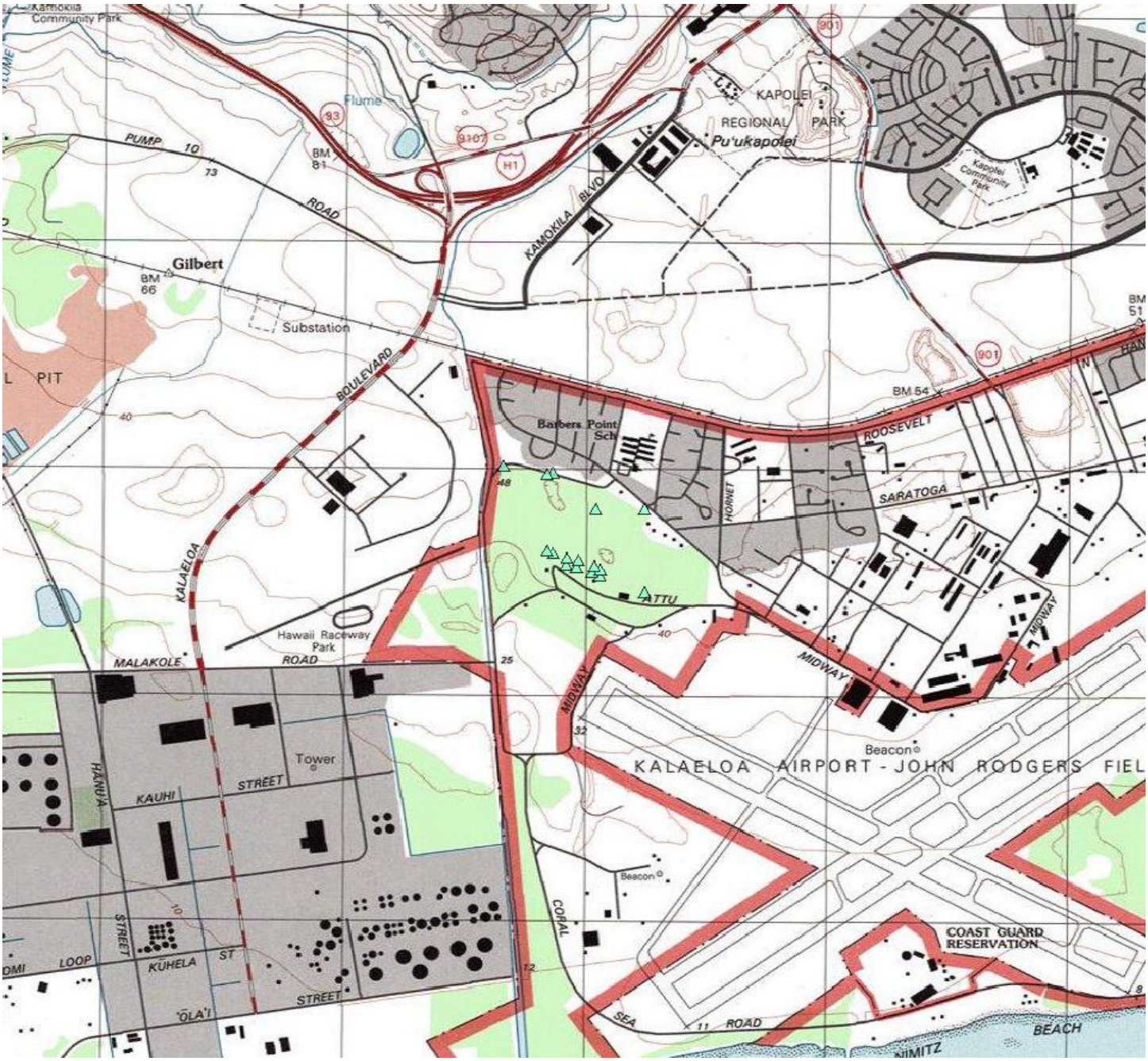
Additional information for ASN 2011-AWP-697-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-697-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-697-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-698-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower - KS1 Cooling Tower NW Corner "J"
Location:	Kapolei, HI
Latitude:	21-19-02.73N NAD 83
Longitude:	158-05-01.23W
Heights:	30 feet above ground level (AGL)
	75 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

A copy of this determination will be forwarded to the Federal Communications Commission (FCC) because the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-698-OE.

Signature Control No: 136865501-139009035 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

cc: FCC

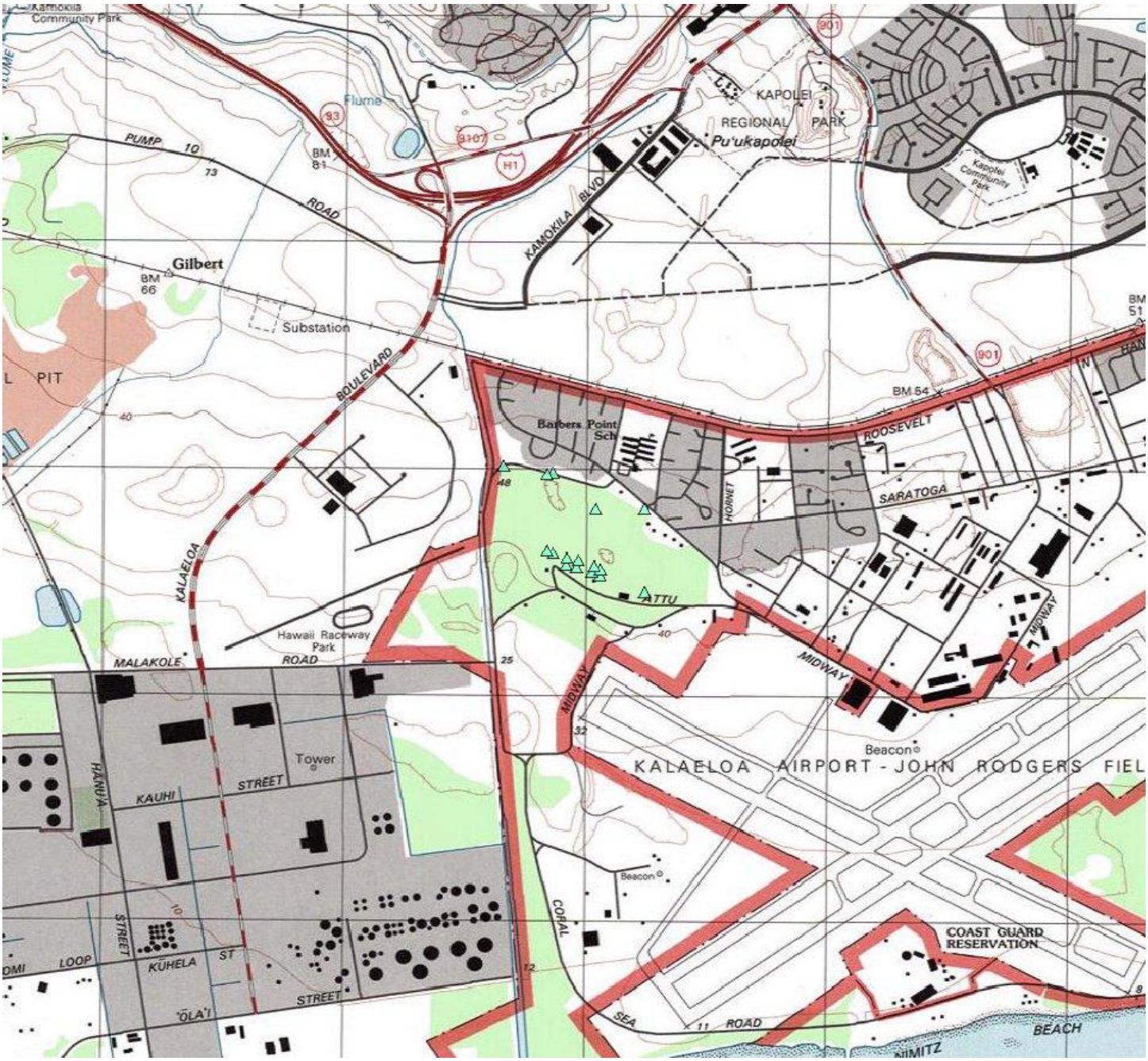
Additional information for ASN 2011-AWP-698-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-698-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-698-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-699-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower - KS1 Cooling Tower NE Corner "K"
Location:	Kapolei, HI
Latitude:	21-19-02.37N NAD 83
Longitude:	158-05-00.35W
Heights:	30 feet above ground level (AGL)
	75 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

A copy of this determination will be forwarded to the Federal Communications Commission (FCC) because the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-699-OE.

Signature Control No: 136865503-139009028 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

cc: FCC

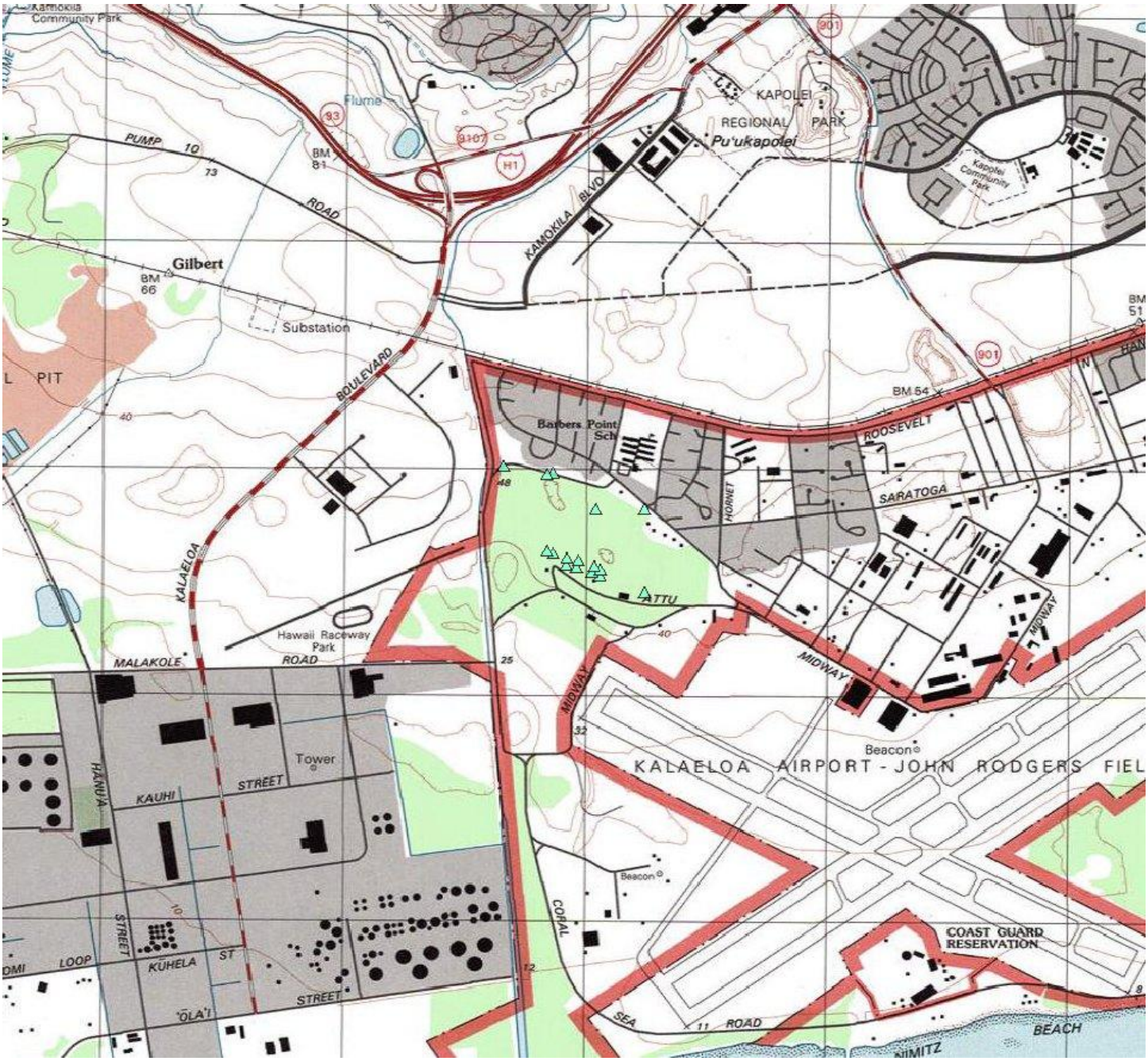
Additional information for ASN 2011-AWP-699-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-699-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-699-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-700-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower - KS1 Cooling Tower SW Corner "L"
Location:	Kapolei, HI
Latitude:	21-19-01.90N NAD 83
Longitude:	158-05-01.58W
Heights:	30 feet above ground level (AGL)
	75 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

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This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

A copy of this determination will be forwarded to the Federal Communications Commission (FCC) because the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-700-OE.

Signature Control No: 136865505-139009037 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

cc: FCC

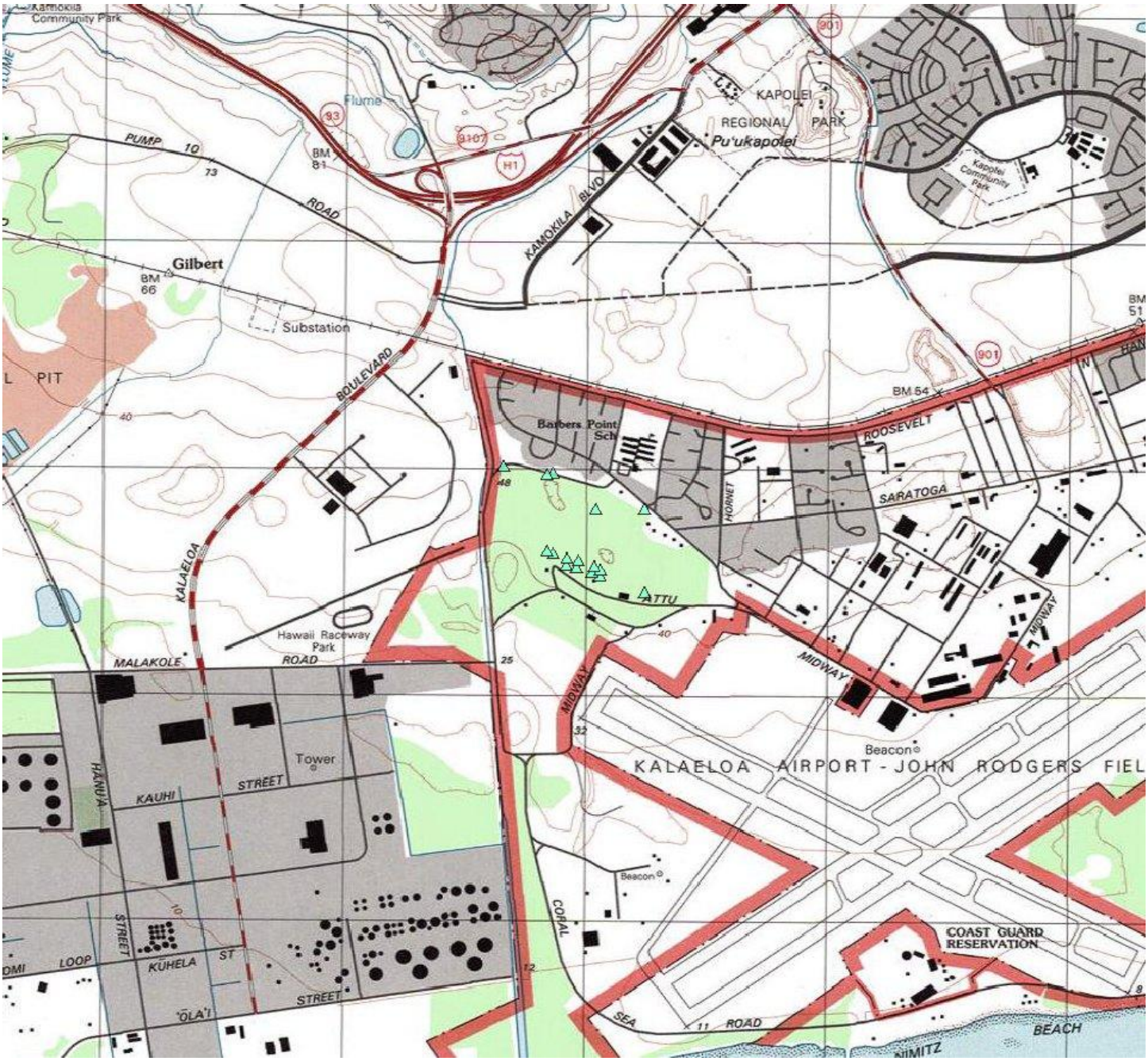
Additional information for ASN 2011-AWP-700-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-700-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-700-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-701-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tower - KS1 Cooling Tower SE Corner "M"
Location:	Kapolei, HI
Latitude:	21-19-01.43N NAD 83
Longitude:	158-05-00.42W
Heights:	30 feet above ground level (AGL)
	75 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

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A copy of this determination will be forwarded to the Federal Communications Commission (FCC) because the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-701-OE.

Signature Control No: 136865507-139009031 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

cc: FCC

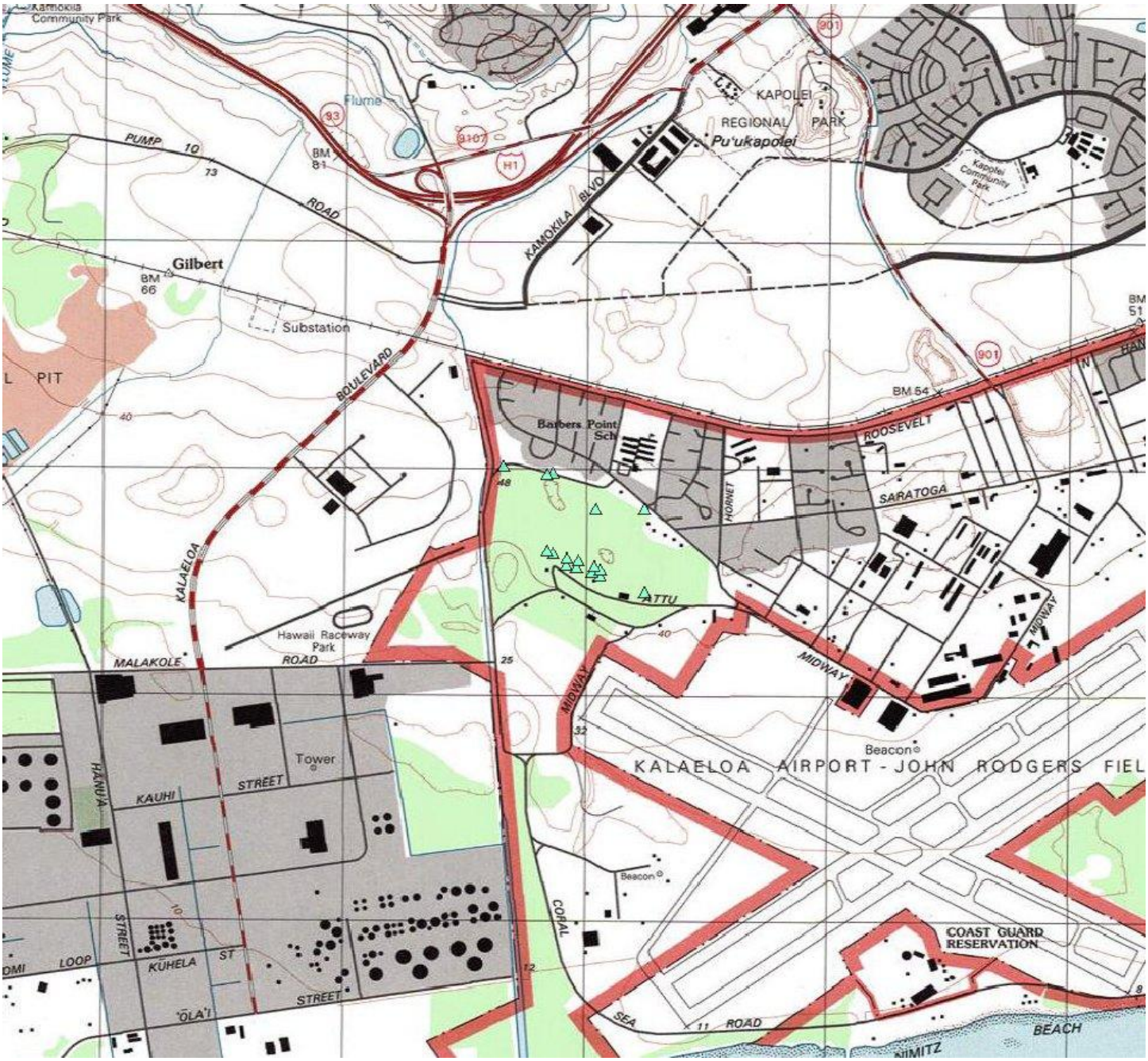
Additional information for ASN 2011-AWP-701-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-701-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-701-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-702-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Power Line - KS1 High Voltage Pole "N" south end
Location:	Kapolei, HI
Latitude:	21-19-04.63N NAD 83
Longitude:	158-05-07.12W
Heights:	40 feet above ground level (AGL)
	85 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-702-OE.

Signature Control No: 136865509-139009032 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

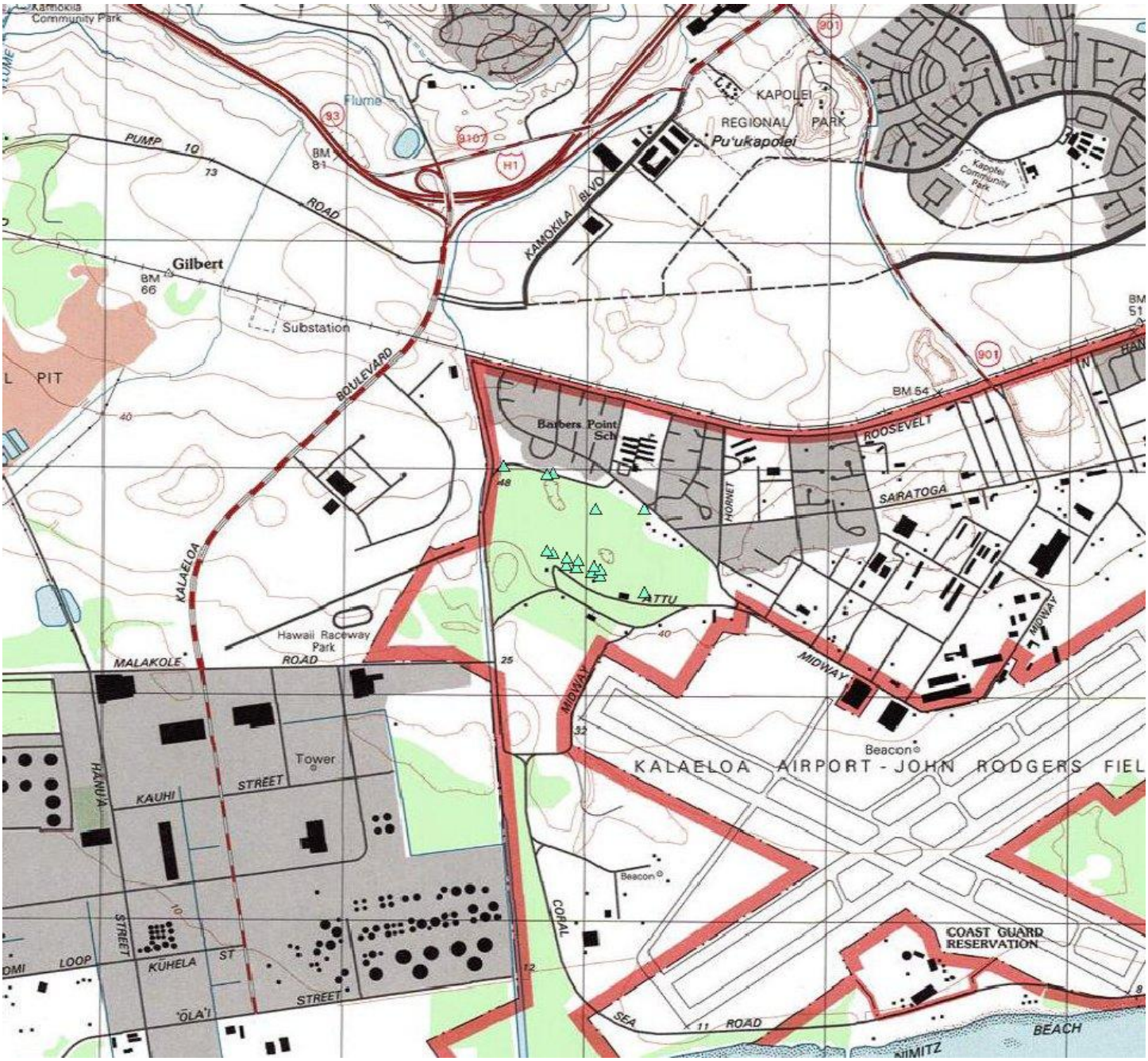
Additional information for ASN 2011-AWP-702-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-702-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-702-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-703-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Power Line - KS1 High Voltage Pole "T" north corner
Location:	Kapolei, HI
Latitude:	21-19-16.22N NAD 83
Longitude:	158-05-07.12W
Heights:	40 feet above ground level (AGL)
	88 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

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Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-703-OE.

Signature Control No: 136865511-139009034 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

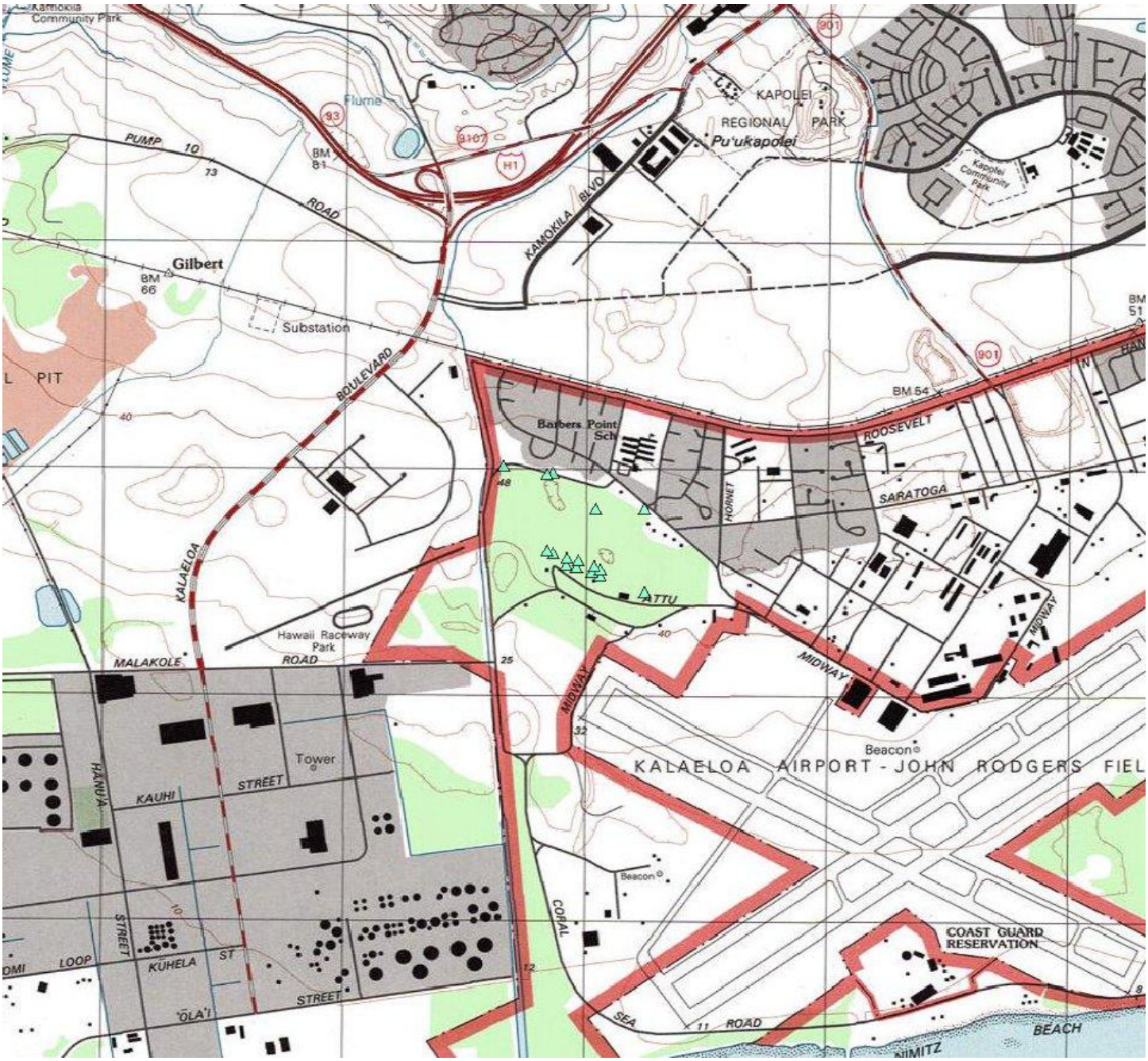
Additional information for ASN 2011-AWP-703-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-703-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-703-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-704-OE
Prior Study No.
2010-AWP-6930-OE

Issued Date: 03/17/2011

Sheldon Char
Kalaeloa Solar One, LLC
2660 Waiwai Loop
Honolulu, HI 96819

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Power Line - KS1 High Voltage Pole "W" west end
Location:	Kapolei, HI
Latitude:	21-19-17.23N NAD 83
Longitude:	158-05-14.23W
Heights:	40 feet above ground level (AGL)
	88 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 09/17/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-704-OE.

Signature Control No: 136865513-139009161 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

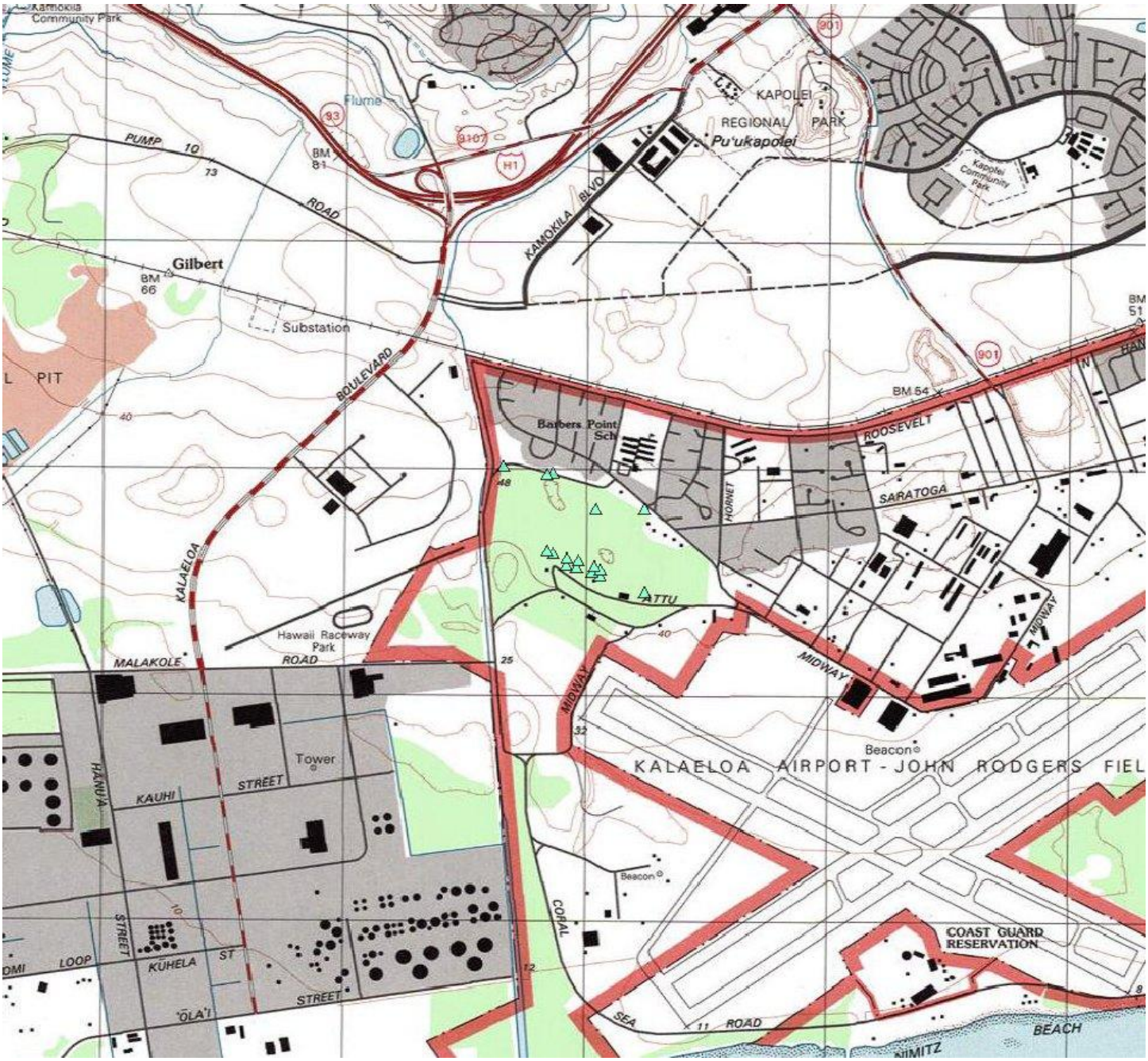
Additional information for ASN 2011-AWP-704-OE

Recommend solar panels associated with this project be non-reflective, light absorbing, to eliminate the potential for glare.

Case Description for ASN 2011-AWP-704-OE

This case was opened in response to Navy request. All information in this case previously submitted under FAA Case ASN: 2010-AWP-6930-0E on 01/24/11

Verified Map for ASN 2011-AWP-704-OE



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1093-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Electrical Equipment Pad
Location:	Kapolei, HI
Latitude:	21-18-52.08N NAD 83
Longitude:	158-05-08.99W
Heights:	15 feet above ground level (AGL) 48 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

ADVISORY RECOMMENDATION - While the structure does not constitute a hazard to air navigation, it would be located within the Runway Protection Zone (RPZ) of the KALAELOA (JOHN RODGERS FIELD) RUNWAY 11.

Structures, which will result in the congregation of people within an RPZ, are strongly discouraged in the interest of protecting people and property on the ground. In cases where the airport owner can control the use of the property, such structures are prohibited. In cases where the airport owner exercises no such control, advisory recommendations are issued to inform the sponsor of the inadvisability of the project from the standpoint of safety to personnel and property.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1093-OE.

Signature Control No: 137694388-141432410 (DNE)
Karen McDonald
Specialist

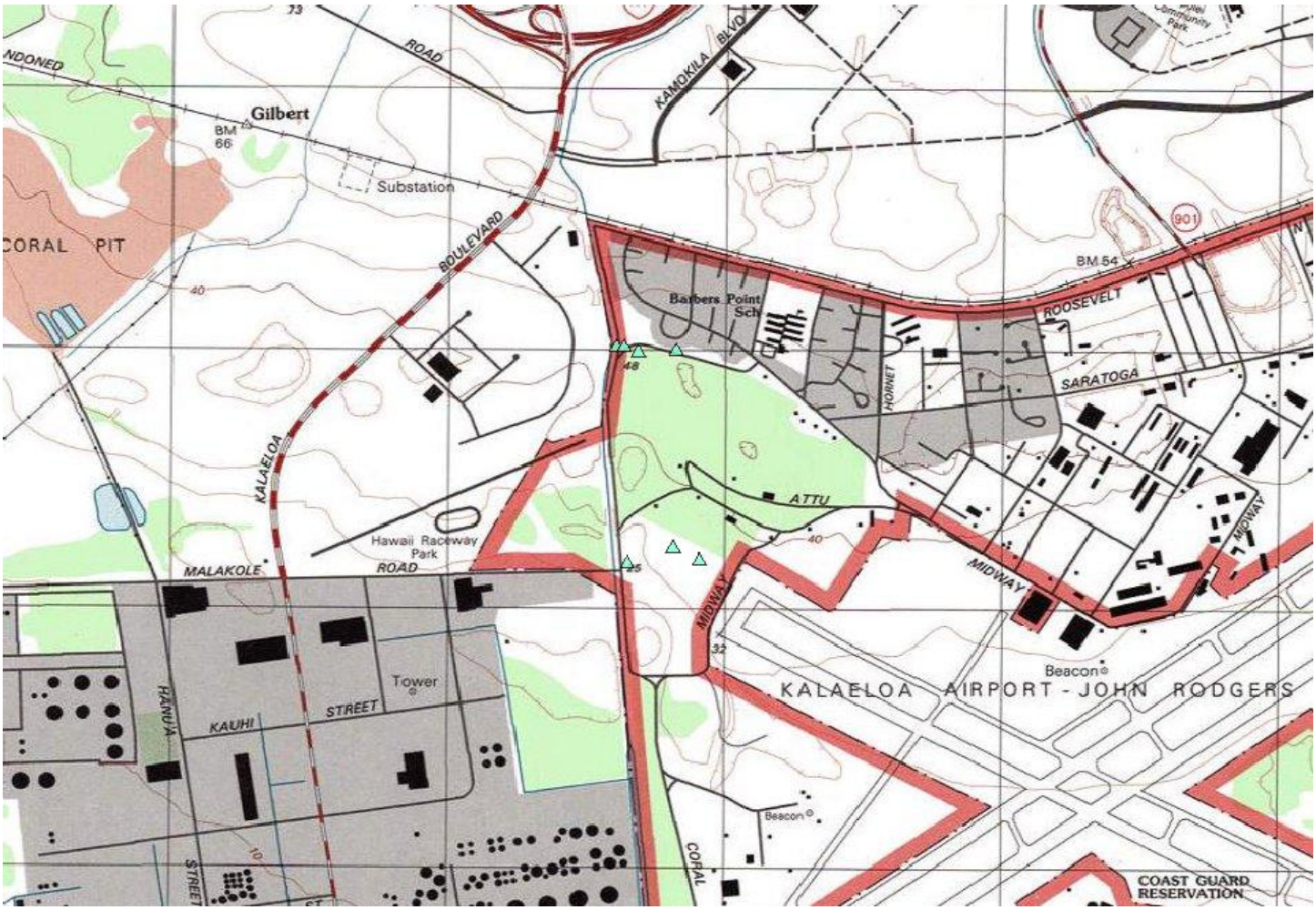
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1093-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1093-OE



Sectional Map for ASN 2011-AWP-1093-OE

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1088-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Northeast Perimeter Fence
Location:	Kapolei, HI
Latitude:	21-19-16.75N NAD 83
Longitude:	158-05-08.58W
Heights:	8 feet above ground level (AGL) 50 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1088-OE.

Signature Control No: 137694378-141432184 (DNE)
Karen McDonald
Specialist

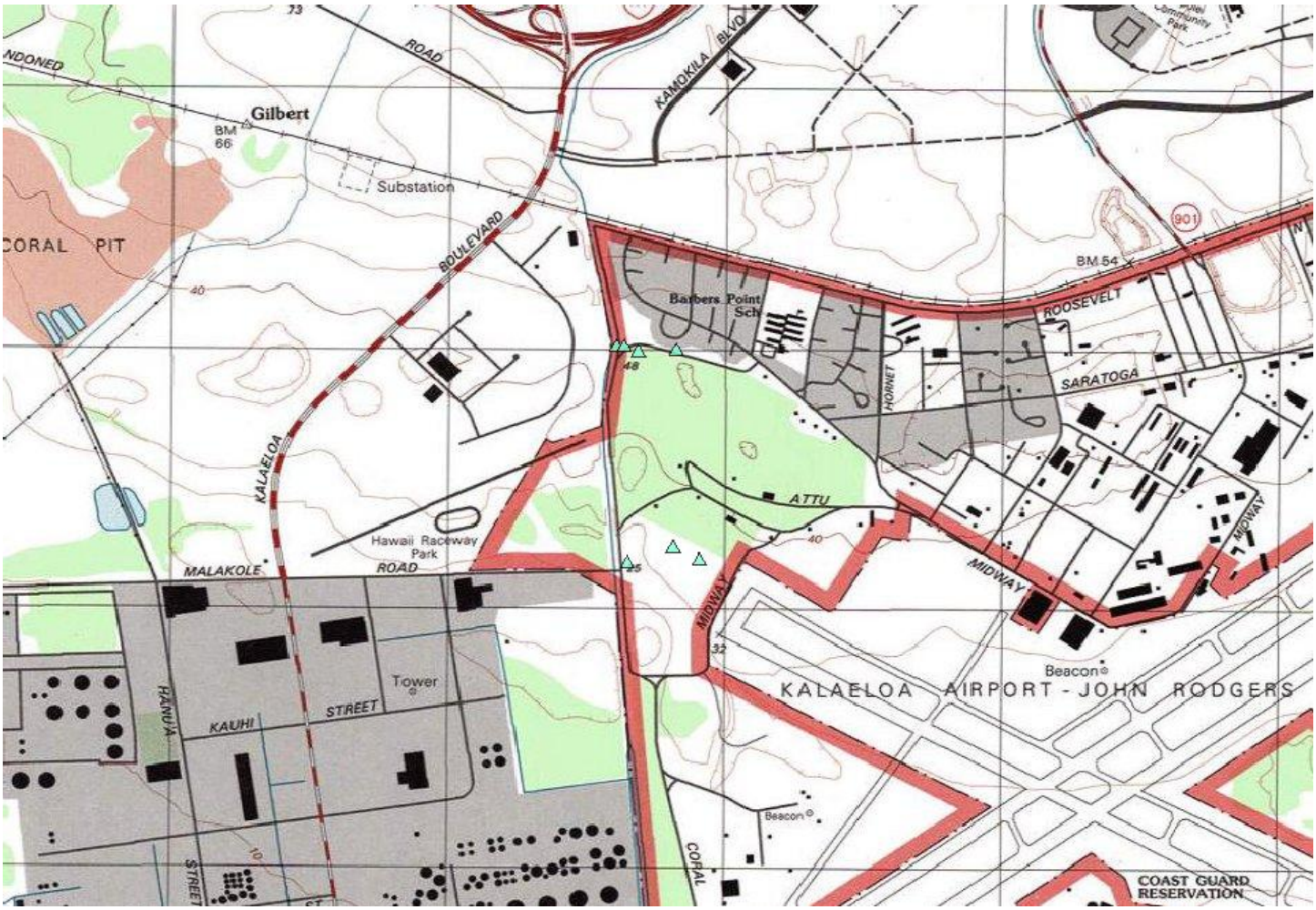
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1088-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1088-OE



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1091-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Northwest Permieter Fence
Location:	Kapolei, HI
Latitude:	21-19-17.28N NAD 83
Longitude:	158-05-15.12W
Heights:	8 feet above ground level (AGL) 56 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

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This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1091-OE.

Signature Control No: 137694384-141432182 (DNE)
Karen McDonald
Specialist

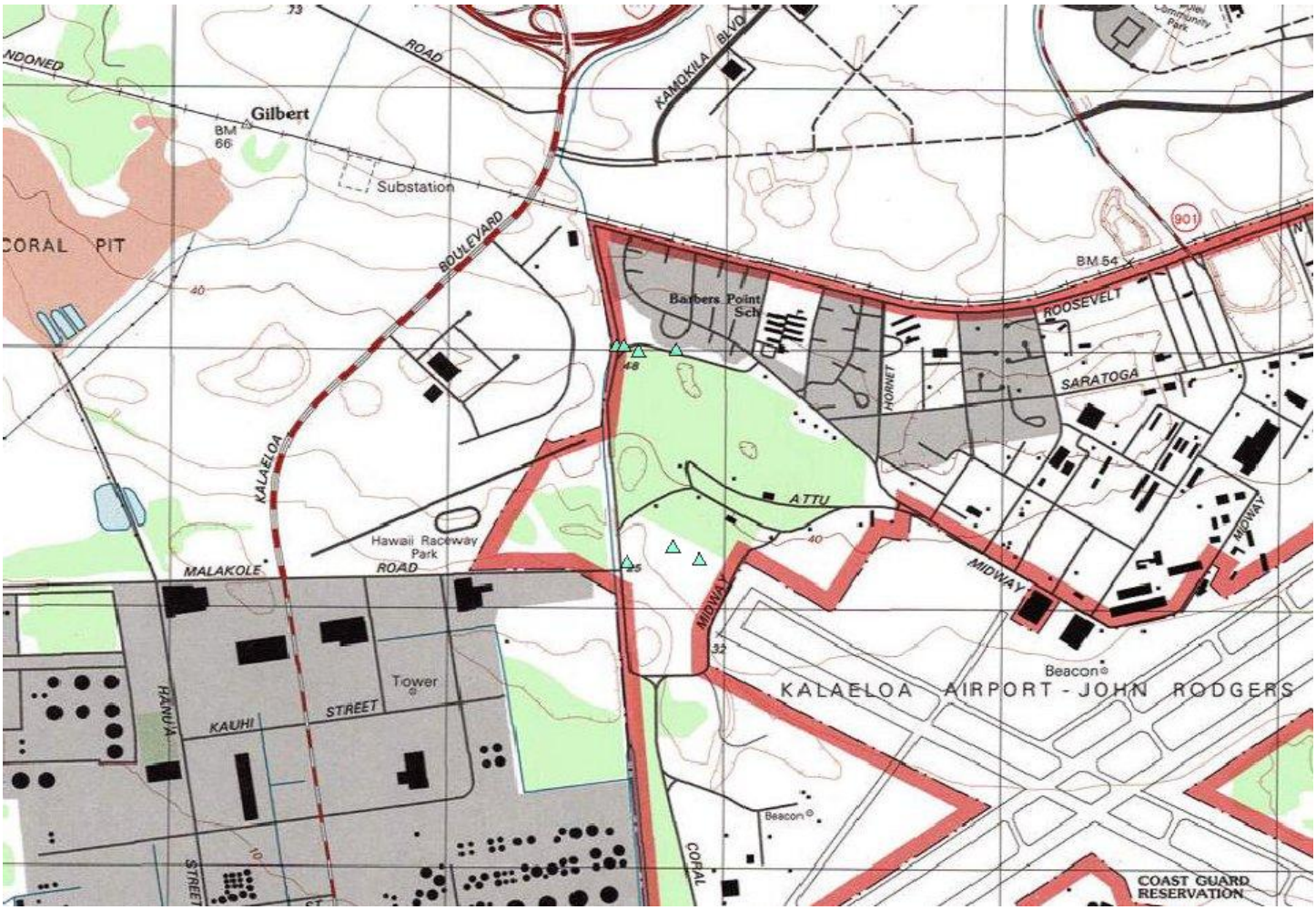
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1091-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1091-OE



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1089-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Southeast Perimeter Fence
Location:	Kapolei, HI
Latitude:	21-18-50.43N NAD 83
Longitude:	158-05-05.68W
Heights:	8 feet above ground level (AGL) 43 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

ADVISORY RECOMMENDATION - While the structure does not constitute a hazard to air navigation, it would be located within the Runway Protection Zone (RPZ) of the KALAELOA (JOHN RODGERS FIELD) RUNWAY 11.

Structures, which will result in the congregation of people within an RPZ, are strongly discouraged in the interest of protecting people and property on the ground. In cases where the airport owner can control the use of the property, such structures are prohibited. In cases where the airport owner exercises no such control, advisory recommendations are issued to inform the sponsor of the inadvisability of the project from the standpoint of safety to personnel and property.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1089-OE.

Signature Control No: 137694380-141432408 (DNE)
Karen McDonald
Specialist

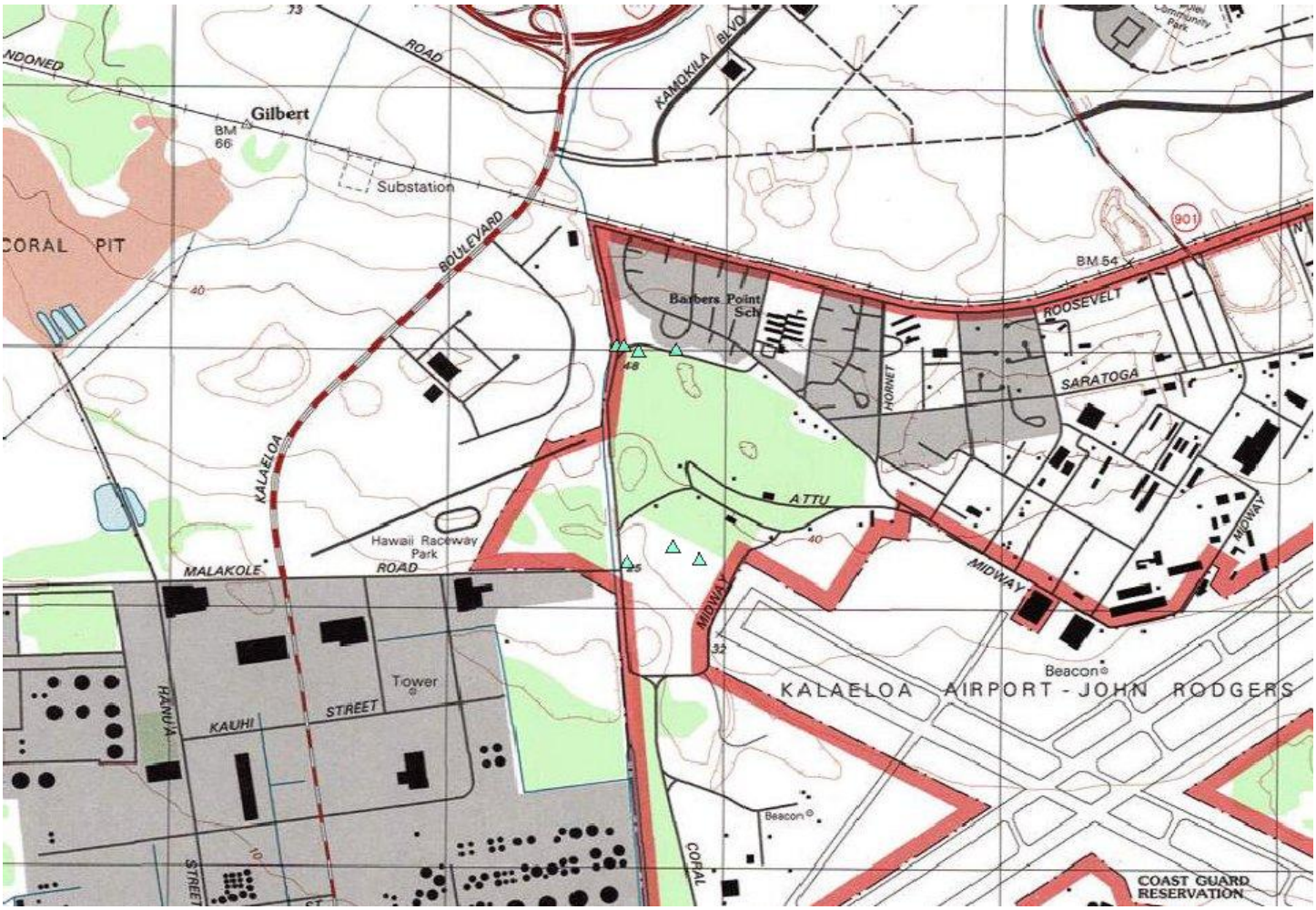
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1089-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1089-OE



Sectional Map for ASN 2011-AWP-1089-OE

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1087-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Proposed Substation
Location:	Kapolei, HI
Latitude:	21-19-16.61N NAD 83
Longitude:	158-05-13.30W
Heights:	60 feet above ground level (AGL) 109 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

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This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1087-OE.

Signature Control No: 137694376-141432185 (DNE)
Karen McDonald
Specialist

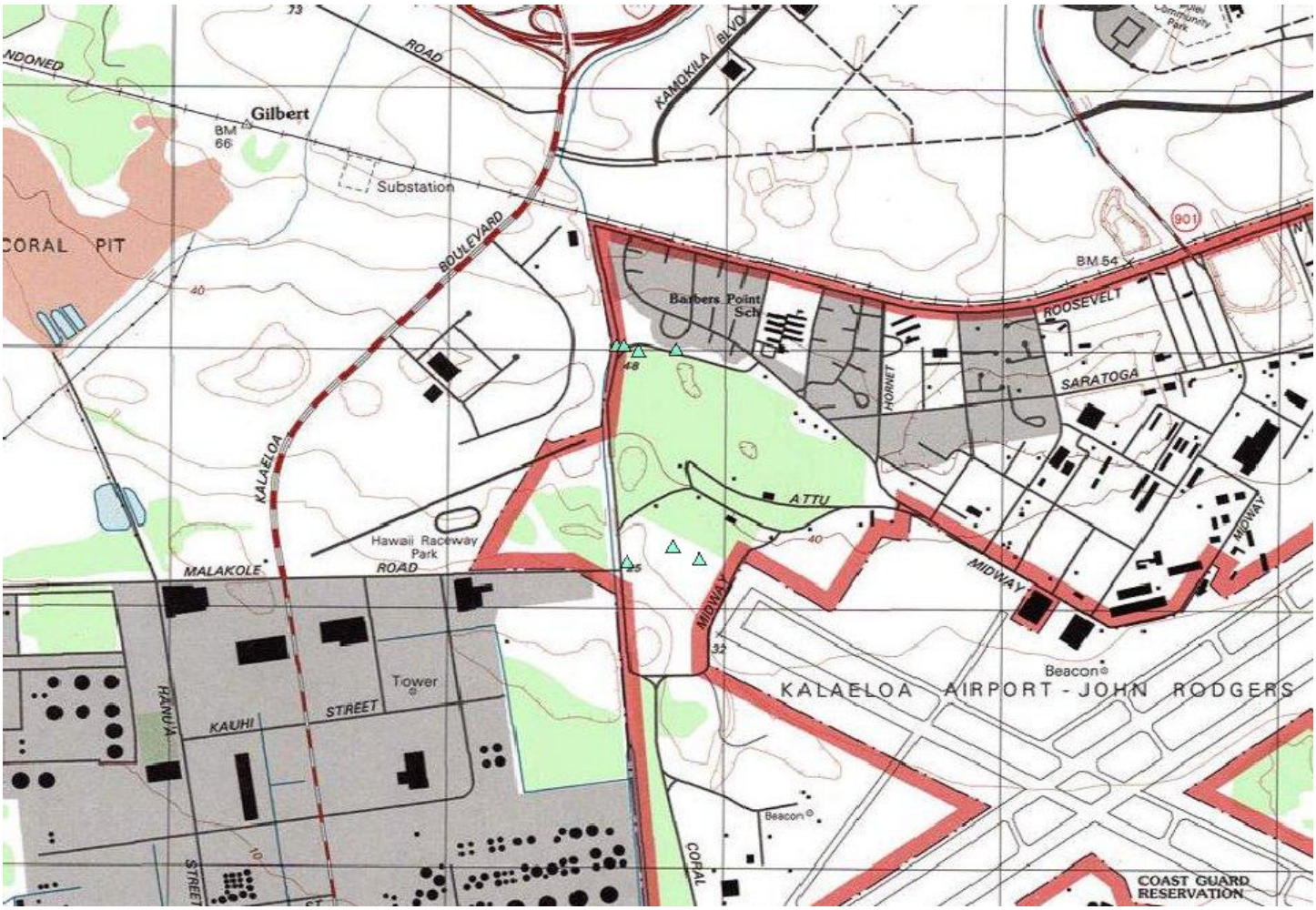
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1087-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1087-OE



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1090-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Southwest Perimeter Fence
Location:	Kapolei, HI
Latitude:	21-18-50.11N NAD 83
Longitude:	158-05-14.73W
Heights:	8 feet above ground level (AGL) 33 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

ADVISORY RECOMMENDATION - While the structure does not constitute a hazard to air navigation, it would be located within the Runway Protection Zone (RPZ) of the KALAELOA (JOHN RODGERS FIELD) RUNWAY 11.

Structures, which will result in the congregation of people within an RPZ, are strongly discouraged in the interest of protecting people and property on the ground. In cases where the airport owner can control the use of the property, such structures are prohibited. In cases where the airport owner exercises no such control, advisory recommendations are issued to inform the sponsor of the inadvisability of the project from the standpoint of safety to personnel and property.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1090-OE.

Signature Control No: 137694382-141432409 (DNE)
Karen McDonald
Specialist

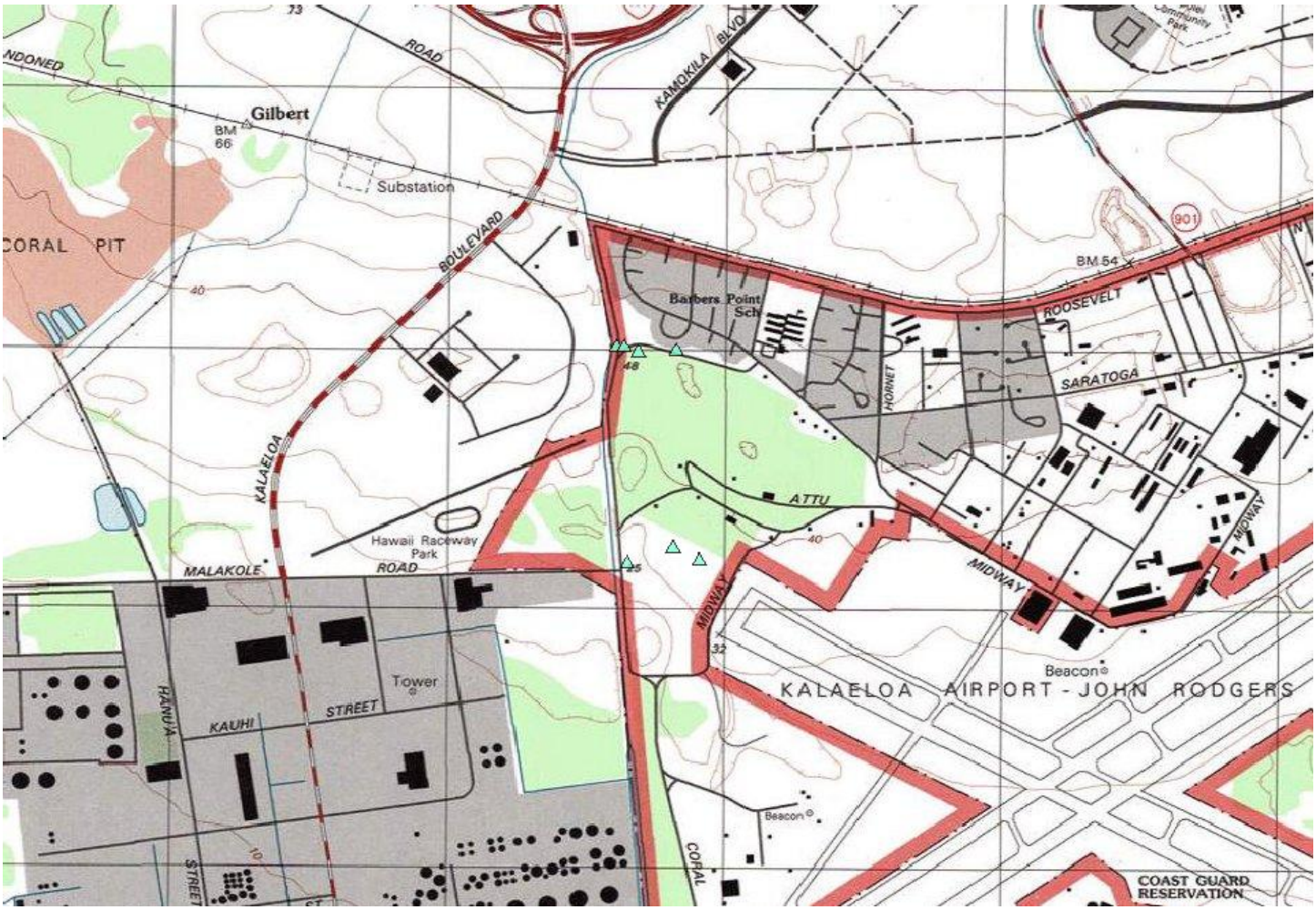
Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1090-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1090-OE



Sectional Map for ASN 2011-AWP-1090-OE

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-1092-OE

Issued Date: 04/18/2011

Seth Sakamoto
SunPower Corporation, Systems
1414 Harbour Way South
Richmond, CA 94804

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Proposed Utility Pole
Location:	Kapolei, HI
Latitude:	21-19-17.31N NAD 83
Longitude:	158-05-16.05W
Heights:	70 feet above ground level (AGL)
	117 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

See attachment for additional condition(s) or information.
Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

This determination expires on 10/18/2012 unless:

(a) extended, revised or terminated by the issuing office.
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NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION

OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

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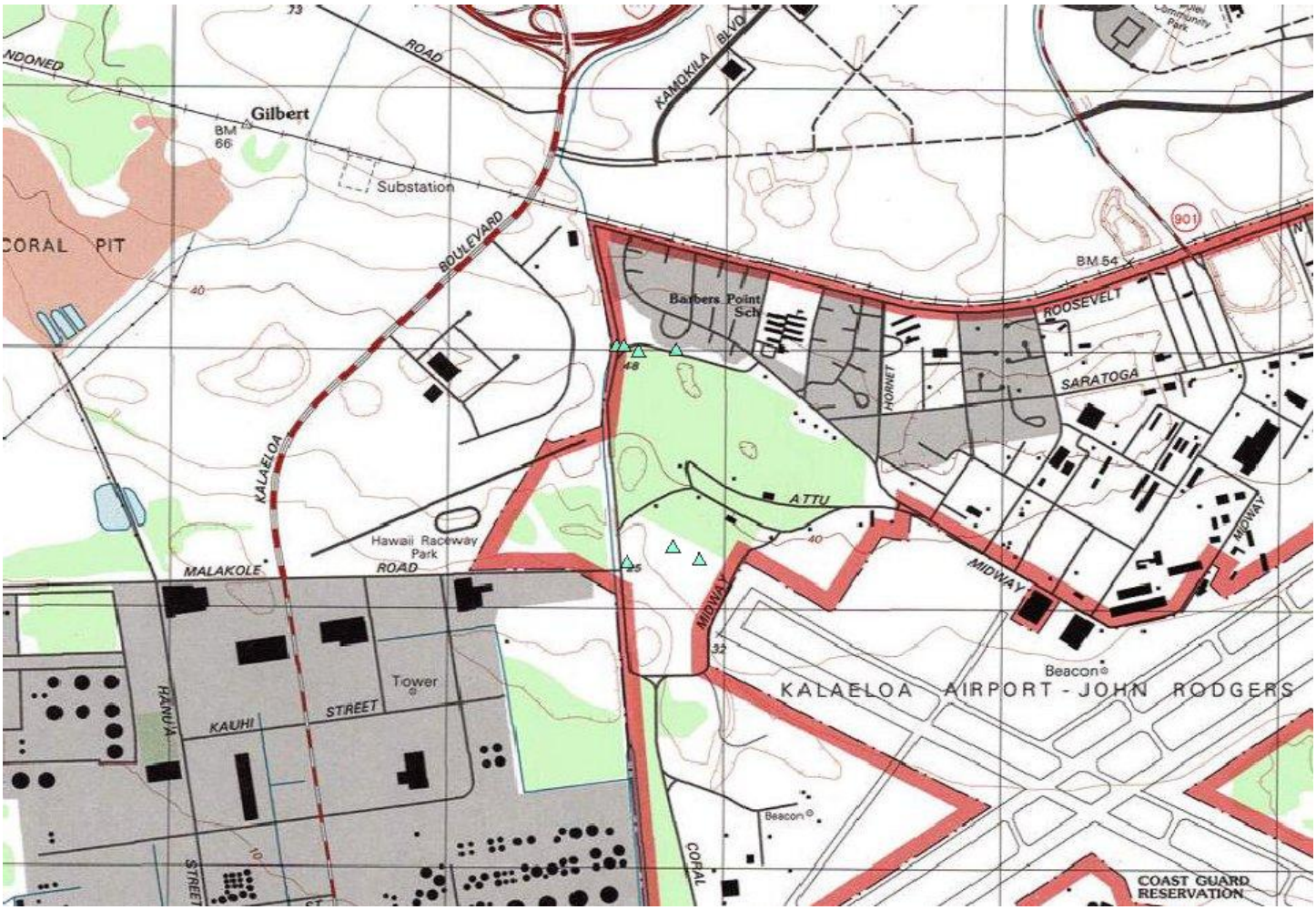
If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-1092-OE.

Signature Control No: 137694386-141432183 (DNE)
Karen McDonald
Specialist

Attachment(s)
Additional Information
Case Description
Map(s)

FAA AIRPORTS DIVISION REQUESTS SOLAR PANELS BE CONSTRUCTED WITH LIGHT-ABSORBING, NON-REFLECTIVE MATERIAL.

Case Description for ASN 2011-AWP-1092-OE

SunPower Corporation, Systems is proposing to construct a 5MW PV solar array northwest of the Kalaeloa airport. The SE corner of the array will be located approx 660ft from the end of the taxiway and approx 700ft from the NW end of runway 29. See attached layout.

Verified Map for ASN 2011-AWP-1092-OE